

MODULE MAINTENANCE PROCEDURE

NO. 2A OR 2C ELECTRONIC SWITCHING SYSTEM

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MAINTENANCE	12	1. GENERAL	
TROUBLESHOOTING	14	1.01 This section provides information on the module maintenance procedures in a No. 2A or 2C Electronic Switching System (ESS) office. It is the intent of this section to familiarize the reader with the maintenance procedures peculiar to the No. 2A or 2C ESS and to serve as a reference source for more detailed information provided by the manufacturer.	
4. COMBUSTIBLE GAS ALARM	21	1.02 Included in this section is information pertinent to the maintenance of the following units:	
MAINTENANCE	27	● Heating, ventilating, and air conditioning system,	
5. HUMIDIFICATION	28	● Pyr-A-Larm* system,	
MAINTENANCE	29	*Registered trademark of Pyrotronics	
6. LIGHTING (FLUORESCENT)	31	● Combustible gas alarm system,	
MAINTENANCE	31	● Vapotron* humidification,	
7. LIGHTING (EMERGENCY)	34	*Registered trademark of Hamilton Humidity, Inc.	
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NOTICE

Not for use or disclosure outside the
Bell System except under written agreement

- Lighting,
- Drinking fountain,
- Water heater,
- Rest-room fan-light unit, and
- Roofing inspection.

2. HEATING, VENTILATING, AND AIR CONDITIONING

2.01 The heating, ventilating, and air conditioning (HVAC) of the No. 2A or 2C ESS is provided by a commercially available Carrier* unit, model number 50MH048-411. The HVAC is a complete system, with the addition of a 7.5 kW accessory electric heater (Fig. 1). The HVACs are air-cooled,

designed for outdoor installation, and are mounted externally to the building modules. The HVAC units are secured to a shelf fastened to the end of the modules, and are shipped from Western Electric Company in this manner.

*Registered trademark of Carrier Corporation

2.02 Two HVAC units supply the control module. Both units are controlled by a standard Honeywell* thermostat (Fig. 2). **No accessory electric heaters are used with these units.** The battery and switching module, switching module, and administration module are supplied by one air conditioning unit for each module. Each unit is individually controlled by a standard Honeywell thermostat.

*Trademark of Honeywell

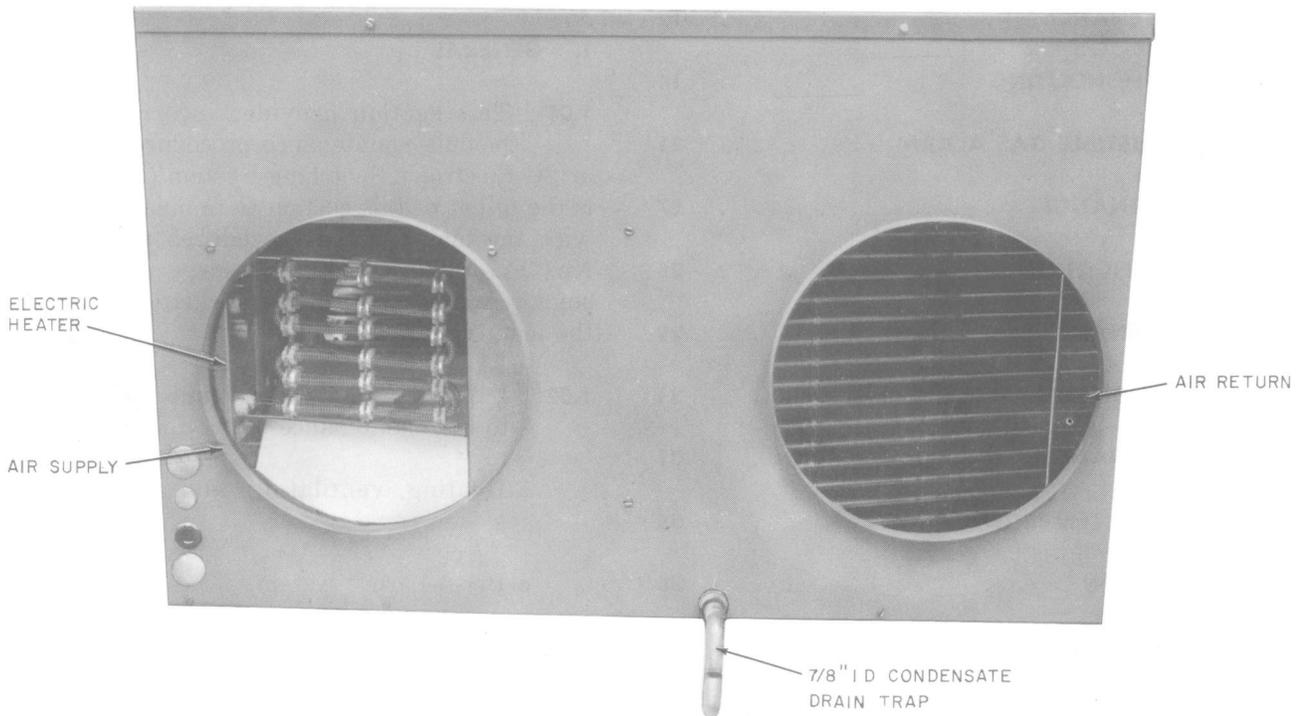


Fig. 1—Carrier Cooling Unit (Rear View) Model 50MH048-411

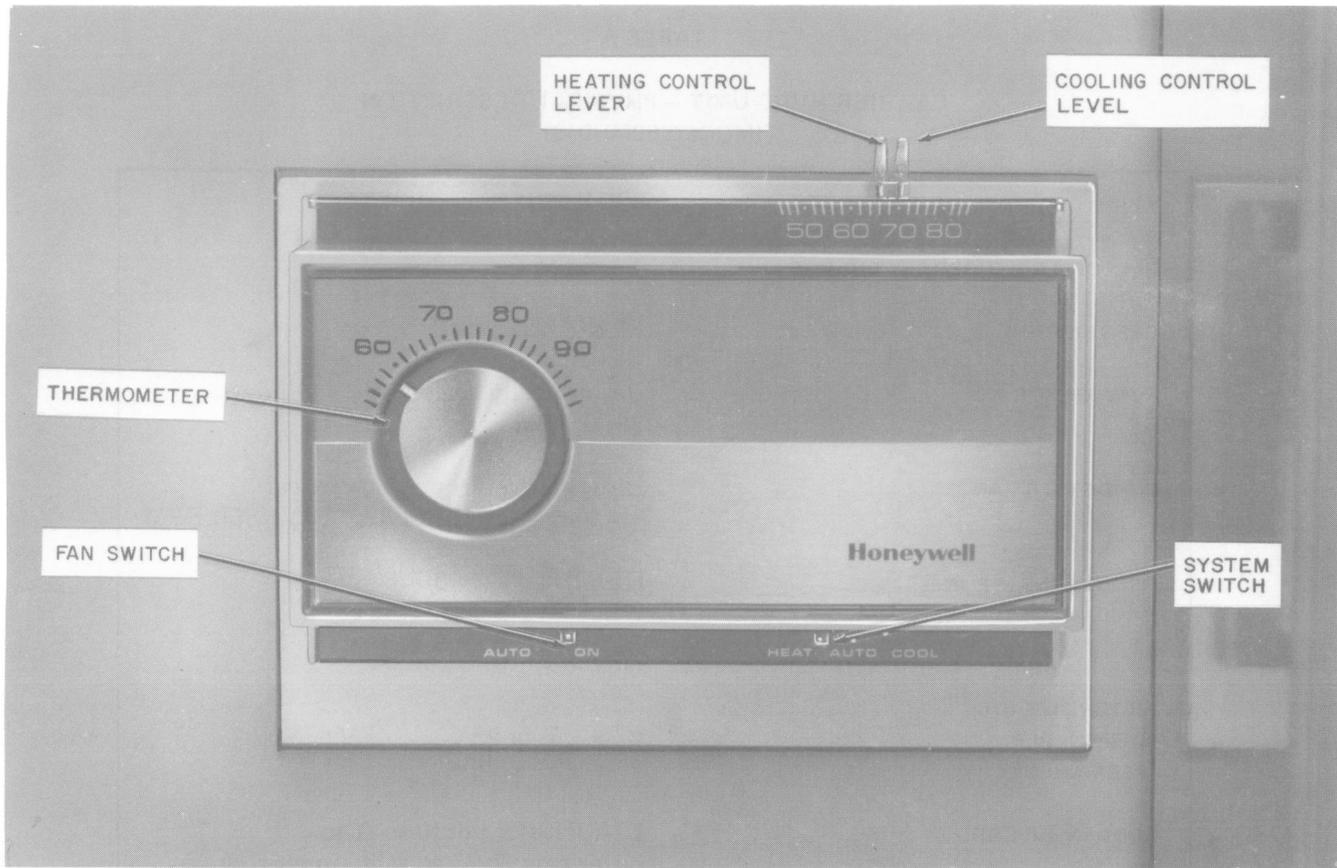


Fig. 2—Honeywell Thermostat Model T872

2.03 The units are enclosed in sheet steel housings with a vertically-upward condenser fan discharge. Several coatings of paint are applied

to the exterior to provide corrosion protection for a wide range of climatic conditions. For additional information, concerning the units physical description, refer to Table A.

TABLE A
CARRIER HVAC UNIT – PHYSICAL DESCRIPTION
(MODEL 50MH048)

WEIGHT	322 lbs.
FACTORY REFRIGERANT CHARGE	4 1/2 lbs.
REFRIGERANT	FREON 22
COMPRESSOR	Hermetically sealed, two cylinder, 3500 RPM
CONDENSER FAN	Direct Drive Propellor, vertical discharge 1/4 HP motor, 1050/850 RPM
DIMENSIONS (FT. IN.)	HEIGHT: 2' – 3 5/8" WIDTH: 3' – 6 1/4" LENGTH: 3' – 3 1/8"
FILTER SIZE (IN.)	
DISPOSABLE	2' x 25" x 25"
PERMANENT	2' x 25" x 25"
CONDENSER COIL	17 FINS/IN.; 8.30 sq ft in. outer row; 7.95 sq ft in. inner row.
EVAPORATOR FAN	Direct Drive, Centrifugal, horizontal discharge, 1/2 HP motor, continuous operation at 1050 RPM, CFPM range of 1200–2000.
EVAPORATOR COIL	Plate fin type, 13 fins/in. 3.97 sq ft face area.
ACCESSORY HEATER	7.5 kW, single phase at 208 volts



It is imperative that the ac power be removed from the unit before attempting any inspection or maintenance.

2.04 Access to the HVAC unit may be obtained by removing the sheet metal screws securing the top cover and side panels. Caution should be exercised when removing the top cover and side

panels to prevent any damage to the evaporator and condenser coils.

MAINTENANCE REQUIREMENTS

2.05 Refrigerant Charging: The unit refrigerant system is factory charged to 4 lbs, 7 ozs. When recharging becomes necessary the system is blown out to remove any refrigerant remaining in the system. A standard 1/4 inch Schraeder service

connection (Fig. 3) is provided on the high and low charged sides of the refrigerant system for evacuation and charging. A correctly charged system ensures the proper relationship between the outdoor temperature, evaporator temperature, and the low pressure line temperature. ***The refrigerant recharging operation must be done by an authorized service representative.***

2.06 Compressor: The compressor (Fig. 3) contains a factory oil charge. The oil must be replaced, if for any reason it is lost. ***Since the oil recharging operation is quite specialized, it must be performed by an authorized service representative.***

2.07 Fan Motor Bearings: Both the evaporator fan and condenser (Fig. 4) motor bearings are prelubricated and do not require further attention.

2.08 Evaporator Coil: The evaporator coil (Fig. 4) should be inspected periodically. Access is obtained by removing the top cover. Cleaning should be done with a brush. If, during the inspection of the evaporator coil, an ice buildup is noticed on the coil, then the refrigerant system is

incorrectly charged or at a low charge level. ***Again the Carrier service representative must be contacted to replace the refrigerant.***

2.09 Condensate Drain: The condensate drain (Fig. 1) is provided with each HVAC unit. The condensate drain must be installed for proper operation and should be free of debris. The condensate drain trap, if plugged, may be cleaned with a bottle brush, then flushed. The condensate pan, located beneath the evaporator coil, should be flushed with clean water to remove any debris.

2.10 Evaporator Fan Wheel: The evaporator fan wheel should be centered in the fan housing. If alignment of the fan motor, in relationship to the opening in the sheet metal cover, becomes necessary, loosen the setscrews (Fig. 4) holding the fan to the motor shaft. Adjust the fan, then tighten the setscrews. Remove any caked-on dirt from the fan wheel and fan housing with a brush.

2.11 Condenser Coil: The condenser coil should also be inspected periodically. Remove debris with a brush. To gain access, lift or remove the top cover. (Refer to Fig. 4.)

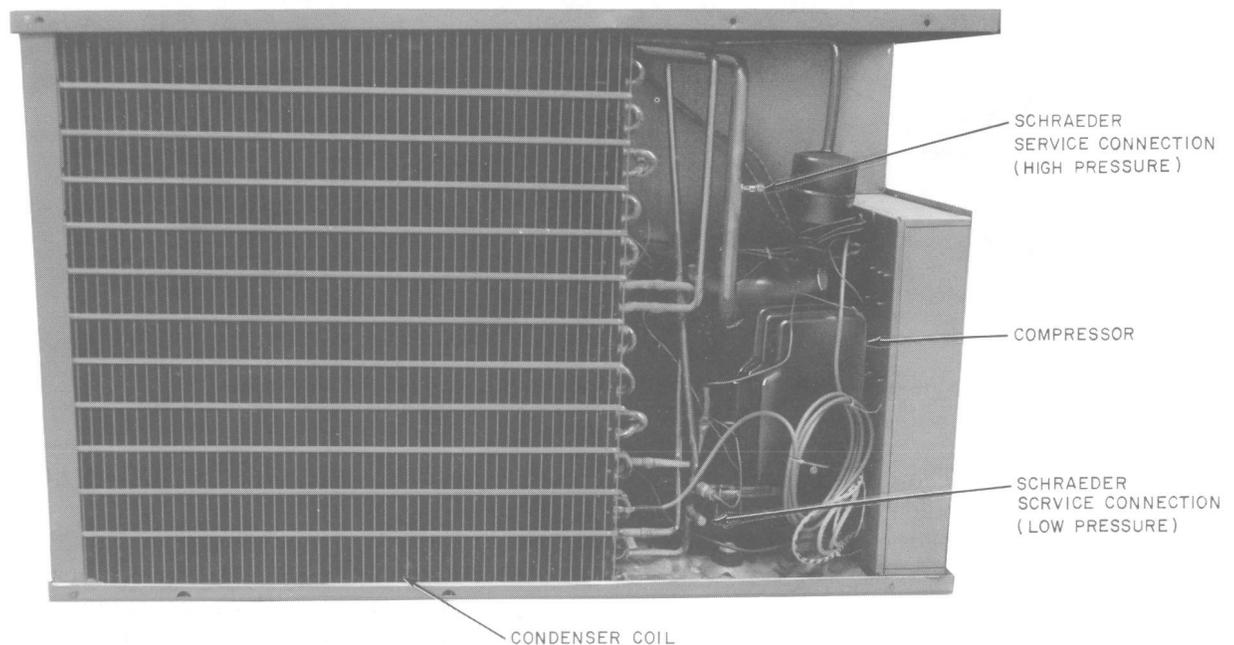


Fig. 3—Carrier Cooling Unit (Front View) Model 50MH048

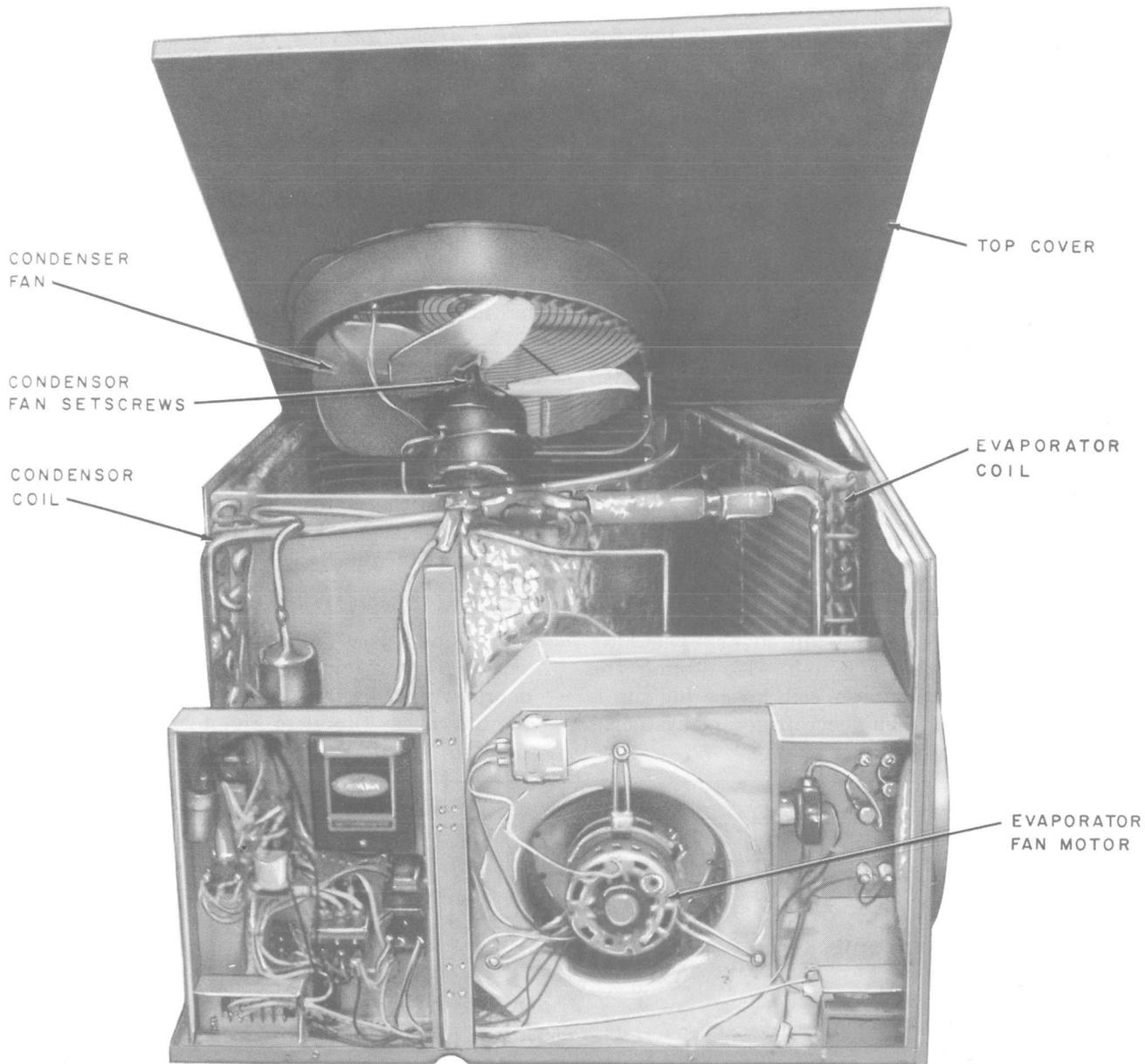


Fig. 4—Carrier Cooling Unit Component Layout (Right Side View)

2.12 Condenser Fan: The condenser fan (Fig. 5) adjustments are made in the same manner as described previously for the evaporator fan.

