DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL

LABORATORY, AIR MOBILE AVIATION FUEL

NSN 6640-00-902-9711

Headquarters, Department of the Army
24 JUNE 1980

WARNING

Point blank firing at equipment with weapons should not be attempted unless the safety of all personnel in the area is assured.

Grounding for the laboratory is provided through the 4-wire cable from the power generator to the laboratory junction box (2, fig. 1-1). Be sure generator and laboratory are properly grounded. Failure to observe the warning may result in serious injury or death.

Main Power circuit breaker CB-1 (4, fig. 1-4) must be in the ON position prior to starting generator. CB-1 shall NOT be manually shut off except in an emergency. Turning CB-1 ON with power applied could result in spark ignition of any combustible vapors that may be present in the laboratory.

Ensure that the power cable is properly connected to the generator set. Color Coding is as follows: Black wire - Phase A (Ll), White wire - Phase B (L2) Red wire - Phase C (L3), Green wire - Ground (G).

The purpose of the exhaust fan is to remove combustible or. toxic gases from the laboratory. Insure access door is open before conducting any procedures in which the laboratory hood must be used. Failure to open the access door can defeat the system and may result in injury or death to operating personnel.

The air in the laboratory must be purged of combustion or toxic vapors before allowing personnel to enter. The exhaust (air-purging) system will operate for ten minutes. All other electrical circuits in the lab are inoperative during the purging cycle, but will activate automatically at its completion. Failure to remove the fire extinguisher shipment retainer bracket will hinder its use during an emergency.

Do not allow unauthorized personnel near the ionizer.

Mercury should be handled or poured over a tray with 1/2 inch of water in the bottom to control spillage and prevent contamination of the laboratory. If a mercury spill occurs, do not vacuum or sweep the area. This will disperse mercury throughout the laboratory. Spills may be cleaned up using a glass tube of about 6 cm diameter drawn out to an opening of about 1 mm and connected by rubber tubing to a filter flask connected with a vacuum pump or aspirator the flask acting as a trap. Control of mercury vapor should not be attempted with Flowers of Sulfur as this is not effective. Spills must be reported to the Environmental Science Officer providing services to the unit.

Never use high-temperature ovens to heat volatile fluids. An explosion may occur and injure personnel.

Handle all test solutions with extreme care to avoid injury. A face shield and rubber gloves should be used.

When filling the Reid Vapor Pressure (RVP) Bomb Bath, exercise extreme caution in adding the required ten (10) Parts Per Million (PPM) (0.1 ml/liters) of copper sulfate. Do not exceed this proportion, as twelve (12) PPM (0.12 ml/liters) of copper sulfate is poisonous.

The air in the laboratory must be purged of combustion or toxic vapors before allowing personnel to enter. The exhaust (Air-Purging) System will operate for ten minutes. All other electrical circuits in the lab are inoperative during the purging cycle, but will activate automatically at its completion.

Sulfuric acid should not be stored with organic compounds. It is a strong oxidant and could cause fire if breakage occurred.

Use a pyrex or equivalent glass container when diluting acids.

The heat generated when making acid solutions may break ordinary glassware. Pour the acid into the water. Never use cracked or broken glassware for any purpose.

Always wear goggles when preparing acid solutions or when handling solutions. If acids come in contact with the skin or eyes, rinse immediately with large amounts of water, for at least 15 minutes, and seek medical attention particularly for acid splashes involving the eyes. Under no circumstances should any base solution be applied to the area where the acid contacted. Handle 30 percent or stronger solutions of hydrogen peroxide cautiously to prevent contaminating the skin. Wash contaminated area thoroughly with water. Do not use an acid to dilute or neutralize a base on the skin. Use only large amounts of fresh water.

Use a pyrex or equivalent container when diluting bases, the heat generated when making base solutions may break ordinary glassware. Pour the base into the water. Never use cracked or broken glassware for any purpose.

Always wear goggles when preparing and handling base solutions.

If bases come in contact with the skin or eyes, rinse immediately with large amount of water for at least 15 minutes and seek medical attention particularly for base splashes involving the eyes. Under no circumstances should any acid solution be applied to the area where the base contacted.

Never return excess chemicals, reagents, or samples to the original container. Similarly, do not place spatulas or other objects in reagent containers for any reason.

Hold the cap in the hand when pouring a sample from a container; never place it on a bench or worktable where it could become contaminated. Be sure to return the cap to the container from which it was removed.

Hold the cap of a reagent bottle between the fingers of the pouring hand when pouring from the bottle; never lay it on a surface that might be touched by personnel or their clothing.

Keep acid and caustic bottles tightly stoppered. Flush and dry the outside of the bottles before returning them to the reagent shelf. Wipe up any spills.