2.13 Return Air Filter: To gain access to the return air filter (Fig. 6), turn the access knob to the left, pull, and swing the hinged grill to the right. The filter (Fig. 7) can then be easily removed. Once removed the return air passageway

will expose the back part of the HVAC unit as shown in Fig. 8.

2.14 The KS-7406 L2 replaceable return air filter covers a 2-inch thick, impingement-type air filter material in different dimensions for various applications in the telephone system. Therefore, the return air filter size, 25" × 20" × 2", must be specified in the ordering information. One return air filter is required for each HVAC unit.

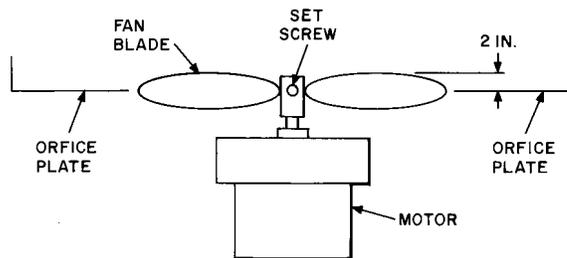


Fig. 5—Condenser Fan Positioning

The replaceable return air filter should be changed at a minimum of twice yearly.

2.15 The permanent type filter which may be used in lieu of the replaceable type filter should be flushed with hot water, steam, or soaked in a mild solution of soap or detergent and water. Allow the filters to dry completely, then replace. Refer to the filter manufacturer's instructions, as required, for other types of filters.

2.16 Ceiling Diffusers and Air Regulation: The modules have a suspended ceiling of acoustical tile. The suspended ceiling is approximately 10 inches below the main ceiling. This 10-inch space acts as an air plenum for the heating and air conditioning system. Regulation of the dispersed air is accomplished by the use of adjustable louvers, refer to Fig. 9 and Fig. 10.

2.17 Regulation of the air flow through the ceiling diffuser, shown in Fig. 9, may be accomplished by actuating the spring clips on the end and on each side of the screen. Then lower the screen as shown in Fig. 11. Insert a screwdriver into the adjustable slot (Fig. 9), and turn to obtain the desired regulation.

2.18 To regulate the air flow through the ceiling diffuser shown in Fig. 10, lower the screen in the same manner as previously described. Louver adjustment, in this model, is done manually. Each louver is individually adjusted to permit the proper air flow.

2.19 *The two ceiling diffusers nearest each HVAC unit in the control module should be closed. In addition, the nearest diffuser to the HVAC unit in each of the other modules should be closed. All other ceiling diffusers*

should be fully opened, with their louvers adjusted so that the cool air is directed towards the heat producing equipment. However, if the control module has only four diffusers and/or the other modules have three, all of the ceiling diffusers should be open.

2.20 Fresh Air Intake: To provide for removal of equipment odors and aid in personnel comfort, a requirement of 5-percent fresh air intake has been adopted. The air intake is provided by an opening in the bottom of the exterior HVAC duct. The fresh air louvers should be adjusted so that they are practically closed to approximate five percent. To achieve the required make-up air, removable snap-in caps, if provided, may be removed one at a time.

2.21 The make-up air filters of the replaceable type are KS-7406 L2, measuring 9" × 18" × 2". The size of the make-up air filter must be specified when ordering with the KS number. Two make-up air filters are required.

TROUBLESHOOTING

2.22 Troubleshooting: The HVAC troubleshooting chart (Fig. 12) *is* provided to inform the user of the possible causes of malfunctions. The HVAC troubleshooting chart *is not* provided for any other action other than that of determining the probable cause of the malfunction. *The user should not attempt any repairs but should contact the service representative.*

2.23 In addition to the HVAC troubleshooting chart, heating, ventilating, and air conditioning application schematic (SD-2H202-01) provides the electrical wiring of the HVAC units and may be used to detect possible causes of malfunctions.

3. FIRE DETECTION AND ALARM

3.01 The No. 2A or 2C ESS uses Bell System approved Pyr-A-Larm equipment for fire detection and alarm. The system is manufactured by Pyrotronics Inc., of Cedar Knolls, New Jersey. The system is listed by Underwriter's Laboratories Inc., and is approved by state or municipal regulatory agencies where required. The general arrangements, wiring, and equipment information are shown on drawing ED-2H068-01 (Fire Detection and Alarm, Typical Equipment, and Wiring Arrangements). The location and installation information is shown

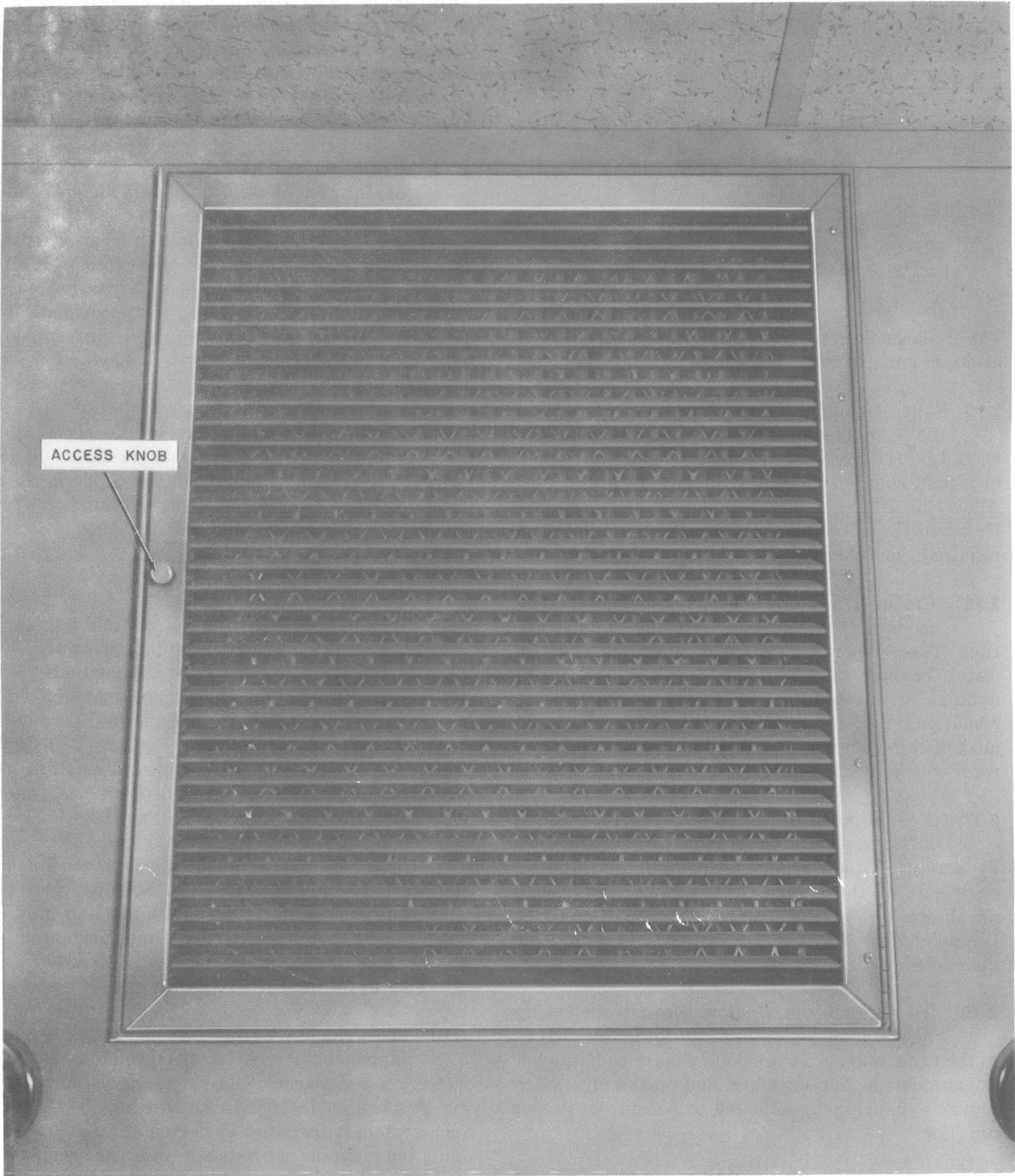


Fig. 6—HVAC Return Air Grille

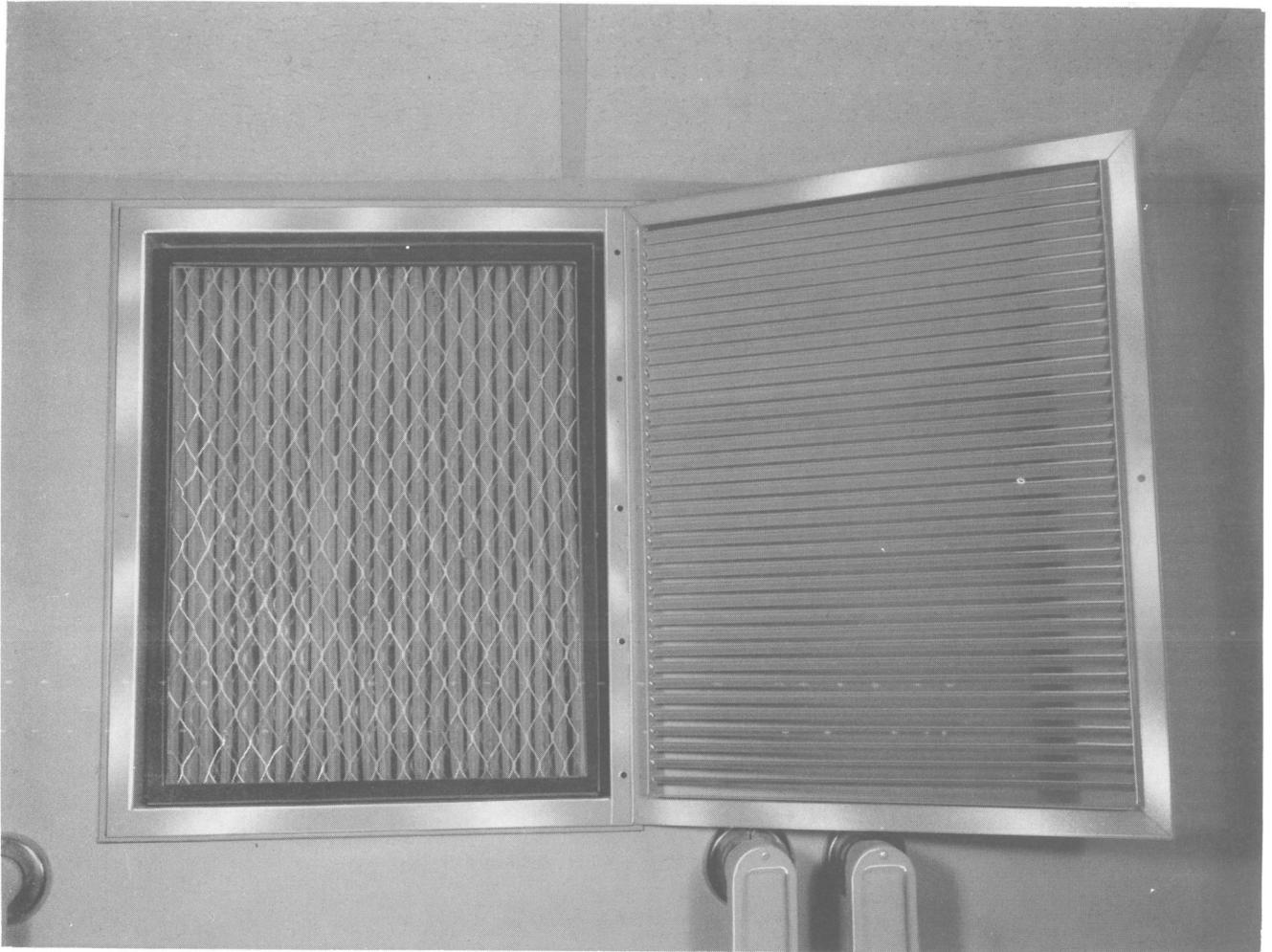


Fig. 7—HVAC Return Air Filter

on the module building's electrical drawings in specification ED-2H126-01 (Building Modules and AC Service Equipment Assembly for KS-20993, KS-21431, and KS-21438).

3.02 The Pyr-A-Larm system provides the following features:

- DC power for operation of detectors
- Control of fire alarm signals
- Control of trouble signals
- Control of supplementary equipment
- Power for visual alarm indicators

3.03 The Pyr-A-Larm control unit (Fig. 13) is a 2-zone unit, Model CTZ-2, and is designed for noncoded automatic fire alarms, using fire detectors and manual fire alarm stations. The unit utilizes a 2-wire circuit and is located in the control module. Normally only one of the two zones is used. If use of the second zone is desired, it may be provided on a local basis.

3.04 The control unit is designed to be operated from a 120 volt, 60-Hz, 3-wire, grounded neutral power source. The control unit must be connected through separate circuit breakers directly to the main power feed. No other equipment should be supplied from these separate circuit breakers. Refer to Fig. 14 for a wiring diagram.



Fig. 8—HVAC Return Air Passageway

3.05 The Pyr-A-Larm unit is interconnected with the No. 2A or 2C ESS via the remote master scanner applique circuit on miscellaneous trunk frame (00). When a trouble or an alarm condition is indicated on the Pyr-A-Larm control unit, the Maintenance Center Teletypewriter (MC TTY) will automatically print the M SY MIS aa bb cccccc message, thereby documenting the occurrence. Refer to Output Message Manual (OM-2H200) for the explanation of the message. Pyr-A-Larm terminals 3 and 4 (Fig. 14) are connected to the No. 2A or 2C ESS to print trouble conditions, while terminals 15 and 20 are connected to print alarm conditions.

3.06 The manual fire alarm station (Fig. 15) is recommended as a backup to the automatic

devices. The station is constructed of die cast zinc and is finished in bright red. The station can be opened for inspection without shutting off the fire alarm system or initiating an alarm.

3.07 Only one manual fire alarm station is required and is located in the equipment receiving module. The reset key, furnished with the station, must be used to reset the station once the station is activated.

3.08 Two Pyr-A-Larm remote alarm lamps (Fig. 13), are for the power service module and one for the cable vault, are mounted above the control unit in the control module. These lamps are used to indicate when an open flame or combustion has been detected by the flame or ionization head

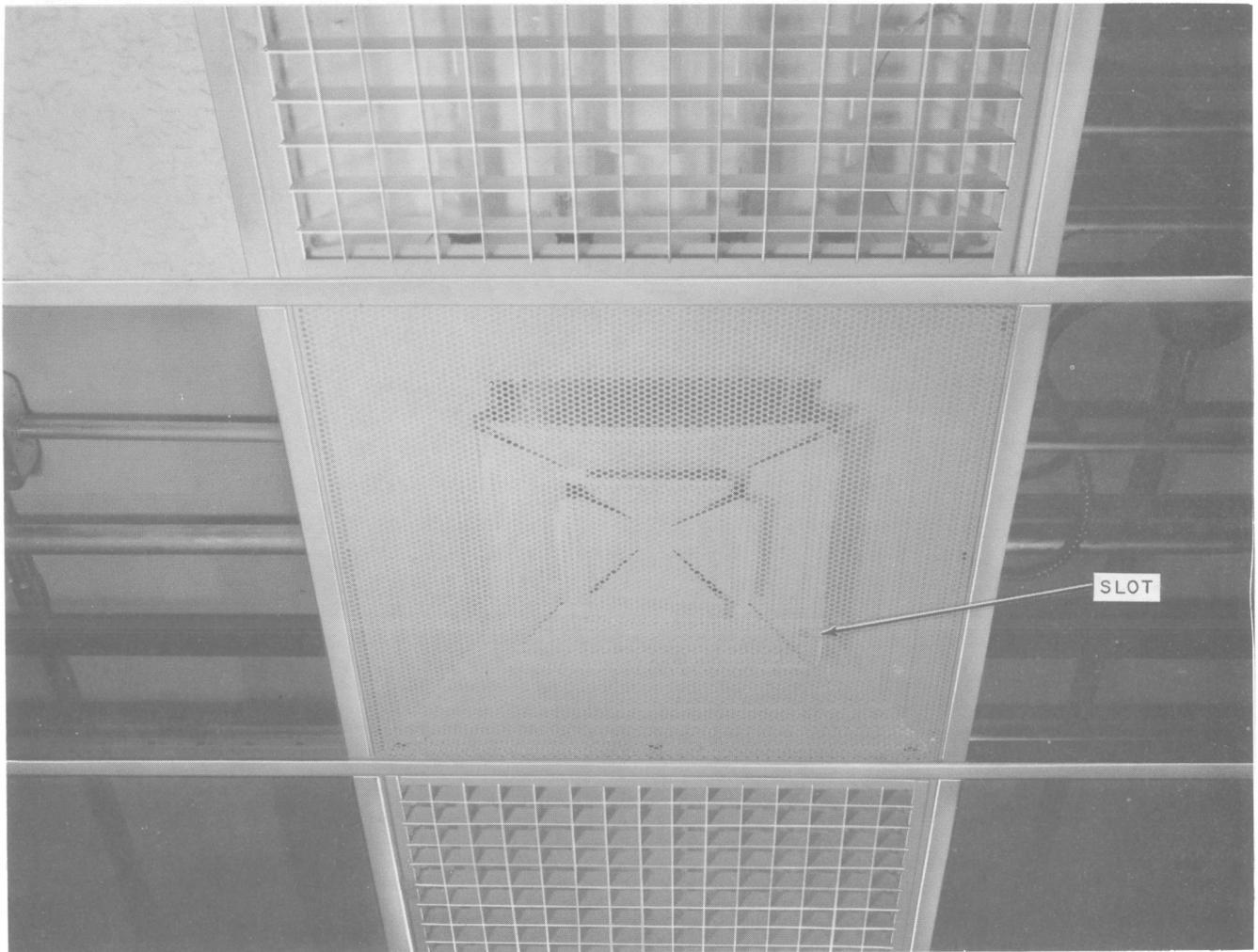


Fig. 9—Ceiling Diffuser (Old Type)

(Fig. 16) in the power service module or cable vault.

3.09 The Pyr-A-Larm ionization fire detectors, Model DIS-3/5A, (Fig. 16), are constructed to react to any indications of a fire. Any invisible combustion products entering the detector's outer chamber, disturbs the balance between two ionization chambers and triggers a highly sensitive cold cathode tube. The firing of the tube transmits a signal to the control panel. The transmitted signal then activates the alarm devices.

3.10 The basic components of the ionization fire detector are shown in Fig. 17. The entire unit contains no moving parts, thus requires no

replacements due to wear. The locking shell acts as a protective cover which twist-locks into place. A socket-head set screw secures the shell to the base, to prevent removal of the detector head without prior loosening of the screw. All of the components are rust and corrosion resistant. Vibration has little effect on the detector operation. A neon indicator is provided for visually locating the detector initiating the alarm.

3.11 Two ionization detector heads are installed in each equipment and administration module. One ionization detector head is located in the equipment receiving module and one in the power service module. An optional ionization detector head may be installed in the cable vault, if a cable

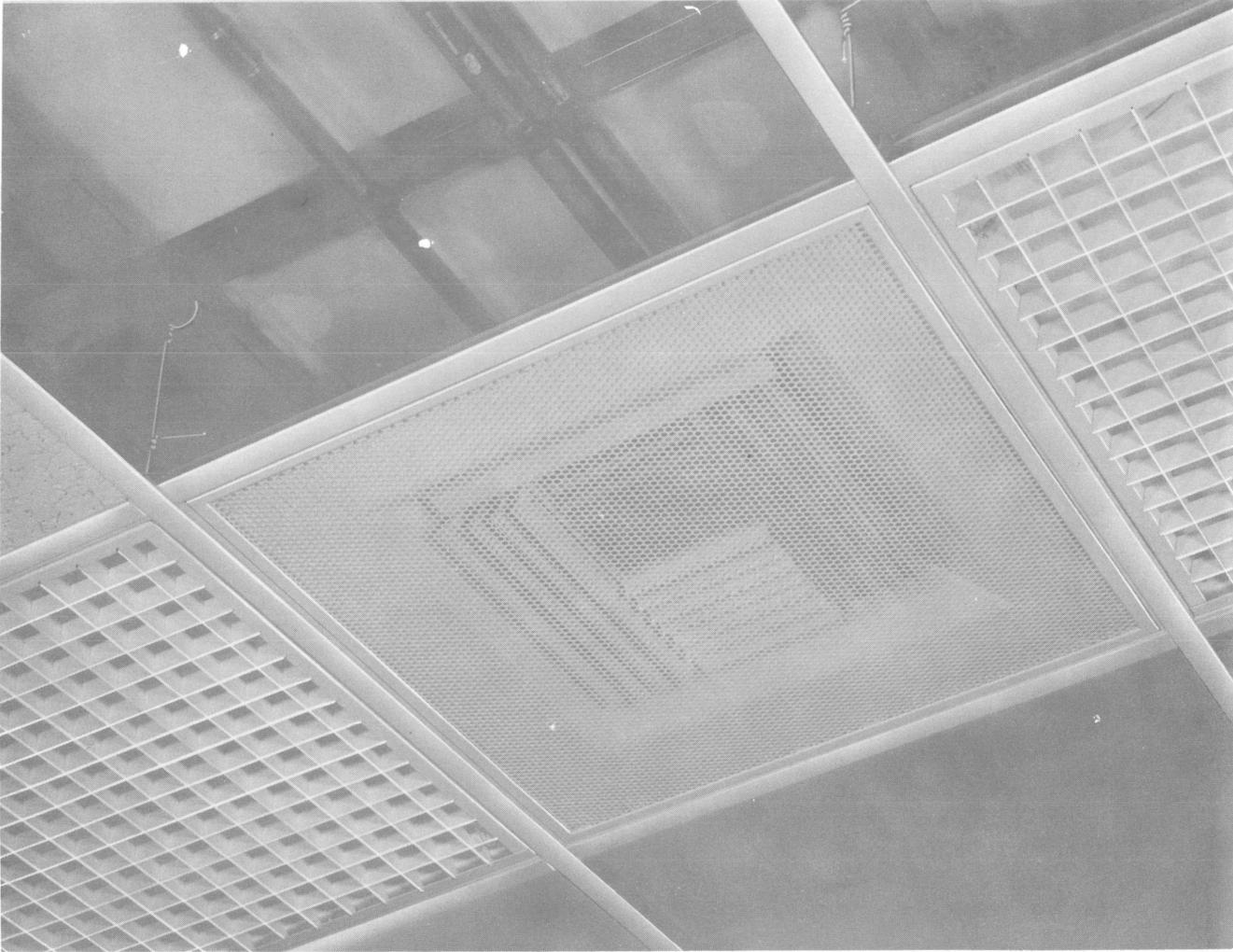


Fig. 10—Ceiling Diffuser (New Type)

vault is required. The equipment receiving module has a manual station. A flame detector head, Model DFS-10, is installed in addition to the ionization detector head in the power service module.

OPERATION

3.12 In the *standby condition*, all switches (Fig. 13) should be set to NORMAL. The power lamp should be "on", the FIRE and TROUBLE lamps should be "off."

3.13 When a *trouble condition* develops the trouble lamp and buzzers are activated. The trouble buzzer may be silenced by setting the TROUBLE switch to SILENCE position. However,

the TROUBLE lamp will remain illuminated. When the trouble condition is corrected, the trouble buzzer will again sound if the TROUBLE switch has been left in the SILENCE position, and the TROUBLE lamp will remain illuminated. This ring-back feature of the system prevents the TROUBLE switch from being inadvertently left in the SILENCE position.

MAINTENANCE



It is imperative that caution be taken while performing any inspection, testing, maintenance, or troubleshooting to avoid hazardous voltages.

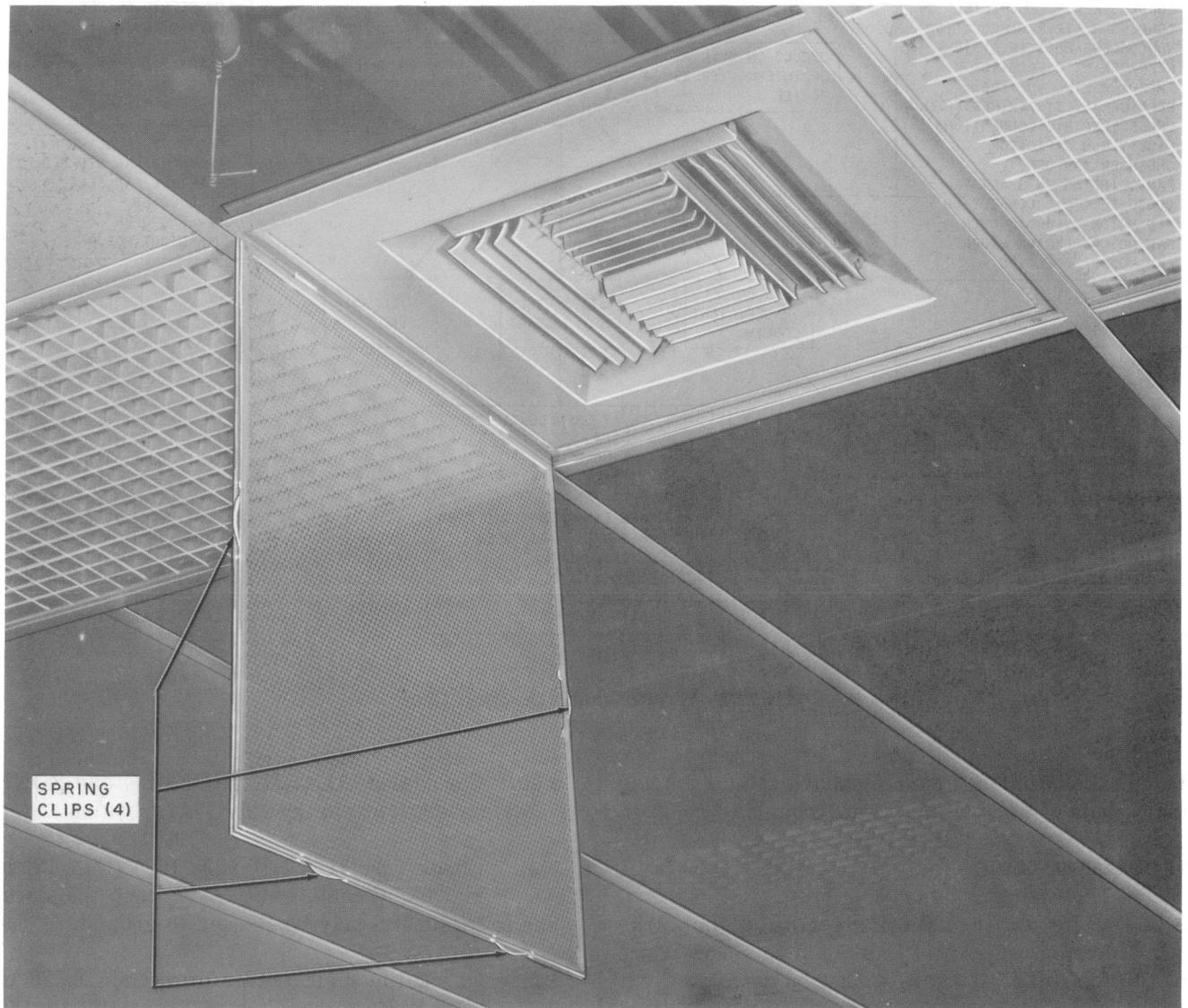


Fig. 11—Ceiling Diffuser With Screen Lowered

3.14 An annual inspection of all fire protection equipment is recommended. The following inspection testing schedule and frequency interval is recommended by the manufacturer, to ensure proper and reliable operation.

3.15 *Every Six Months:* Inspect each detector head screen for dust accumulations. In event of excessive build-up, tap the detector *lightly* with a pencil to remove any dust deposits. If a heavy dust accumulation has occurred, it may be necessary to disassemble the detector for cleaning. *This*

operation may only be performed by an authorized Pyr-A-Alarm representative.

3.16 Activate one ionization detector by blowing smoke into the screened chamber or holding a lighted match slightly below the detector. This action will activate the system enabling the check of the alarm lights and ensuring that proper alarm and zone indications are given by the control unit.

3.17 The supervisory circuits may be operated by setting the POWER switch to RESET.

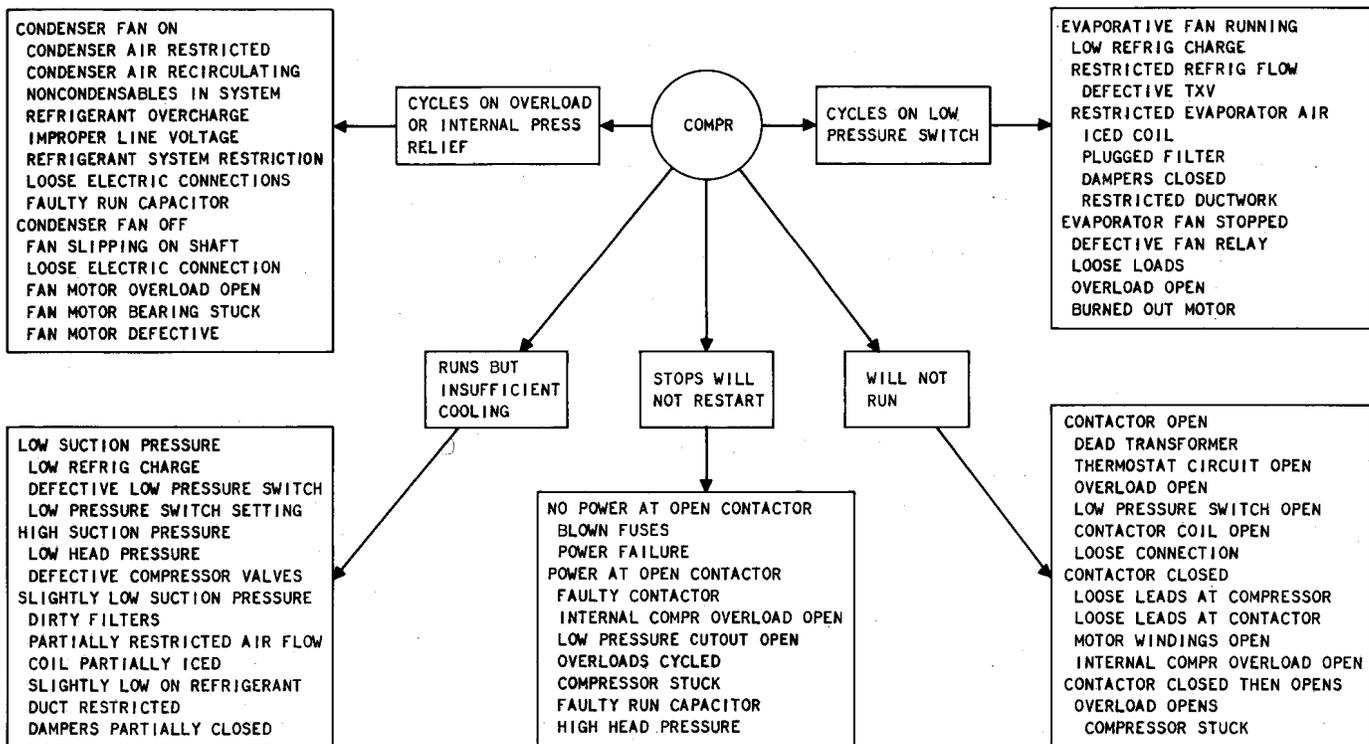


Fig. 12—HVAC Troubleshooting Chart

In this position, the control panel should display indications of audible and visual trouble.

TROUBLESHOOTING

3.18 In order to effectively troubleshoot the system, use the symptom(s) to select which of the following procedures must be performed.

Power Lamp Not Lighted

3.19 Check fuse (F2), refer to Fig. 18:

- (1) If fuse is blown and continues to blow after replacement, disconnect leads to terminals 23, 24, and 25 to isolate trouble. If the power lamp remains lighted when the fuse is replaced, check the disconnected leads for a short to ground.
- (2) Check input voltage across terminals 27 and 28. Voltage should be within the range of 102 to 132 volts ac.
- (3) Check the POWER lamp—TROUBLE lamp is lighted and TROUBLE buzzer is activated.

3.20 Check that ALARM, TROUBLE and ZONE switches are in the NORMAL position.

3.21 Check fuse (F1): If fuse (F1) (Fig. 18) is blown and continues to blow, then the alarm line to terminal 8 may be shorted to ground.

3.22 Check the main power on terminals 26 to 27. Voltage reading of from 102 to 132 volts ac should be obtained.

3.23 Check the detector circuit voltage, terminals 21 (–) to 22 (+) for ZONE 1 and terminals 13 (–) to 14 (+) for ZONE 2.

- (1) If the voltage is greater than normal, 220 volts dc, place a 90.9K ohm resistor across terminals 13 to 14 (for ZONE 2), and a 90.9K ohm resistor across terminals 21 to 22 (for ZONE 1). If the panel returns to normal, then there is an "open" in the external detector circuit.
- (2) If the voltage is below 200 volts dc or the preceding paragraph does not solve the problem, disconnect the detector line to terminal 14 and place a 90.9K ohm resistor across terminals

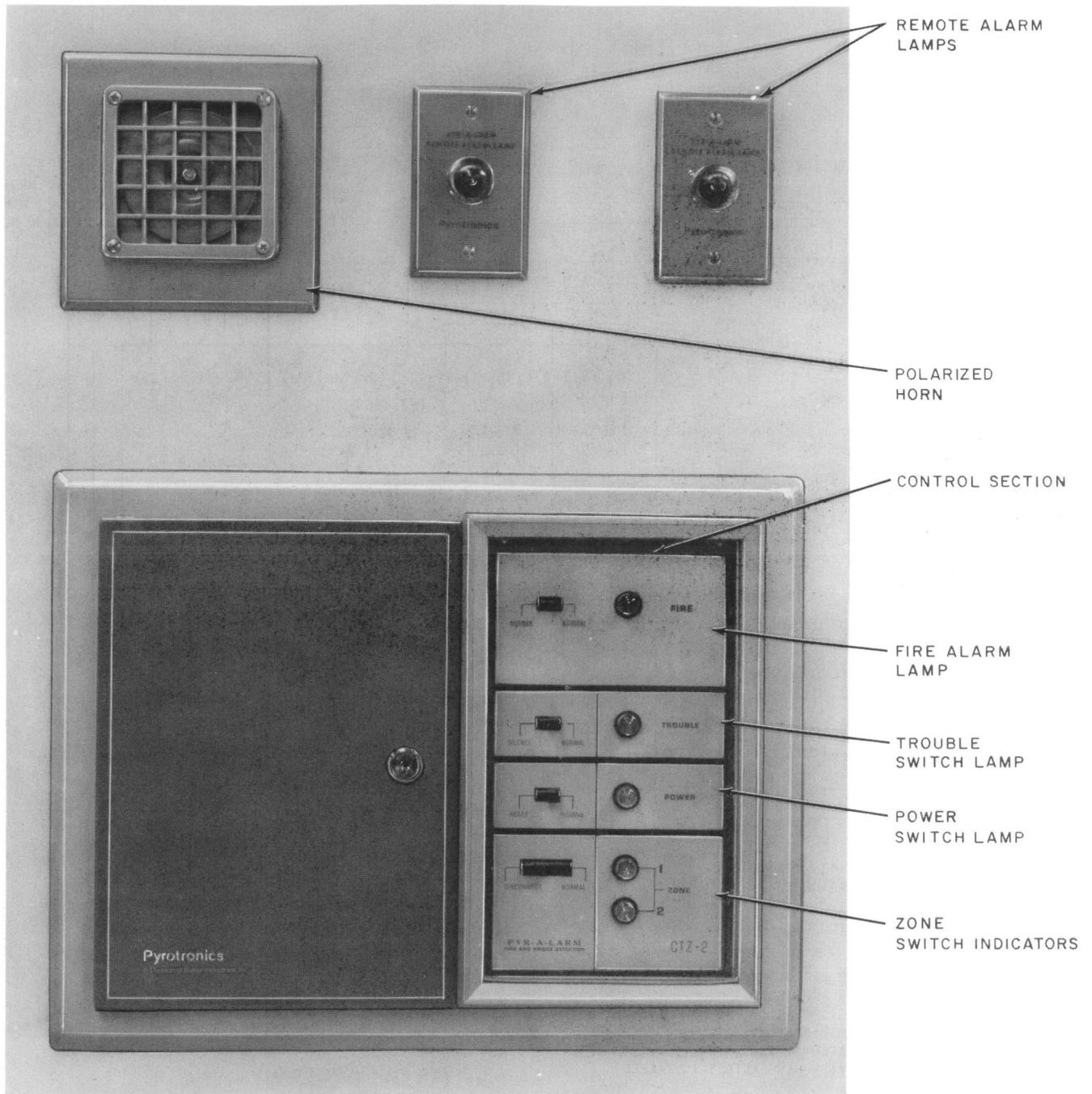


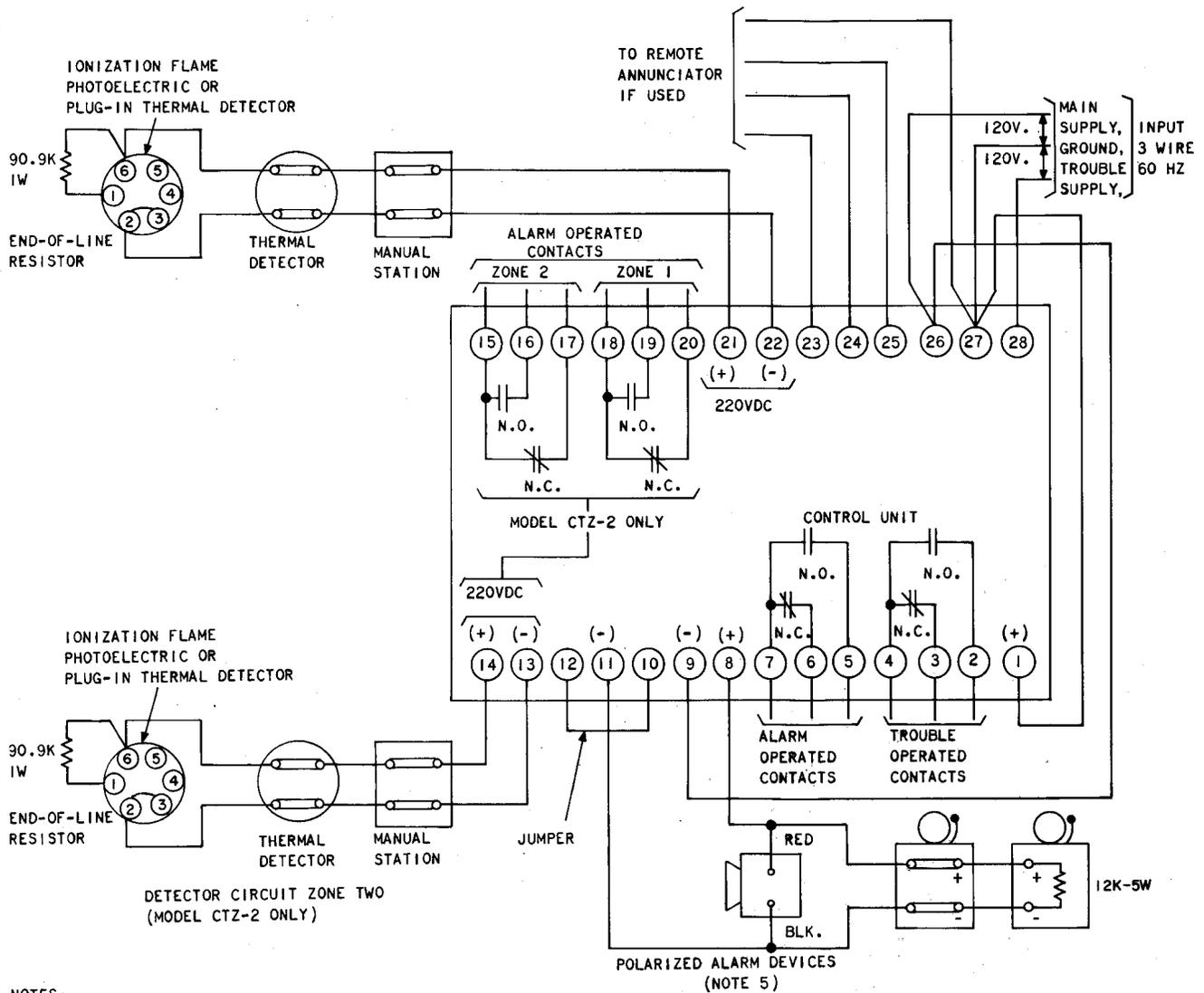
Fig. 13—Pyr-A-Larm (Model CTZ-2)

13 to 14 (for ZONE 2). If the TROUBLE lamp extinguishes, then the disconnected lead is shorted to ground. If a normal condition does not exist, disconnect the detector line to terminal 21 and place a 90.9K ohm resistor across terminals 21 and 22 (for ZONE 1). If the TROUBLE lamp

extinguishes, then the disconnected lead is shorted to ground.

(3) Check voltage between terminal 13 (for ZONE 2) and the chassis ground and terminal 22 (for ZONE 1) to chassis ground. Meter reading

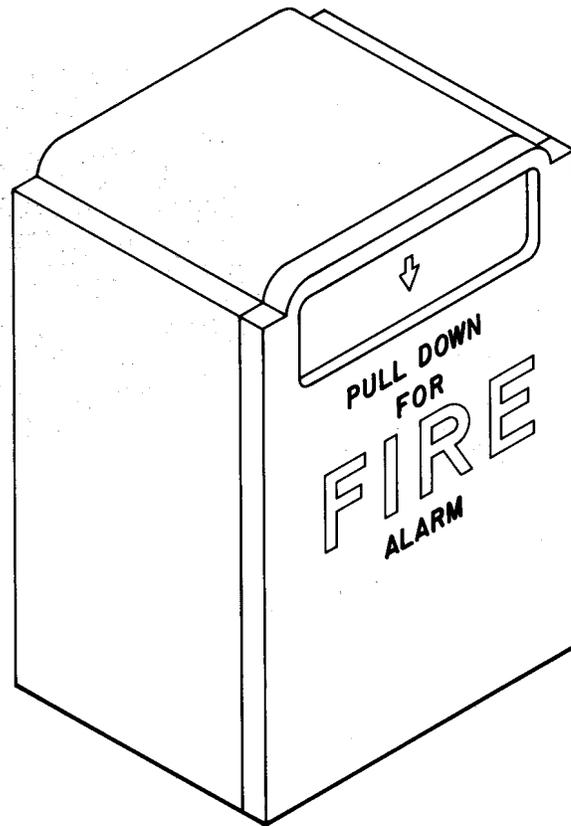
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NOTES:

1. POWER INPUT AND ALARM CIRCUIT WIRING - #14 AWG, 600V.
2. DETECTOR WIRING - #18 AWG, 600V.
3. NO PARALLELED BRANCHING. POLARITY MUST BE OBSERVED ON DETECTOR AND ALARM CIRCUITS.
4. ALL RELAY CONTACTS RATED AT 120V, 60HZ, 5A.
5. END-OF-LINE ALARM DEVICE HAS FACTORY INSTALLED END-OF-LINE RESISTOR.
6. RELAY CONTACTS SHOWN IN NORMAL SUPERVISORY CONDITION.

Fig. 14—Pyr-A-Larm Wiring Diagram



SURFACE MOUNTED TYPE
PROVIDES ITS OWN BACK
BOX AND CONDUIT OPENINGS.
EXTENDS ONLY 3" BEYOND
WALL SURFACE.

Fig. 15—Manual Fire Alarm Station (Model MFS-2)

should be from 1 to 8 volts dc. If voltage is low, disconnect the lead on terminal 14 and place a 90.9K ohm resistor across terminals 13 to 14 (for ZONE 2). If the TROUBLE lamp extinguishes, then the disconnected lead is shorted to ground. If a normal condition does not exist, disconnect the detector line to terminal 21 and place a 90.9K ohm resistor across terminals 21 and 22 (for ZONE 1). If the TROUBLE lamp extinguishes, then the disconnected lead is shorted to ground.

(4) Check voltage between terminals 8(+) and 11(-).

(a) If the voltage is over 110 volts ac, place a 12K ohm resistor across terminals 8 and 11. If TROUBLE lamp extinguishes, then the alarm lines or the end-of-line resistor may be open.

(b) Remove leads from terminals 8 and 11, and place a 12K ohm resistor between the two terminals. If the TROUBLE lamp extinguishes, then the alarm lines are shorted to ground.

(5) Ensure that the proper connections have been made to terminals 10 and 12.

Alarm Conditions Without Symptoms Of Fire

3.24 If the system is activated without the evidence of a fire, take the following action:

(1) Move the RESET switch to "reset" position and release.

(2) Check voltage from terminals 13 to chassis ground and from terminal 22 to chassis ground.

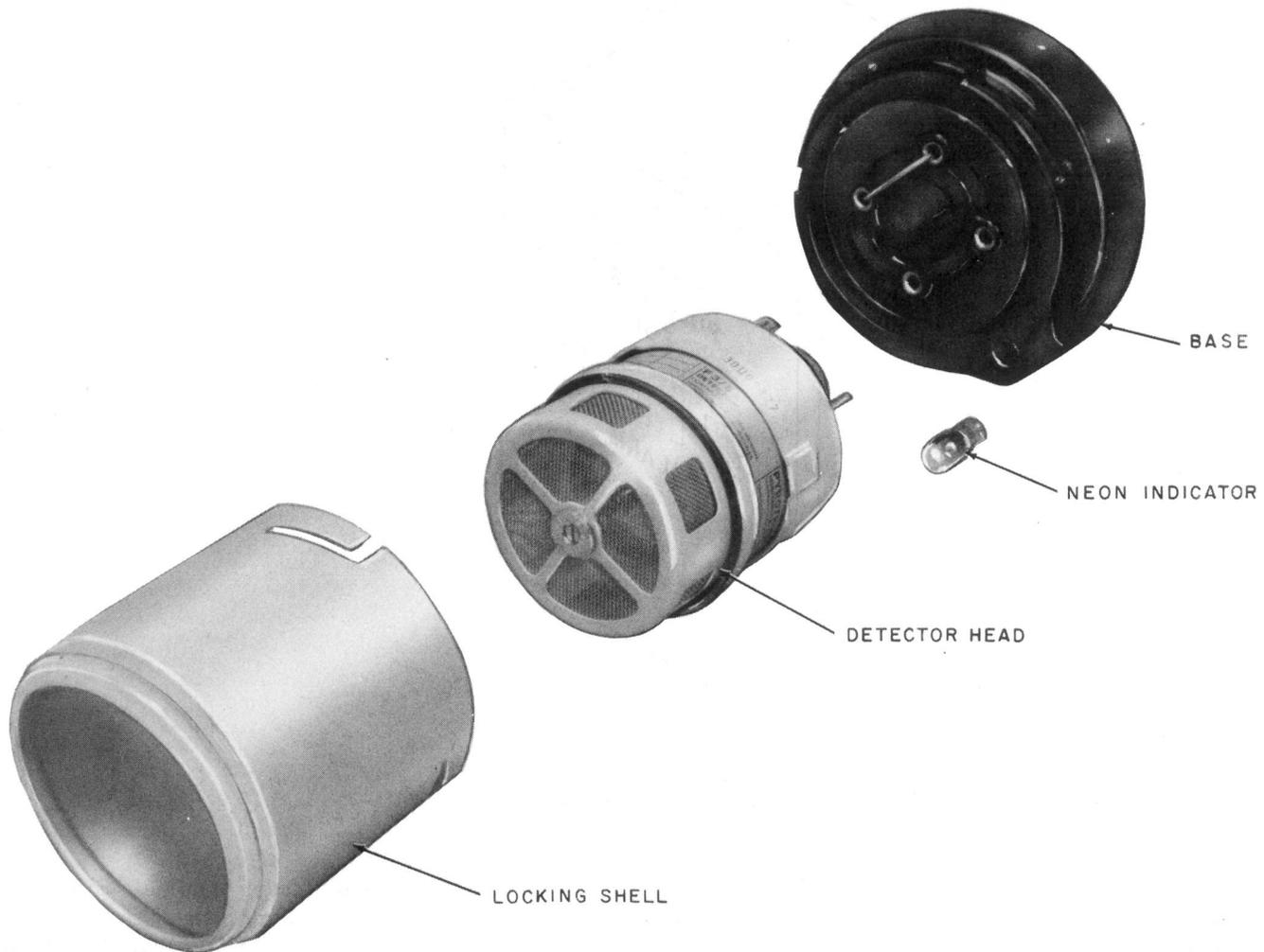


Fig. 16—Pyr-A-Larm Ionization Fire Detector (Model DIS-3/5A) Unassembled

(a) If the voltage measurement is between 10 to 30 volts dc, then the detector has fired and is not resetting. Locate the defective detector by observing a detector with the neon indicator (Fig. 17) flashing.

(b) If the voltage is above 30 volts dc, then disconnect the detector leads from terminals 14 and 21. Place a 90.9K ohm resistor across

terminals 13 to 14 and place a 90.9K ohm resistor across terminals 21 to 22. If the panel will now reset, then there is a short circuit across the detector circuit.

(c) Check the alarm circuit for an audible horn that has been installed in reversed polarity.



Fig. 17—Pyr-A-Larm Ionization Fire Detector (Model DIS-3/5A) Assembled

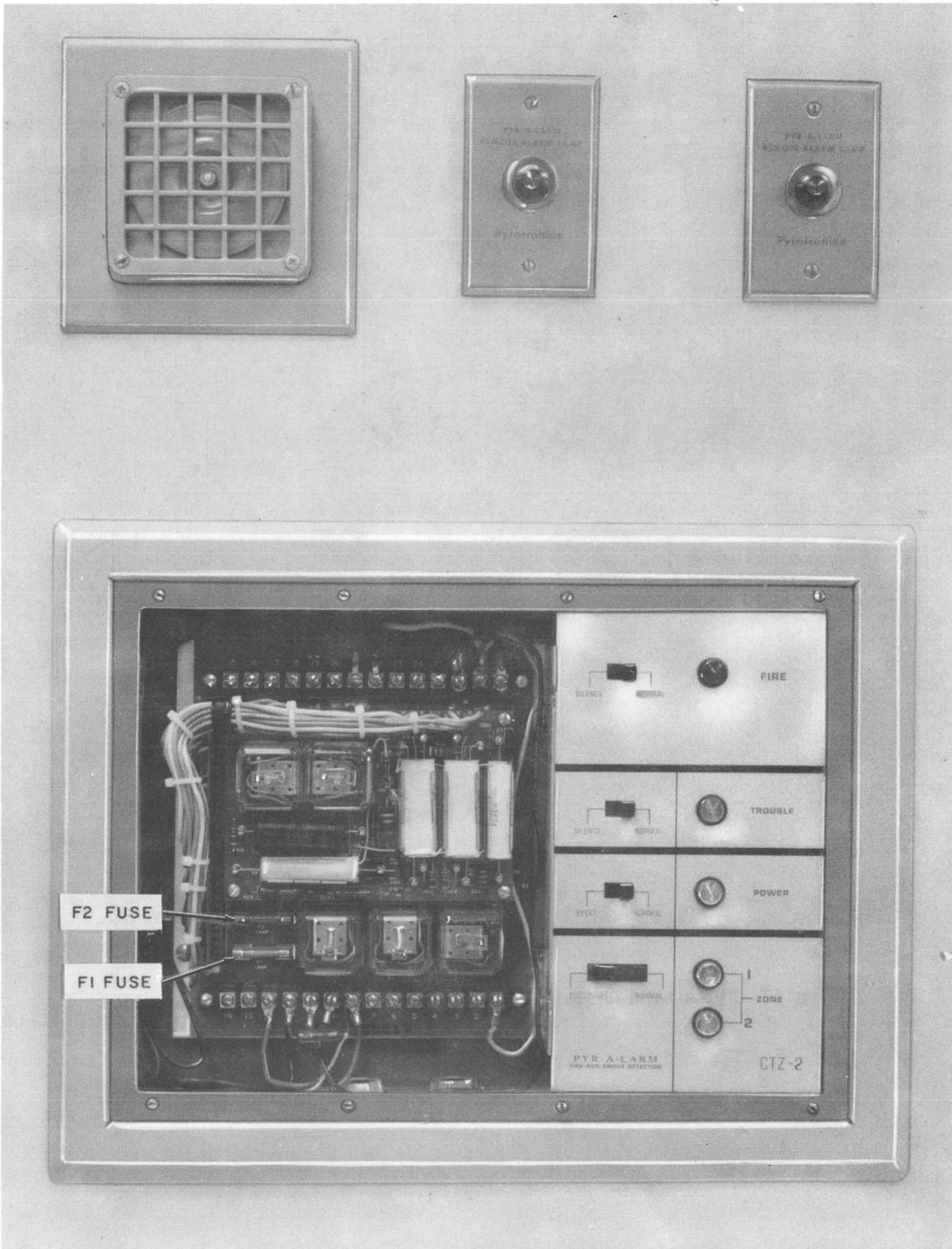


Fig. 18—Pyr-A-Larm Without Control Panel Cover

3.25 Table B lists the various voltage measurements previously mentioned in tabular form.

TABLE B
PYR-A-LARM VOLTAGE MEASUREMENT CHART

TERMINALS	VOLTAGE	MODE
14 to 13	175 — 240 Volts dc	Normal
13 to Chassis Ground	1 — 8 Volts dc	Normal
21 to 22	175 — 240 Volts dc	Normal
22 to Chassis Ground	1 — 8 Volts dc	Normal
8 to 11	75 — 110 Volts dc	Normal
11 to 27	50 — 75 Volts dc	Normal
26 to 27	102 — 132 Volts ac	Normal or Trouble
28 to 27	102 — 132 Volts ac	Normal or Trouble
22 to Chassis Ground	10 — 30 Volts dc	Alarm
8 to 11	102 — 132 Volts ac	Alarm
13 to Chassis Ground	10 — 32 Volts dc	Alarm

4. COMBUSTIBLE GAS ALARM

4.01 As an additional safety feature for the No. 2A or 2C ESS, a combustible gas alarm system is provided as an option (Fig. 19). The system is made by the Bacharach Instrument Company, of Pittsburgh, Pa. This system consists of two major components, control unit and gas detector. Although a few No. 2A or 2C ESS offices may be equipped with combustible gas alarm systems made by other firms, this section covers only that unit made by the Bacharach Instrument Company.

4.02 The control unit, (Fig. 19) model CD800W, is mounted in a fiberglass-reinforced polyester case, 11-1/2 inches in height, 5 inches deep, and 9-1/4 inches wide. The control unit is located on the wall adjacent to the rest room, and is electrically connected to existing building alarms. The control unit contains a plug-in circuit board, three control relays, and a front panel containing a pushbutton power switch (PILOT), ALARM, RESET, and WARN/TEST pushbutton switch, FAIL indicator lamp, and a meter indicating gas-air mixture in percentage of lower explosive limit. Refer to Fig. 20 and 21 for a detailed component layout of

the control unit. The control unit supplies power to the remote detector and processes returning signals for operating the alarm circuitry. In addition, a convenient pushbutton-operated, self-test circuitry, is provided for easy system maintenance.

4.03 The Bacharach gas detector,* Fig. 22 and 23, model 800-080.10, is an explosion-proof unit capable of detecting combustible gas in the air by exposing the existing air-gas mixture to flameless catalytic burning on the surface of its sensing element. A Wheatstone bridge circuit is used to compare the electrical resistance of the active sensing element with that of a companion reference element at the same temperature. If a difference in electrical resistance between the active and reference elements exists, it produces a signal current in the detector bridge circuit. This signal is then fed to the control unit where it activates the indicating meter and the alarm circuitry.

*Registered trademark of Bacharach Instrument Company

4.04 Each combustible gas has its own rate of heat-energy release upon oxidation. For this reason the control unit is adjusted and calibrated specifically for a particular type of gas to be

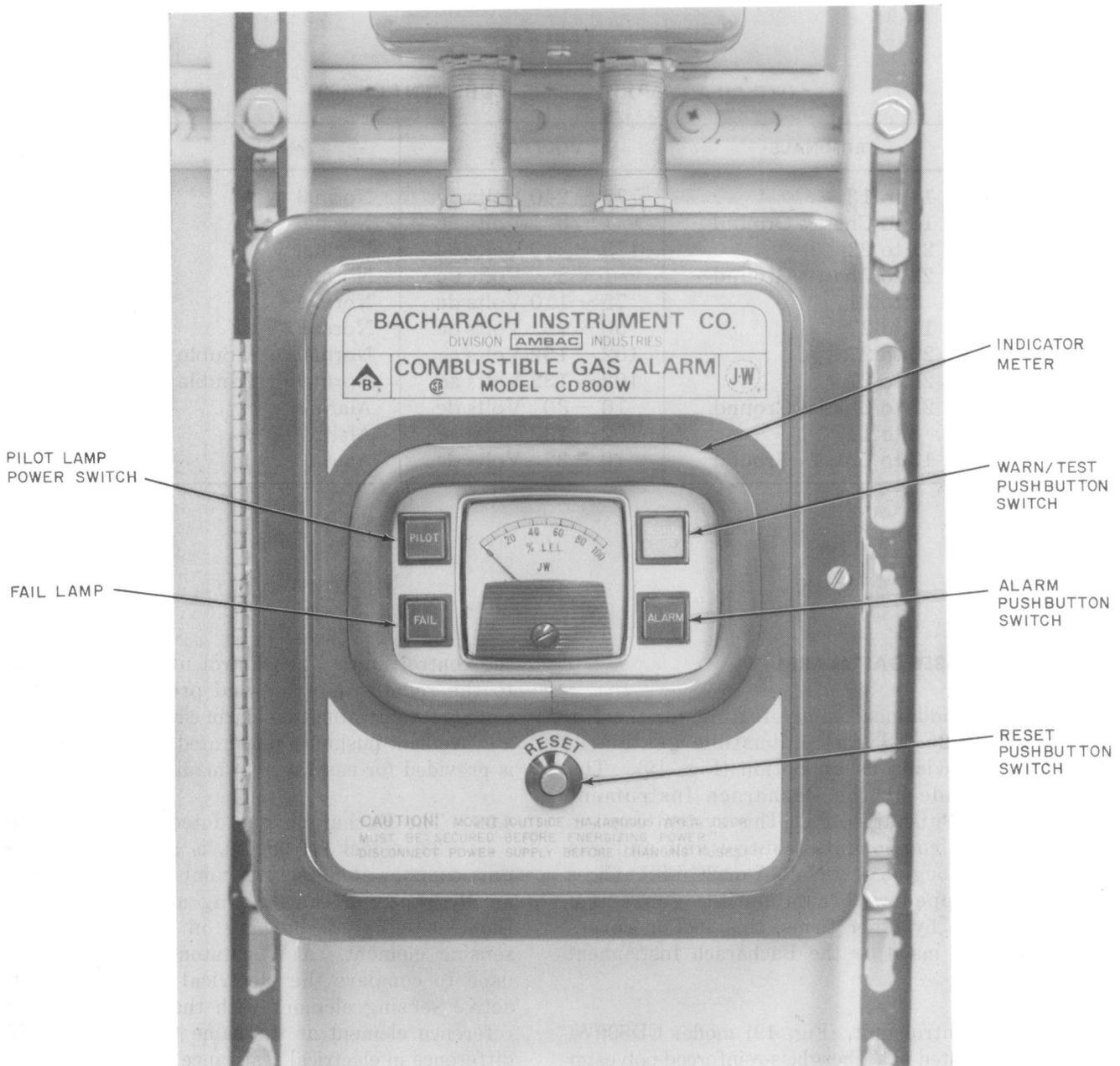


Fig. 19—Bacharach Combustible Gas Alarm (Model CD800W) Control Unit

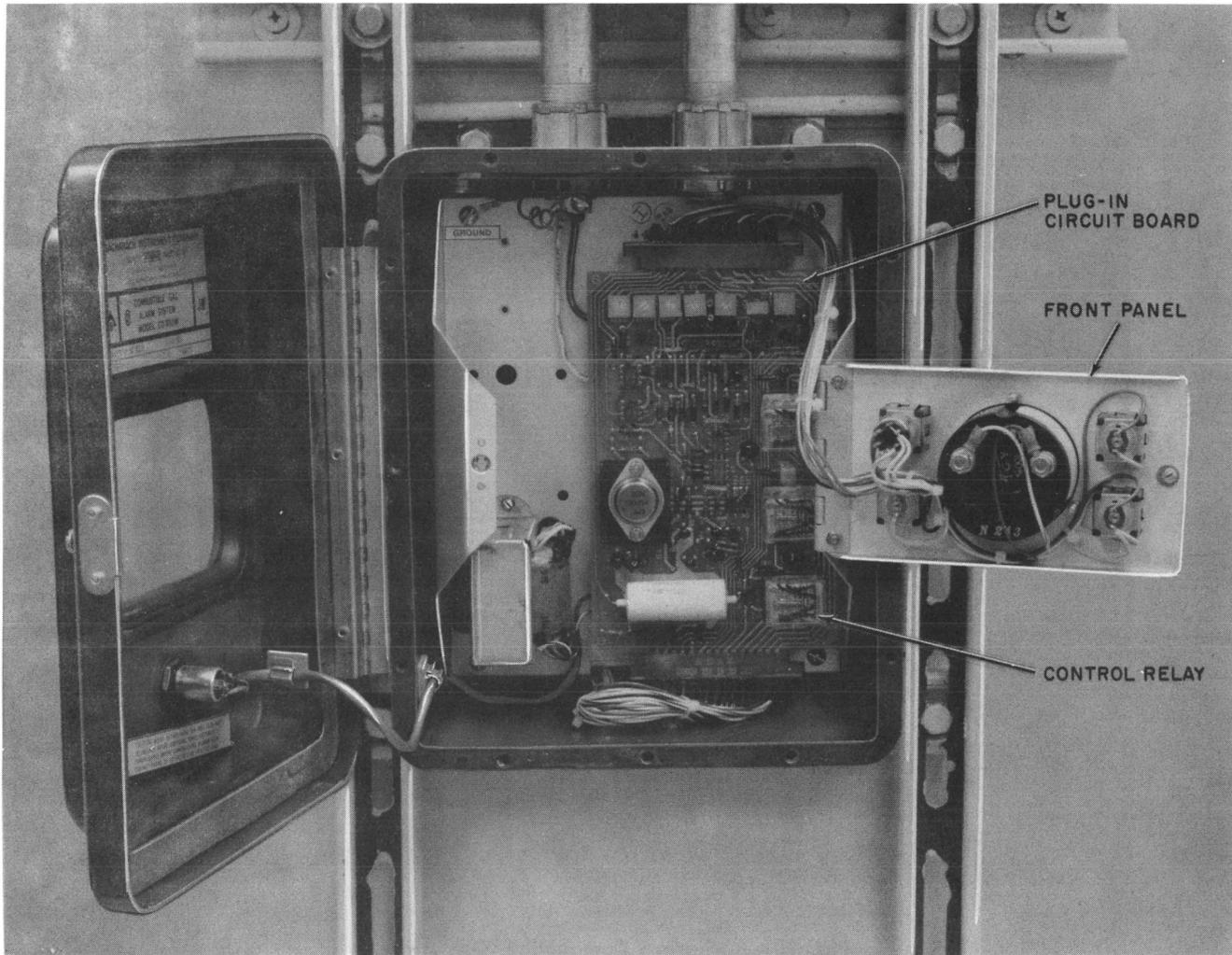


Fig. 21—Bacharach Combustible Gas Alarm Component Layout

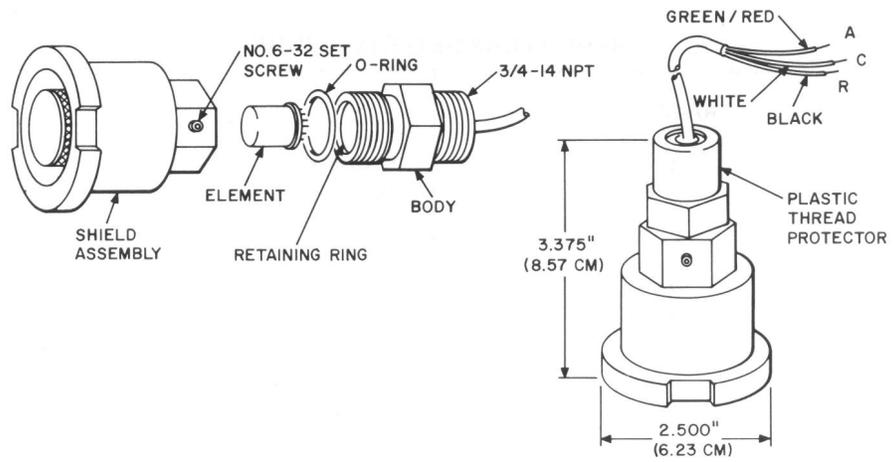


Fig. 22—Bacharach Combustible Gas Detector (Model 800-080.10) Exploded View

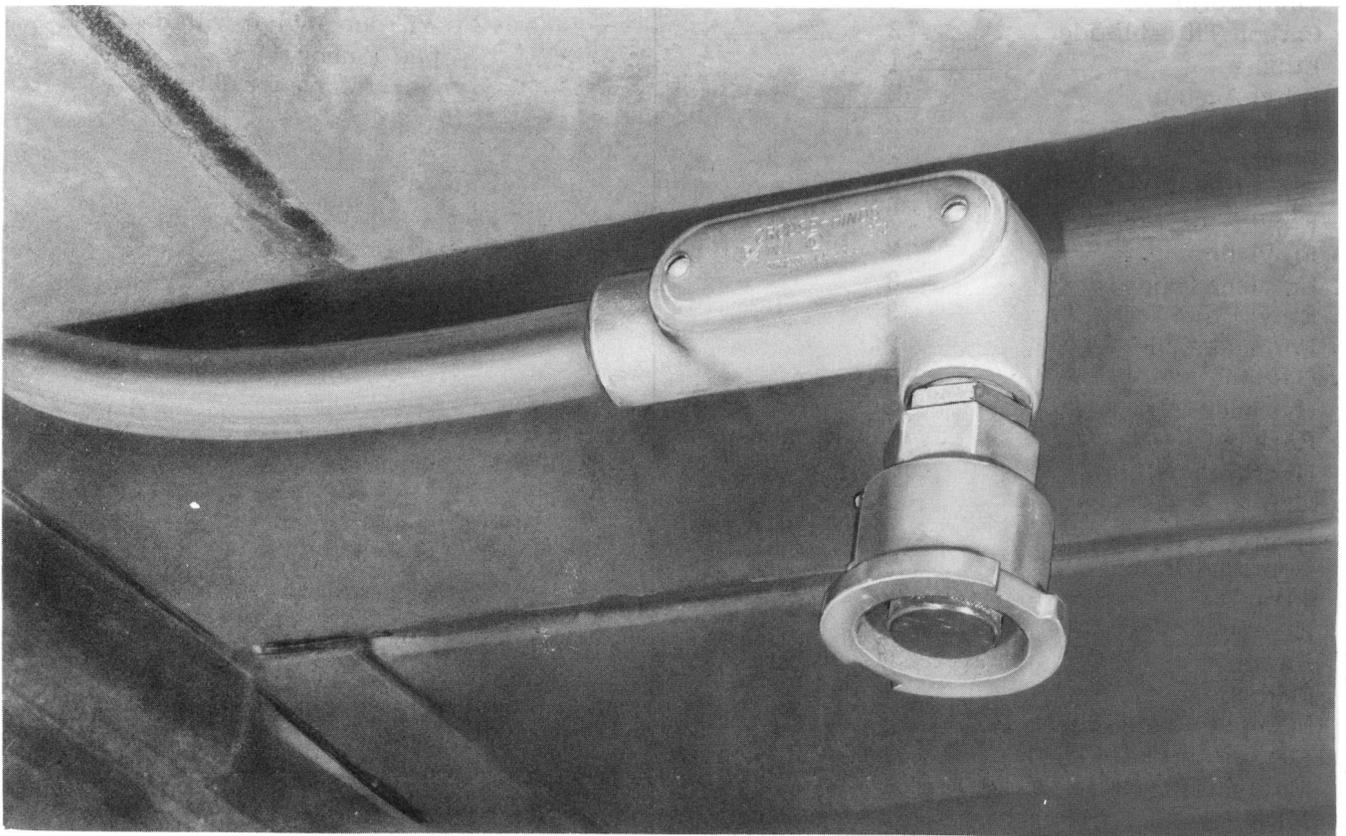


Fig. 23—Bacharach Combustible Gas Detector (Typical Installation)

TABLE C
SYSTEM GAS DETECTOR GUIDE

<u>GAS</u>	<u>RATING</u>	<u>GAS</u>	<u>RATING</u>
Acetone	3	Propane	2
Alcohol — Ethyl	2	Propylene	2
Alcohol — Methyl	2	Propylene Oxide	2
Ammonia	2	Phenol	2
Acetylene	2	Styrene	2
Acrylonitrile	2	Toluene	2
Argon	3	Triethylamine	2
Benzol	2	Trichloroethane	2
Butane	2	Turpentine	2
Butyl Alcohol	2	Vinyl Acetate	2
Cyclo Hexane	3	Vinyl Chloride	2
Carbon Disulfide	3	Xylene	2
Carbon Monoxide	3		
Chlorobenzene	2		
Chloroform	2		
Carbon Tetrachloride	2		
Ethane	1		
Ethyl Acetate	2		
Ethyl Acrylate	2		
Ether	2		
Ethyl Cellosolve	2		
Ethyl Chloroacetate	2		
Ethylene	3		
Ethylene Oxide	3		
Ethyl Ether	3		
Formaldehyde	2		
Gasoline	2		
Hystane	2		
Hexane	2		
Hydrogen	2		
H ₂ S	2		
I.P.A.	2		
Isopropylamine	2		
J P 4	2		
Kerosene	2		
Ketones	2		
Methane	1		
Methyl Cyclohexane	2		
Methyl Acrylate	1		
Methyl Chloride	1		
MEK	2		
Methyl Isobutyl Ketone	2		
Methyl Methacrylate	2		
Methylene Chloride	2		
Naptha	2		
Natural Gas	1		
N-Octane	2		
N-Pentane	2		

KEY:

- 1 = Easily detectable
- 2 = Will operate but with degraded performance
- 3 = Not suitable for detection

monitored. In the No. 2A or 2C ESS the combustible gas detection system is adjusted and calibrated to detect *methane* gas. Table C reflects the suitability

of the system to detect various other gasses in addition to *methane* gas.

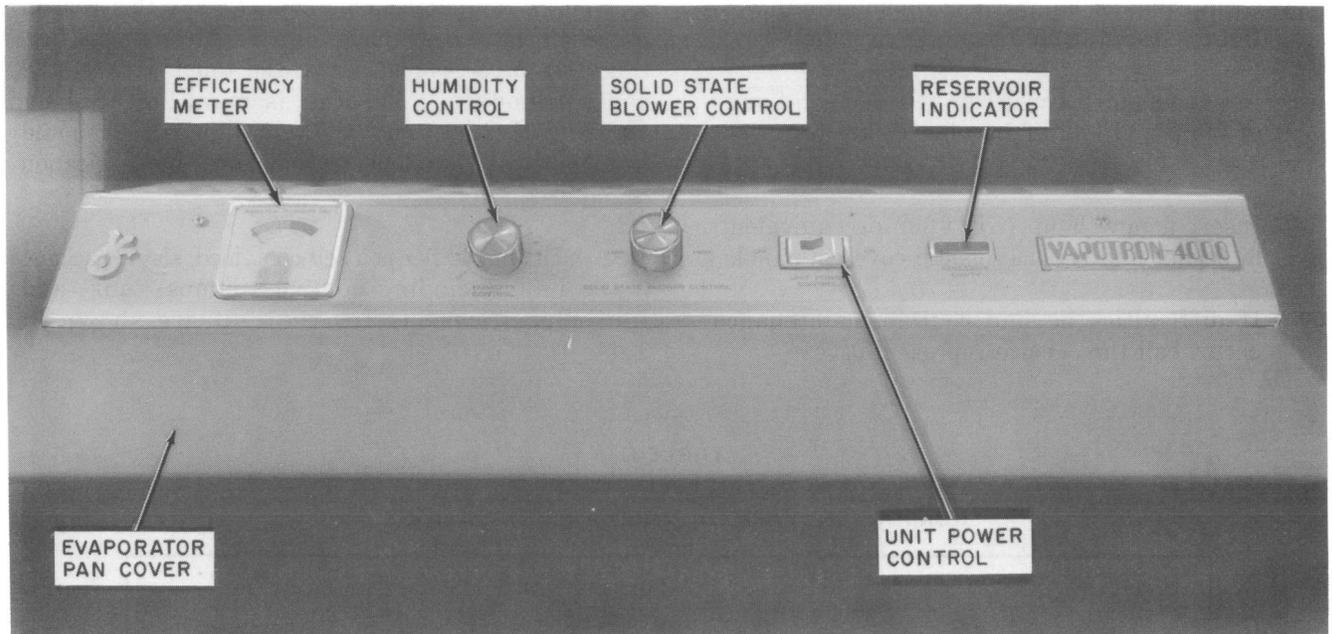


Fig. 24—Vapotron Humidifier (Model 4000) Control Panel

MAINTENANCE

4.05 The following maintenance program is recommended by the manufacturer to assure that the gas alarm system is operating properly, and to detect any faults that may occur.

Daily Inspection

4.06 Perform the following inspections on a daily basis:

- (1) Observe the front panel to determine if the PILOT lamp is lighted.
- (2) Observe the front panel to determine if the FAIL lamp is extinguished.
- (3) Observe the indicator meter to determine if the indication is less than zero, or more than zero when no combustible gas is present at the gas detector.

Weekly Inspection

4.07 Perform the following operations on a weekly basis:

- (1) Depress and hold the TEST pushbutton switch and observe the front panel for the following:
 - (a) Indicator meter pointer indicates full-scale reading.
 - (b) WARN and ALARM lamps lighted (after a 45-second delay if ac power has been interrupted).
- (2) Release TEST pushbutton switch, and press RESET pushbutton switch, and observe the front panel for:
 - (a) WARN and ALARM lamps extinguish.
 - (b) Indicator meter returns to zero.

Lamp Replacement

- 4.08** Replace burned-out indicator lamps (WARN, ALARM, FAIL, and PILOT) as follows:
- (1) Group plastic lamp cover (pushbutton) with fingers and pull to extract from panel.
 - (2) Insert a small screwdriver between end flange of lamp and end of tubular socket to unseat the lamp.
 - (3) Insert a new lamp (GE #382 or equivalent) in socket and replace plastic cover in panel.
- 4.09** If difficulties beyond routine maintenance occur, call the service representative.

5. HUMIDIFICATION

5.01 Relative humidity control is a vital concern of the No. 2A or 2C ESS offices. Static electric discharge poses a threat to electronic circuits as well as to operating personnel. For this reason provisions have been made for a Vapotron humidifier, (Fig. 24), Model 4000, above the toilet area of the control module. The unit is manufactured by Hamilton Humidity Inc., Chicago, Illinois, and should be provided by the telephone company if humidification is required.

5.02 The humidifier is a self-contained, single-package unit, including controls, lamps, tank, and fan. Specifications for the unit are shown in Table D.

TABLE D

HUMIDIFIER (VAPOTRON-4000) SPECIFICATIONS

CAPACITY	2.3 gal per hour, 19 lb water vapor per hour rating
WATER RESERVOIR	Stainless steel, welded construction, built-in drain and overflow nipples coated with Teflon — 5
ELECTRICAL	Control — 115 Volts, 60 Hz, 5 Amps Power — 208 Volts, 3-Phase, 60 Hz 6400 Watts
POWER TUBES	GE Infra-Red T3 Quartz (4), 1600 Watts each, 5000 hour life
FITTINGS	Water Supply — 1/4 inch compression Drain — 3/4 inch pipe Overflow — 1/2 inch pipe

5.03 Electrical and mechanical provisions are made within the No. 2A or 2C ESS modules for the low-maintenance, infrared type humidifier. Infrared tube heaters positioned over a water bath, vaporize the upper surface of water without heating the entire pool to a high temperature. A built-in

fan moves the air across the water surface through the air grille located directly above the restroom entrance and into the module.

5.04 The air intake grille (Fig. 25), located on the left side of the humidifier, should be

open fully. An adjustment slot (Fig. 26) is located in the upper left corner of the grille.

MAINTENANCE



It is imperative that the ac power be removed from the unit before attempting any inspection or maintenance.

5.05 The following maintenance program is recommended by the manufacturer to assure the proper operation and to avoid frequent repairs.

5.06 Blower Motor—The blower motor is of a ball bearing design and requires lubrication at the bearing raceways every 2500 hours of operation. It is recommended that the lubrication be of a good grade #10 weight, high temperature, motor oil.

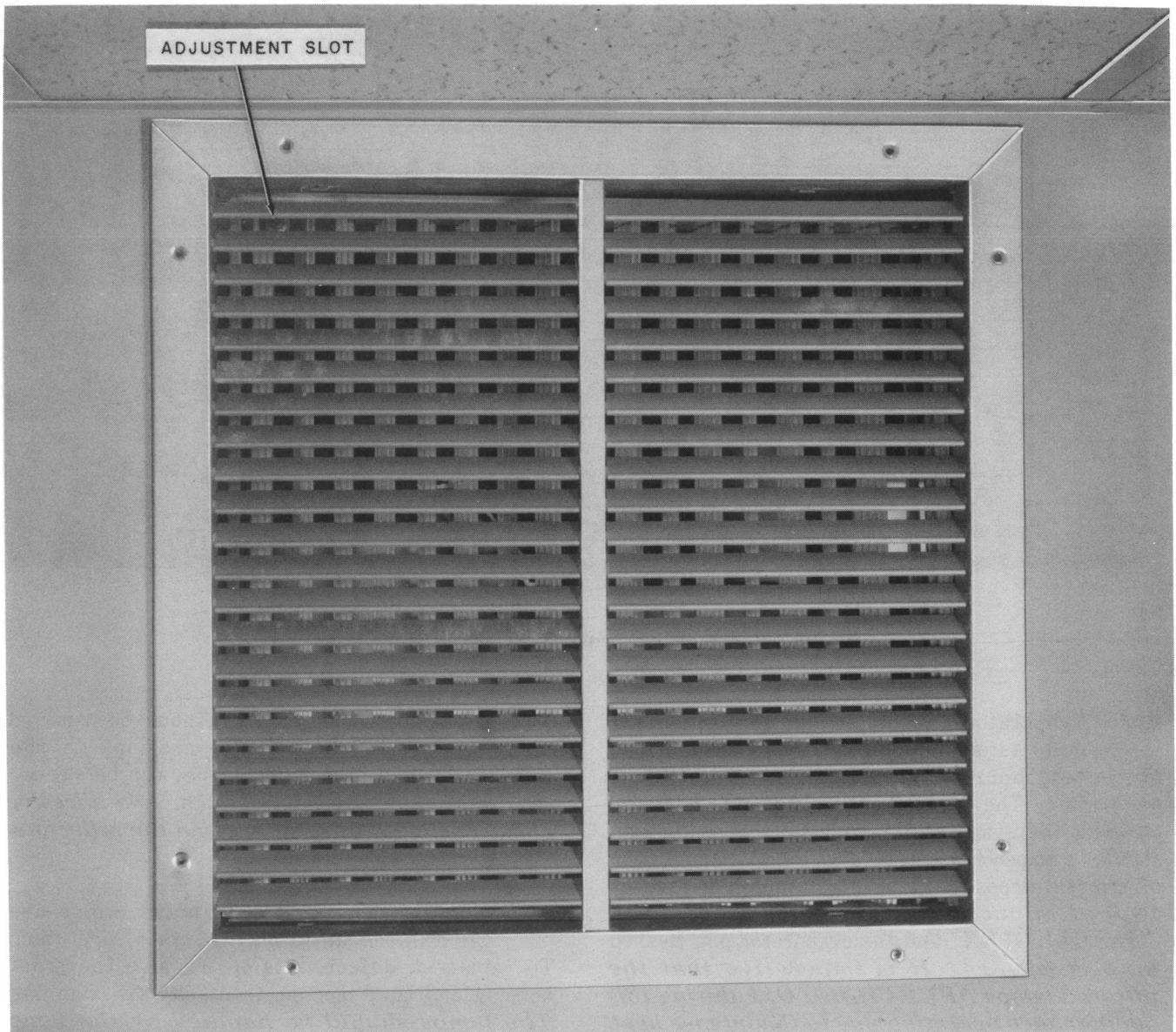


Fig. 25—Vapotron Air Intake Grille

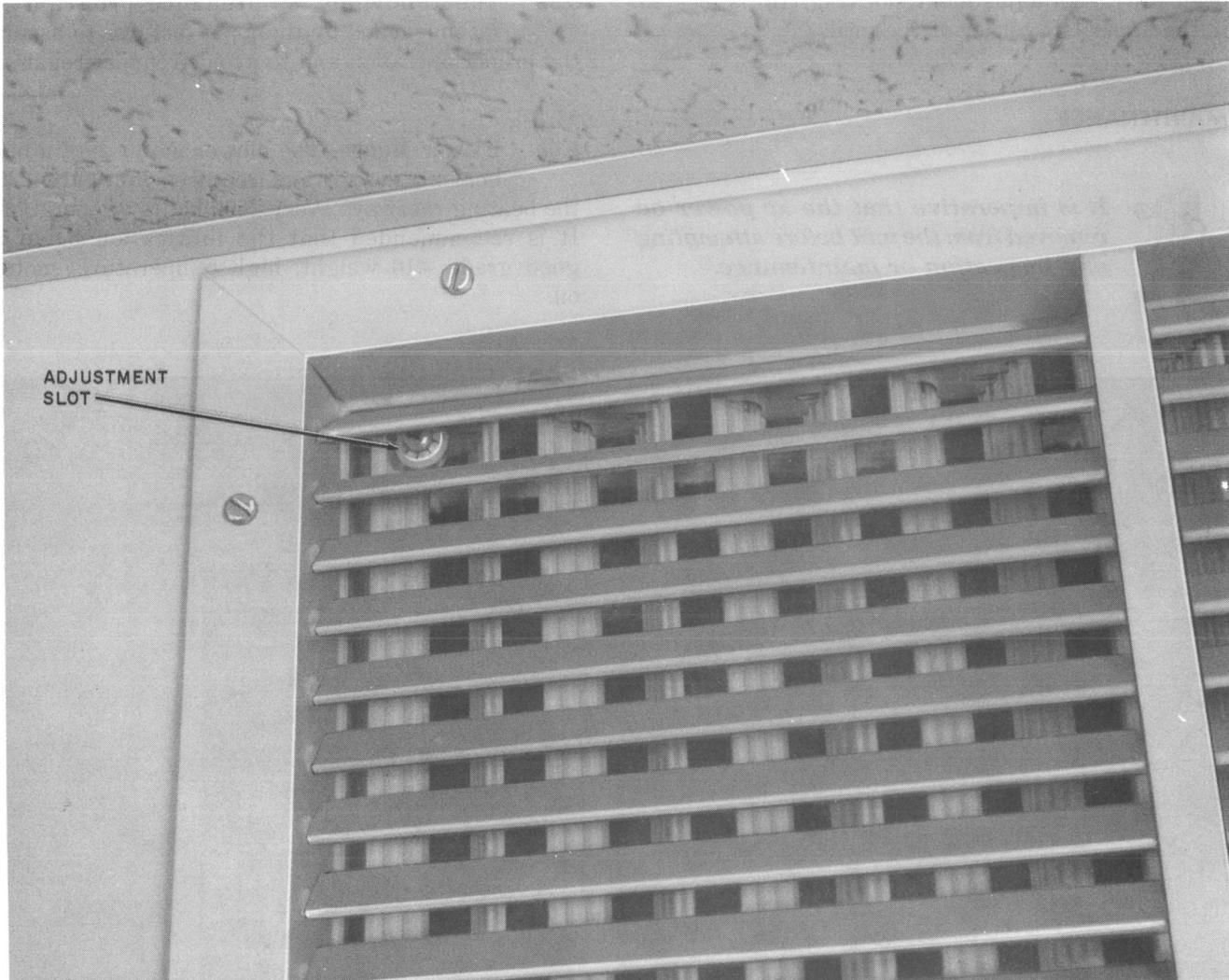


Fig. 26—Vapotron Air Intake Grille Upper Left Corner

5.07 Evaporator Pan—The Vapotron unit is set up to automatically flush the evaporator pan once every hour of operation for a duration of one minute. The flushing action is done to minimize cleaning the evaporator pan. The evaporator pan should be inspected every 90 days for an accumulation of mineral deposits. If the accumulation exceeds 1/16 of an inch, the valve should be set on "MANUAL OPEN" and the evaporator pan flushed for five minutes. ***It is imperative that the infrared lamps ARE TURNED OFF during this maintenance operation due to the intense heat.*** The safety overflow and float valve should be checked for obstructions.

5.08 Reflectors—The reflectors should be inspected every 2500 hours of operation. If the reflectors should become dirty, they can be cleaned with warm water and a soft cloth. ***No abrasive cleaners should be used to clean the reflectors.***

5.09 Lamps—The infrared quartz lamps are guaranteed up to 5000 hours of operation. To replace a defective lamp, remove the front housing and lamp module, then snap the lamp out. ***The lamps should be handled by the lamp sockets only. The lamp envelope should not be touched with your hands.***

5.10 Safety Thermostats—The Vapotron unit is equipped with two safety thermostats.

- (1) The first thermostat senses the evaporator pan temperature. Should the valve become clogged from the supply side of the unit and the pan runs dry, then the unit is automatically turned-off.
- (2) The second thermostat is an integral part of the blower motor. If the motor were to fail or stop running, the thermostat would turn the unit off. The motor should then be inspected and lubricated and/or repaired if necessary.

5.11 Trouble Indicators—During *normal* operation the efficiency meter needle should point in the *green* area (Fig. 24). If the needle points to the *red* area, it is an indication of a faulty infrared quartz lamp. Refer to the lamp replacement paragraph of this section for proper replacement.

5.12 The RESERVOIR EMPTY lamp constitutes the unit's second trouble indicator. The RESERVOIR EMPTY lamp will be lighted if the evaporator pan runs dry or if the blower motor fails.

5.13 Electrical Wiring—The rear housing must be removed to gain access to the unit's

wiring. This is accomplished by removing two sheet metal screws on each side of the unit. With the rear housing removed, the electrical enclosure is now accessible. Refer to Fig. 27 for a complete wiring diagram of the unit.

6. LIGHTING (FLUORESCENT)

6.01 The lighting design in the No. 2A or 2C ESS is unique to the system. Each administration and equipment module has three lighting circuits, therefore; it is not necessary to have all lights on at all times. This design provides the maximum amount of lighting between the lineups in the aisle. In addition, special drop down light diffusers are provided for easy access to the fluorescent lamps above the lineups. This facilitates the changing of lamps in the fixture. Each fixture contains four lamps rated at 40 watts each. For areas that do not require high levels of illumination, two lamps in each fixture may be removed.

MAINTENANCE

6.02 The following maintenance procedures are recommended for the lighting system to avoid frequent disruptions in service.

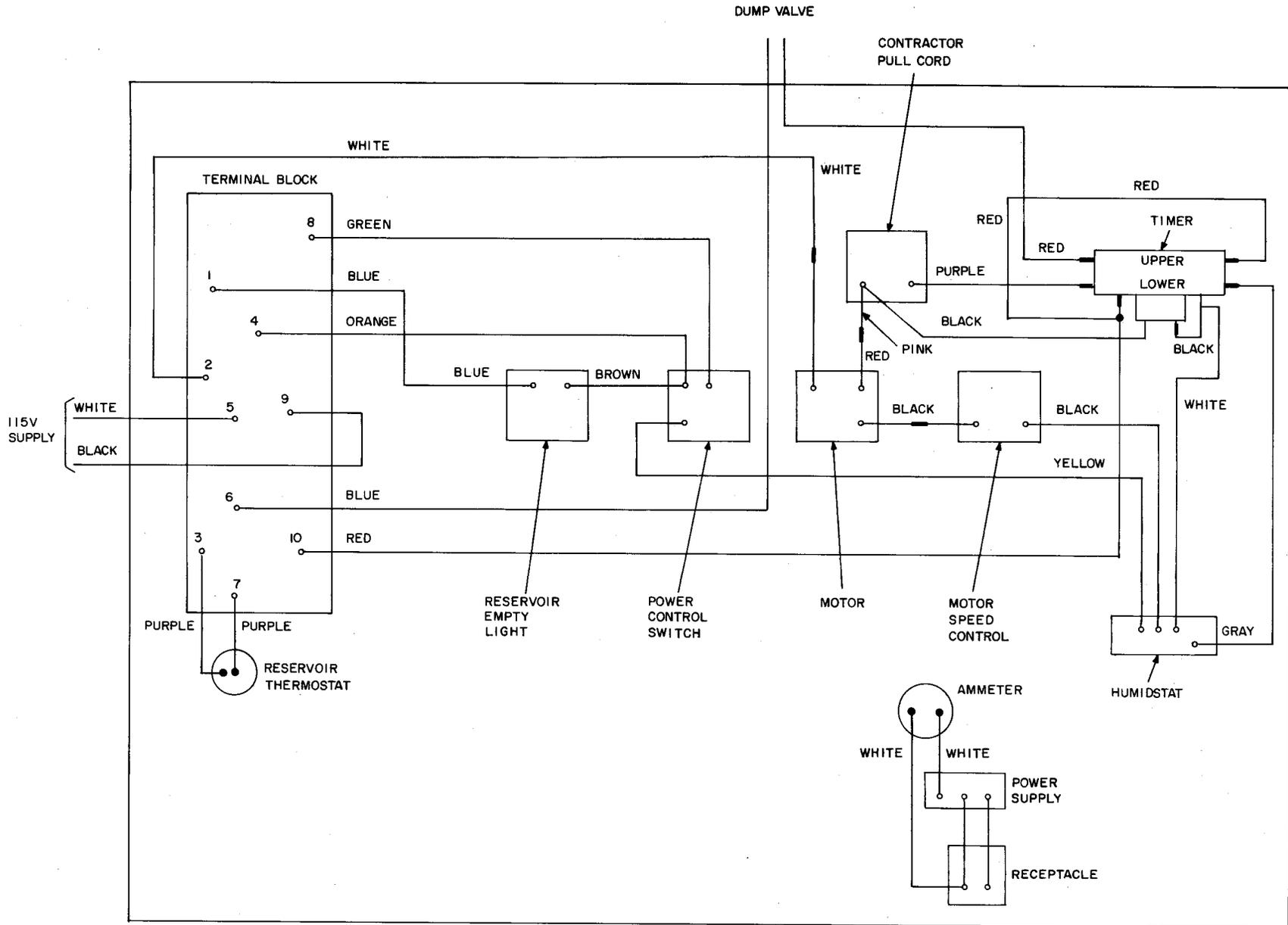


Fig. 27—Vapotron—4000 Wiring Diagram

6.03 Although the ballast is the first component of the fluorescent lamp system to be suspected of failure, this is more often not the case. Common sources of trouble which cause a particular condition are identified in Table E. The use of this

troubleshooting guide will aid in the location of the source of the trouble in minimum time. *Failures of a magnitude greater than lamp replacement should be referred to an electrical contractor.*

TABLE E
TROUBLESHOOTING GUIDE FOR FLUORESCENT LAMP SYSTEM

CONDITION	POSSIBLE CAUSE
Lamps won't start	Lamp failure Poor lamp-to-lampholder contact Dirty lamps or lamp pins Low or high lamp bulb-wall temperature High humidity Fixture not grounded Ballast failure
Short lamp life	Improper voltage Poor lamp-to-lampholder contact Defective lamps Defective ballast
Lamp flicker (Spiraling or swirling)	Drafts on lamp bulb from air-conditioning system Defective lamps Improper voltage Defective ballast
Audible ballast "hum"	Loose fixture louvers, panels or parts defective ballast
Very slow starting	Poor lamp-to-lampholder contact Defective lamp High humidity Bulb-wall temperature too low or too high
Blinking	High voltage Defective ballast Wrong type lamps Wrong number of lamps High ambient temperature

7. LIGHTING (EMERGENCY)

7.01 An emergency lighting system in the No. 2A or 2C ESS with the exception of the power service module is provided by Teledyne Big Beam* lighting units, Fig. 28. These units are manufactured by Teledyne Big Beam Company of Crystal Lake, Illinois, and are referred to as model 2A6N20-P2.

*Trademark of Teledyne Big Beam

7.02 The emergency lamps provide lighting of the exit points of the modules as depicted

in Fig. 29. In an administration module, one additional emergency lamp unit is provided.

7.03 The devices necessary for operation and visual inspection of the operation are mounted on the front panel of the slide-out chassis. The devices include:

- Ammeter
- Trickle charge green indicator lamp
- DC voltmeter

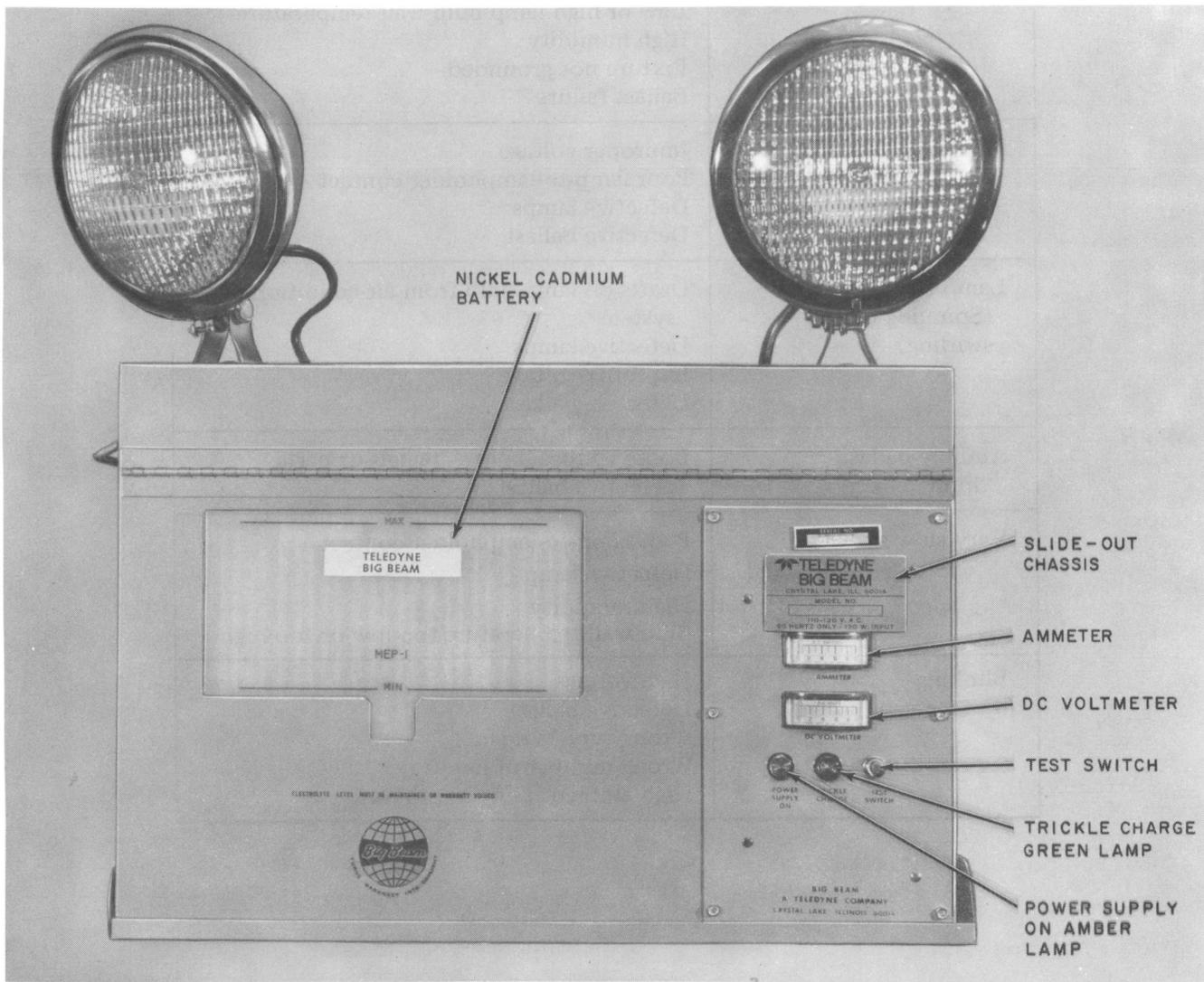


Fig. 28—Teledyne Big Beam Lighting Unit (Model 2A6N-20P2)

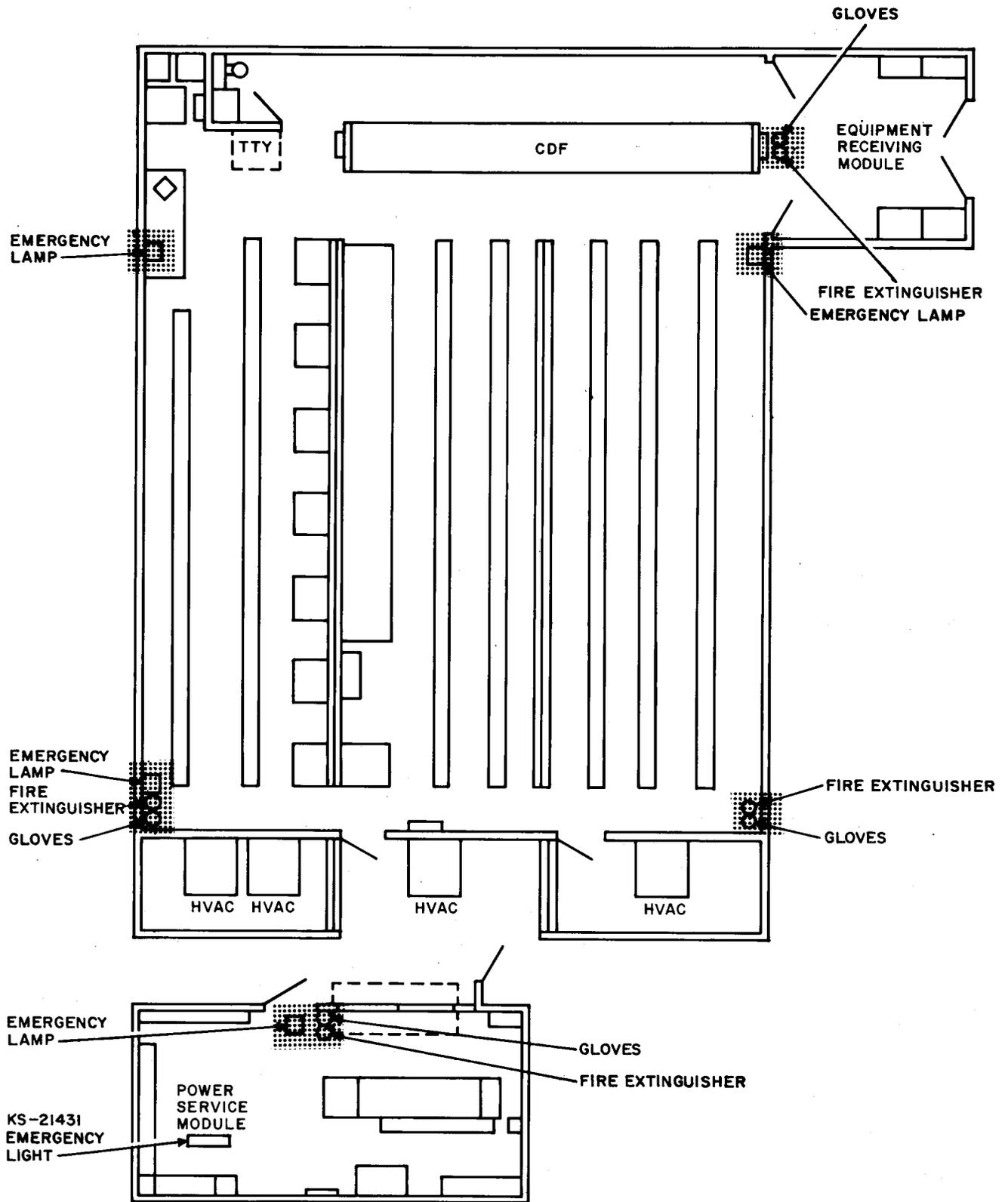


Fig. 29—Location of Emergency Equipment

- Test switch
- Power supply amber indicator lamp
- Cut-off switch

(1) When ac power is restored to the unit, after a power failure, the AMMETER will activate. The AMMETER indicates the amount of recharge current being delivered to the battery. The AMMETER will continue to indicate current until the battery has been fully recharged. Once the battery is fully charged the trickle charge circuit is activated.

(2) When the trickle charge circuit is activated the green indicator lamp is lighted, and remains lighted until an ac power failure occurs.

(3) The DC VOLTMETER indicates the battery voltage under load. The voltmeter is operative only when the emergency lamps are in operation during an ac power failure or when activated by the TEST SWITCH.

(4) The momentary contact TEST SWITCH is used to determine lamp readiness. The TEST SWITCH simulates ac power failure, thus the lamps are lighted. Releasing the switch restores ac power to the unit. The lamps extinguish and the battery charging circuit is activated to restore the current to the battery.

(5) When the CUT-OFF switch is in the "ON" position, and the unit is connected to an ac source with the line fuse in tact, the amber lamp is lighted.

(6) The CUT-OFF switch must be in the "ON" position for operation of the emergency lamps during an ac power failure.

OPERATION

7.04 To place an emergency lamp into operation or to perform an operational test, the following procedure should be followed:

Note: If, during any part of the procedure the proper results are not obtained, the unit should be disconnected from the ac and dc power sources. This may be accomplished by disconnecting the line cord or by removing the line fuse and disconnecting one battery

lead. Consult the service representative for further action.

(1) Connect the unit to an ac power source of 117 volt, 60 Hz. Place the CUT-OFF switch in the "ON" position. The amber lamp will light.

(2) Depress the TEST SWITCH and hold it for several seconds. Both of the emergency lamps on the unit will light.

(3) Release the TEST SWITCH. The emergency lamps will extinguish and the AMMETER will indicate from 3 to 5 amperes.

(4) Within a few seconds after the release of the TEST SWITCH, the AMMETER will revert to "0", and the green indicator lamp will be lighted. This indicates that the battery is fully charged and that the trickle charge circuit is activated.

(5) Repeat steps 1 thru 4 several times to ensure reliability. After successfully completing several tests the unit is ready for service.

7.05 *When power is restored after a power failure or operational test, the unit automatically delivers a high rate of recharging current to the battery. Within 24 hours after the restoration of power the AMMETER should revert to "0", and the green indicator lamp is lighted. If this change has NOT taken place, disconnect the ac and dc power sources as previously described. This action will preserve the battery by avoiding an overcharging condition. Contact the service representative for proper repair.*

MAINTENANCE

7.06 The following maintenance program is recommended by the manufacturer to ensure the proper operation and long life of the unit. In order to perform monthly inspection and test, do the following:

(1) Perform the operational test in 7.04.

(2) The electrolyte level in the nickel cadmium battery must be maintained at all times. Add distilled water to bring the level up to the level line marked on the battery (Fig. 28).

7.07 Once every 3 to 6 months the nickel cadmium batteries must be discharged for one hour and 20 minutes. This may be accomplished by removing the line cord from the ac power source, thus simulating a power failure. The emergency lamps will light and should remain lighted for the 1-1/3 hour duration. At the end of this period connect the line cord to the ac power source. The recharging process will return the battery to its original level. This battery recycling process is intended to lengthen the useful life of the battery.

OPERATION EMERGENCY LIGHTING—PSM

7.08 The emergency lighting system in the power service module is provided by General Electric Company* of Danville, Illinois, Fig. 29. The two lighting units (KS-21431) are located on the Day Brite fixtures and provide illumination for the ac switchboard.

*Trademark of General Electric Company

7.09 The lighting system consists of:

- Battery—A sealed nickel-cadmium battery which provides dc power during ac power failure.
- Inverter/Charger—Solid state device to control battery charging, switching from emergency operation to ac power, and operation of the lamps in the emergency mode.
- Ballast—Operate two 40-watt lamps, (F40T12/RS), from a 120-volt ac source.
- Push-to-test amber indicator light—operating the momentary contact test switch simulates a power failure providing a visual check of the system. The amber indicator light, GE #267 or equivalent, confirms the battery is charging.

MAINTENANCE—EMERGENCY LIGHTING—PSM

7.10 Other than routine inspections and system listing as required by local codes, no maintenance is required to ensure satisfactory operation of the system. The nickel-cadmium rechargeable batteries require no water or servicing.

8. REFRIGERATED WATER COOLER DRINKING FOUNTAIN

8.01 A refrigerated water cooler drinking fountain (Fig. 30) manufactured by Elkay* Manufacturing Co., of Broadview, Illinois, is provided in the No. 2A or 2C ESS. The drinking fountain, Model ESR-8, is self-contained, electric, wall-mounted, semirecessed unit located adjacent to the sink and hot water heater in the control module. The drinking fountain contains a hermetically sealed combination tube tank type cooling unit enclosed in the cabinet.

*Registered trademark of Elkay Manufacturing Company

8.02 The drinking fountain has a capacity of eight gallons per hour of 50°F cooled drinking water. The fountain has a sanitary hooded stream projector and a pushbutton control. The electric cord has a 3-prong molded rubber plug. *It is imperative that the proper water connections are made before connecting the drinking fountain plug to ac power.*

MAINTENANCE

8.03 The following maintenance procedures are recommended for the drinking fountain to avoid frequent disruptions in service.

Stream Projector

8.04 Local water conditions may cause a buildup of mineral deposits in the orifice opening, resulting in a distortion in the stream trajectory. Deposits should be removed with a small instrument not exceeding 1/8 inch in diameter.

Stream Height Adjustment

8.05 To adjust the stream height, remove the set screw (Fig. 31) holding the hex nut in place. Then remove the hex nut and pushbutton to gain access to the stream height adjusting screw. To raise the stream height, turn the screw to the right (clockwise). To lower the stream height, turn the screw to the left (counterclockwise). The water stream should crest at the drinking point approximately 1/2 inch above the mouth guard.

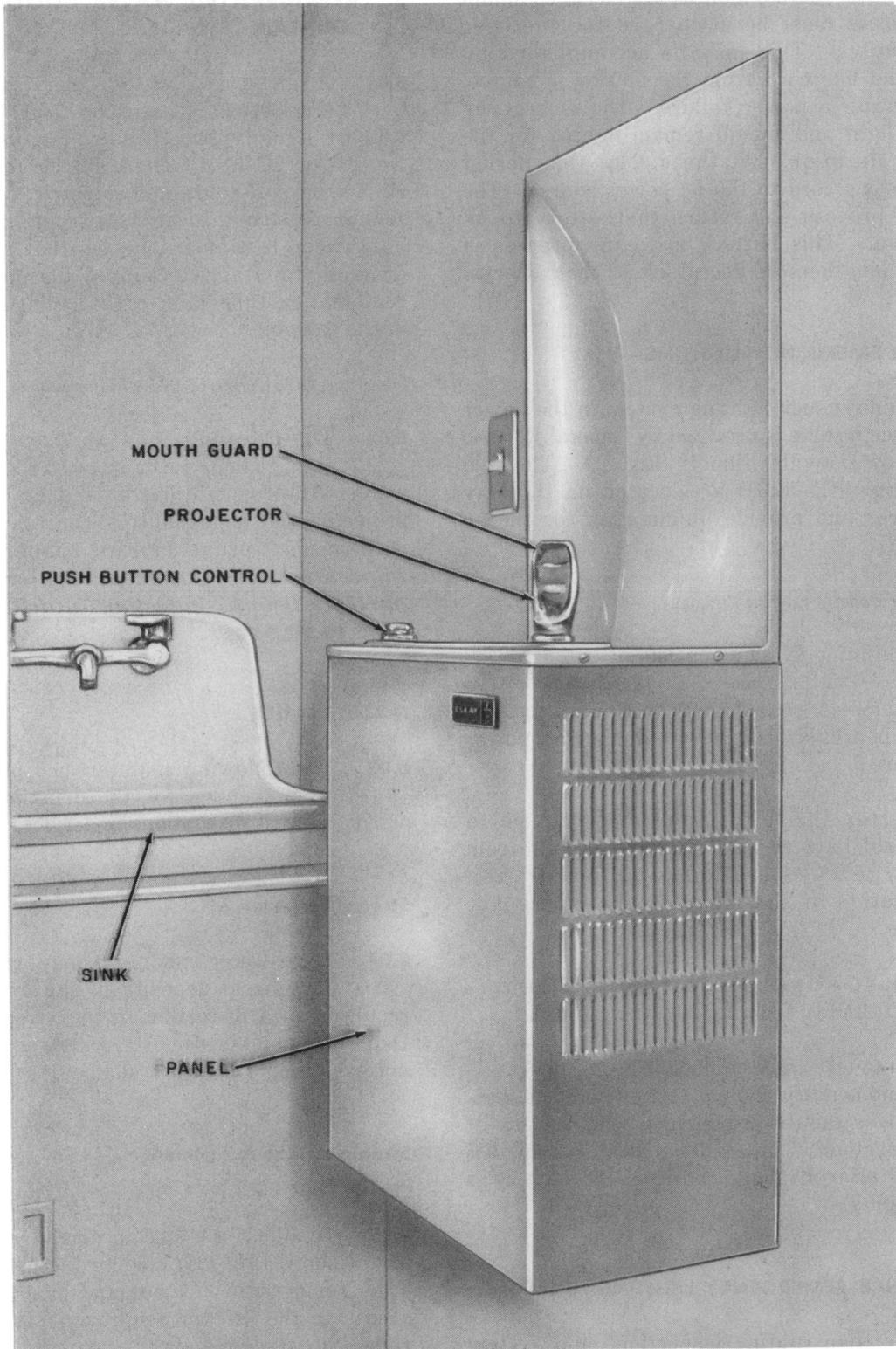


Fig. 30—Elkay Refrigerated Water Cooler Drinking Fountain (Model ESR-8)

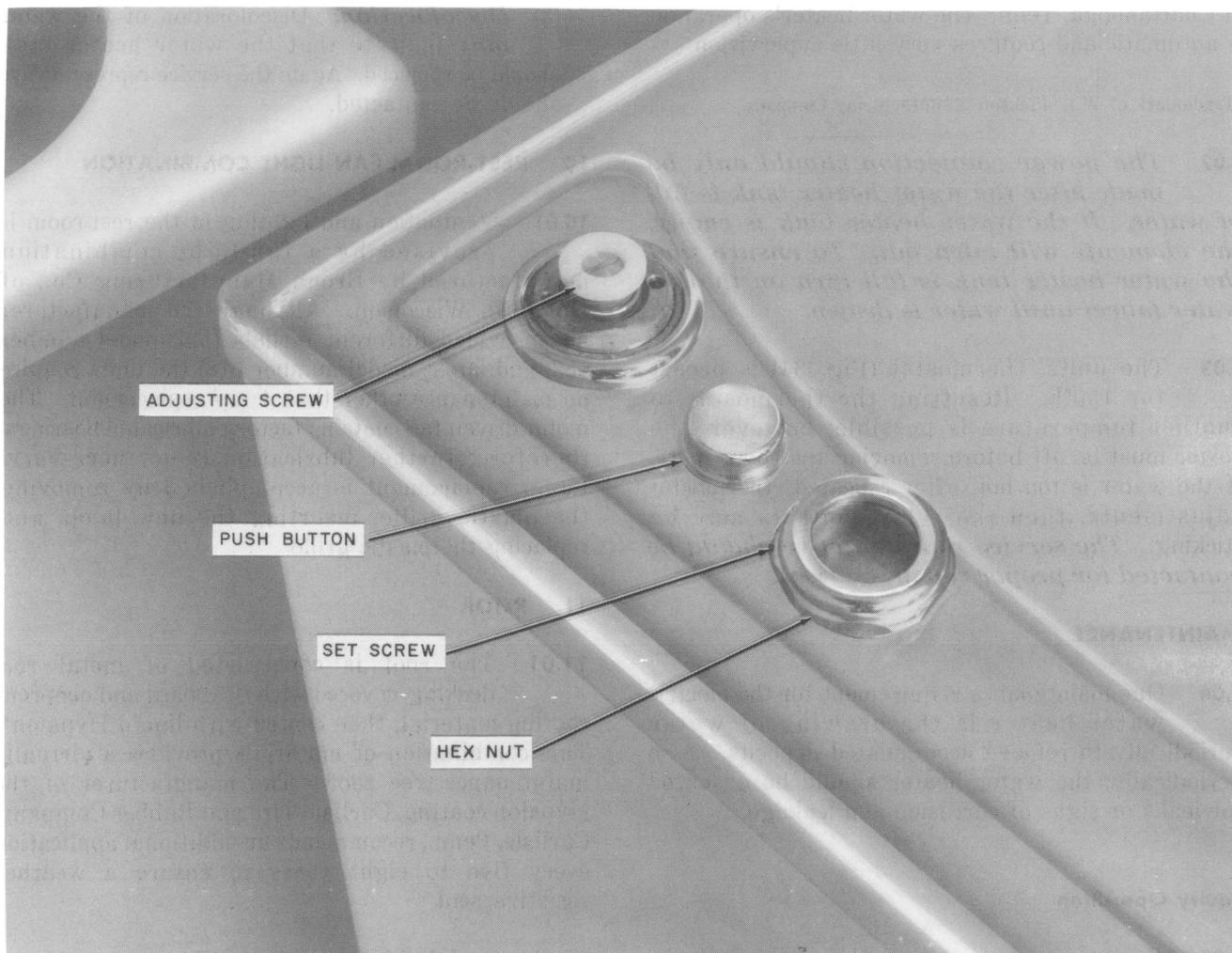


Fig. 31—Elkay Refrigerated Water Cooler Stream Adjustment

Temperature Control

8.06 Normally no adjustment is necessary to the factory preset thermostat. However, if adjustment is necessary, the drinking fountain cabinet must be removed to gain access to the water thermostat temperature control (Fig. 32). To raise the water temperature, turn adjusting screw to the left (counterclockwise). To lower the water temperature, turn adjusting screw to the right (clockwise). One-half turn will normally raise or lower water temperature 4° to 5°F.

Cleaning

8.07 The stainless steel basin and trim may be cleaned with soap or detergent, cloth, and

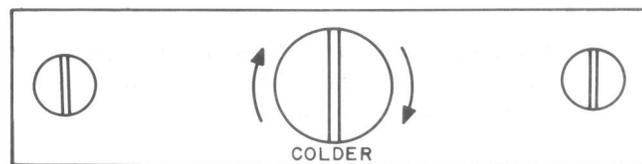


Fig. 32—Elkay Drinking Fountain Temperature Control

warm water. After cleaning, the drinking fountain should be rinsed and dried.

9. ELECTRIC WATER HEATER

9.01 The electric water heater (Fig. 33) is manufactured by W.L. Jackson* Mfg. Co.,

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of Chattanooga, Tenn. The water heater's operation is automatic and requires very little supervision.

*Trademark of W.L. Jackson Manufacturing Company

9.02 *The power connection should only be made after the water heater tank is full of water. If the water heater tank is empty, the elements will burn out. To ensure that the water heater tank is full turn on the hot water faucet until water is drawn.*

9.03 The units' thermostat (Fig. 34) is preset for 150°F. Resetting the thermostat to another temperature is possible; however, the power must be off before removing the cover plate. If the water is too hot, after repeated thermostat adjustments, then the relay contacts may be sticking. *The service representative should be contacted for proper repair.*

MAINTENANCE

9.04 One maintenance requirement for the electric water heater is the drawing of water periodically to remove accumulated deposits. Also periodically, the water heater should be observed for leaks or signs of corrosion and leakage.

Faulty Operation

9.05 Faulty operation may be one of three different types:

- (1) **Lack of Water:** If steam comes from the faucet, disconnect the electrical circuit and call the service representative.
- (2) **Loss of Electrical Power:** If the water does not heat, check the circuit breaker to ensure its proper position.

(3) **Discoloration:** Discoloration of the water *may* indicate that the water heater tank should be replaced. Again the service representative should be contacted.

10. REST-ROOM FAN-LIGHT COMBINATION

10.01 Ventilation and lighting in the rest-room is provided by a fan-light combination manufactured by Broan Manufacturing Co., of Hartford, Wisconsin. Although the manufacturer has provided different models (old model number 652, and latest model number 678) the units require no maintenance other than lamp replacement. The motor driven fan contains factory lubricated bearings, therefore; further lubrication is not necessary. Lamp replacement is accomplished by removing the plastic grille, inserting the new lamp, and replacing the plastic grille.

11. ROOF

11.01 The roof is constructed of metal roof decking, covered with flexboard and neoprene roofing material, then coated with liquid Hypalon*. This combination of materials provides a virtually maintenance-free roof. The manufacturer of the Hypalon coating, Carlisle Tire and Rubber Company, Carlisle, Penn., recommends an additional application every five to eight years to ensure a weather resistive seal.

*Trademark of Carlisle Tire and Rubber Company

11.02 If air bubbles develop under the neoprene roofing material, repair by slitting the neoprene open, thereby releasing the air pocket, and rebonding the neoprene to the roof substrate. Apply a neoprene patch over the cut areas, then apply Hypalon over the patching. The repair material may be obtained from the Carlisle Tire and Rubber Company.

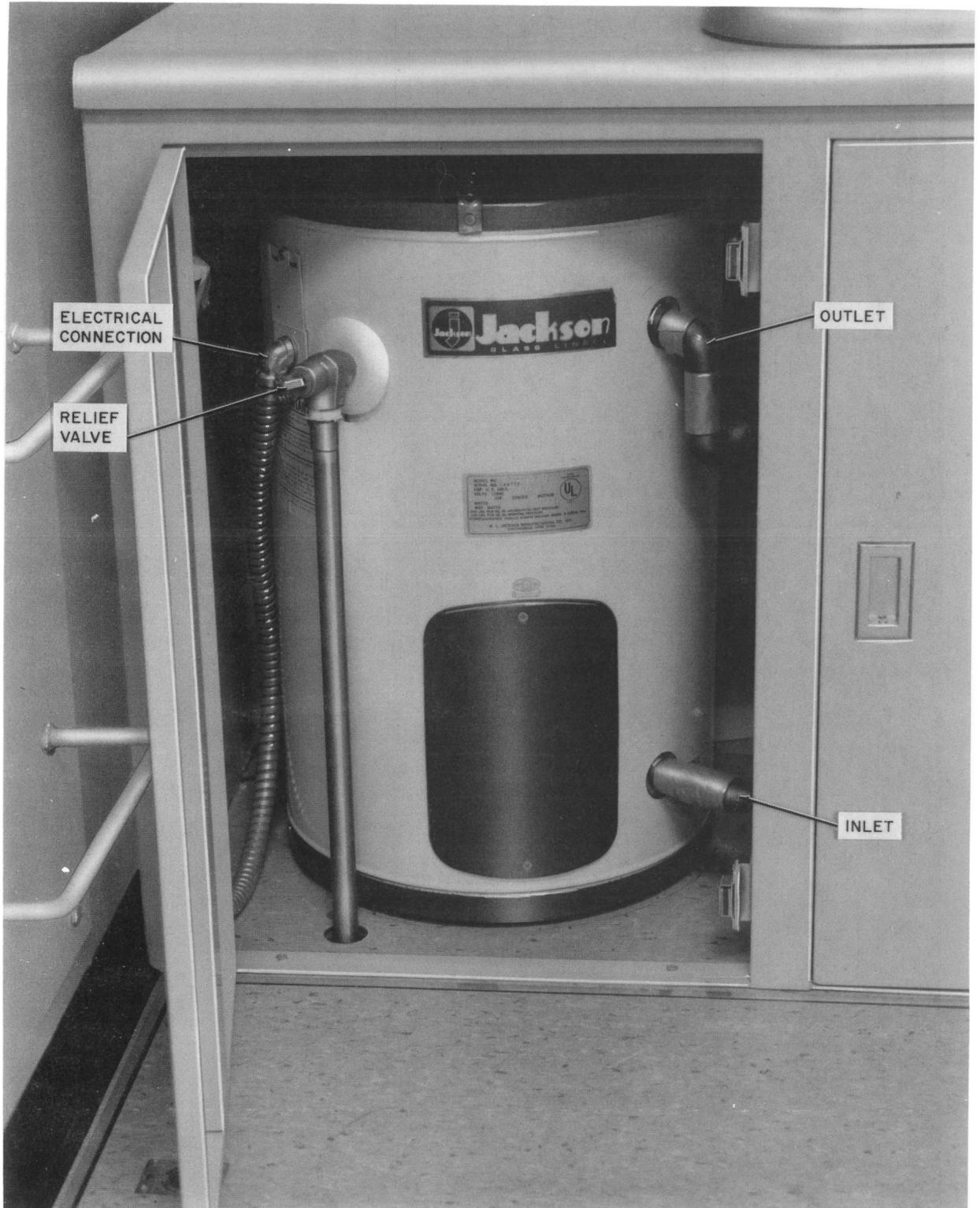


Fig. 33—Jackson Electric Water Heater

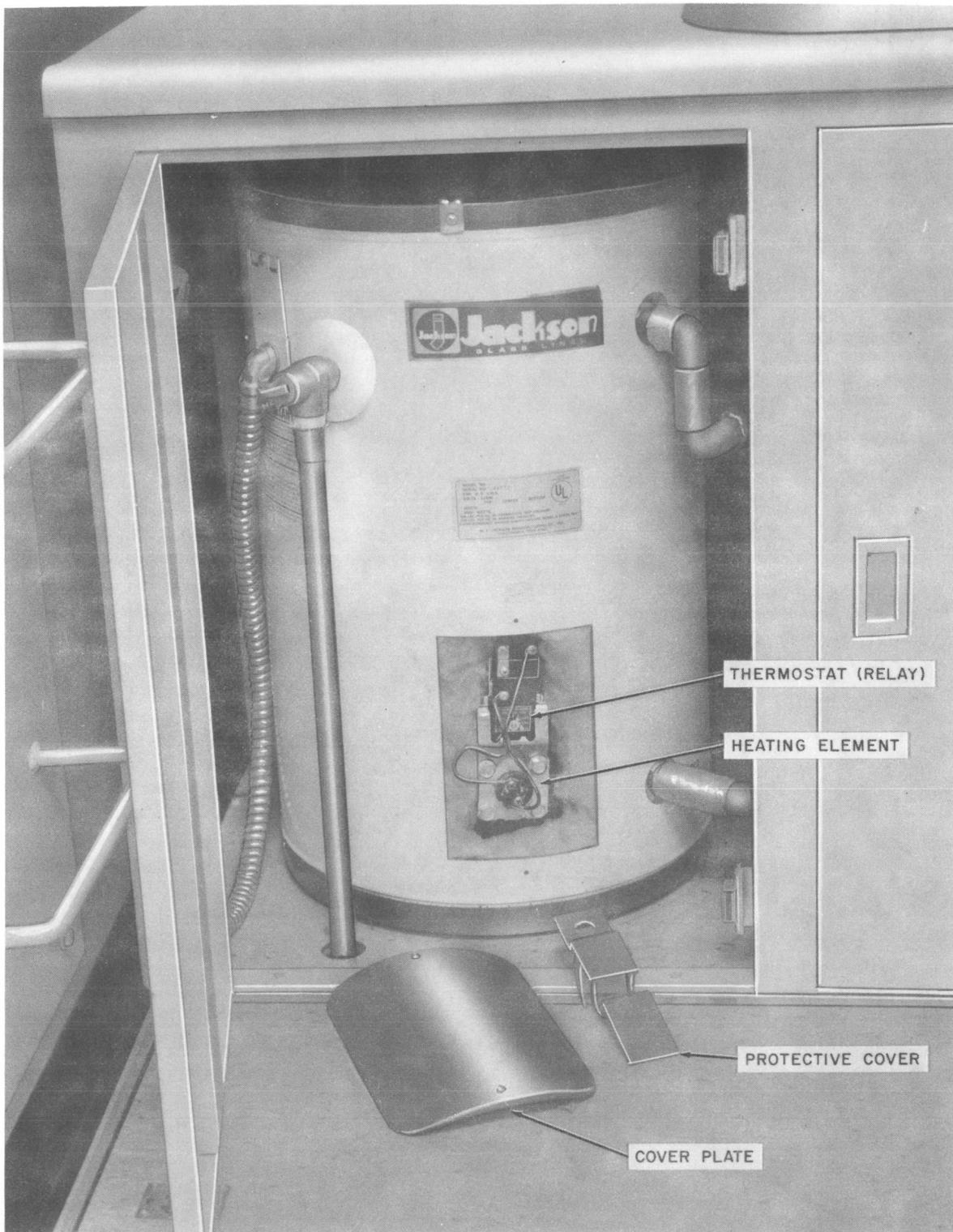


Fig. 34—Jackson Electric Water Heater (Thermostat Adjustment)