Handle gas cylinders under high pressure cautiously; do not drop them on the ground or floor. Store gas cylinders away from sources of heat. Support or check gas cylinders to keep them from falling or rolling. Assure that protective caps are kept in place when cylinders are not in use. Never use grease or oil on gas cylinder valves or on pressure regulators. Gas cylinders must be chained to prevent them from falling.

Wear goggles when opening air valves.

Make sure that proper shielding is provided when using vacuum apparatus made of glass.

Face shield, rubber gloves and rubber apron must be worn when preparing chromic acid solution.

Never use high-temperature ovens to heat volatile fluids. An explosion may occur and injure personnel.

(ANALYTICAL BALANCE-SARTORIUS MODEL 2400-2463)

The radioactive Isotope Polonium 210 is toxic and ingestion or inhalation of the solid material should be prevented. If the strip is accidentally touched or handled, wash hands immediately with soap and water. The Ionizer is made by sealing Polonium between a base of silver and a layer of gold. The element is then protected by a shield and grid which prevent direct contact. Most of the radioactivity will be decayed to a non-radioactive substance when the device is no longer effective as a static eliminator. The small quantity of remaining material may be a potential hazard if mishandled. Return for disposal if use is to be discontinued. Do not discard as scrap. Dispose of as radioactive material.

Technical Manual

No. 5-6640-213-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 24 June 1980

OPERATOR'S ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL LABORATORY, AIR MOBILE AVIATION FUEL NSN 6640-00-902-9711

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to; Commander, U.S. Army Troop Support & Aviation Materiel Readiness Command. ATTN: DRSTS-MTPS, 43OO Goodfellow Boulevard, St. Louis MO 63120. Amply will be furnished directly to you.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. SCOPE.

This manual is published for use by personnel to whom the air-mobile aviation fuel laboratory (NSN 6640-00-902-9711) is issued. It is intended as a guide for operating and maintaining the utility and test equipment. The manual provides a description of the laboratory and equipment and includes operating instructions, general safety procedures, and operator and organizational maintenance. Appendix A gives a list of pertinent references; Appendix B gives the components of end item and basic issue items; Appendix C is a list of abbrev-iations used in this manual and Appendix D contains the Maintenance Allocation Chart.

1-2. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

EIR's can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to perform a procedure, just simply tell why the design is unfavorable or why a procedure is difficult. EIR's may be submitted on SF 368 (Quality Deficiency Report). Instructions for preparing EIR's are provided in TM 38-750, The Army Maintenance Management System. Mail directly to Commander Headquarters, U.S. Army Troop Support and Aviation Materiel Readiness Command, ATTN: DRSTS-MEM, 4300 Goodfellow Blvd., St. Louis, MO 63120. A reply will be furnished directly to you.

1-3. MAINTENANCE FORMS AND RECORDS.

Equipment maintenance forms and procedures for their use are contained in TM 38-750, The Army Maintenance Management System (TAMMS).

1-4. DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE.

a. Demolition of Shelter and Contents. Methods of destruc-tion should achieve such damage to equipment and repair parts that it will not be possible to restore the equipment to a usable condition in the combat zone either by repair or cannibalization.

b. Mechanical Destruction. Using an axe, pick, mattock, sledge or any other heavy implement, damage all vital elements such as controls, switches and valves, electric motors and any other major assemblies and components.

WARNING

Point blank firing at equipment with weapons should not be attempted unless the safety of all personnel in the area is assured.

c. Gunfire. Fire on equipment with the heaviest weapons available, aiming at the major assemblies and controls. Although one well placed direct hit may render the equipment inoperative, several hits may be required for complete destruction of all components. For additional information on procedures for destruction of equipment to prevent enemy use, refer to TM 750-244-3.

1-5. ADMINISTRATIVE STORAGE

a. Storage Site.

(1) Select the best available site for administrative storage. Separate stored equipment from equipment in use. Conspicuously mark the area "Administrative Storage".

(2) Covered space is preferred. When sufficient covered space for all items to be stored is not available, priority should be given to items which are most susceptible to deterioration.

(3) Open sites should be improved hardstand, if available. Unimproved sites should be firm, well-drained, and kept free of excessive vegetation.

b. Storage Plan.

(1) Store equipment so as to provide maximum protection from the elements and to provide access for inspection, maintenance and exercising. Anticipate removal or deployment problems and take suitable precautions.

(2) Take into account environmental conditions, such as extreme heat or cold; high humidity; blowing sand, dust, or loose debris; soft ground, mud, heavy snows, earthquakes, or combinations thereof and take adequate precautions.

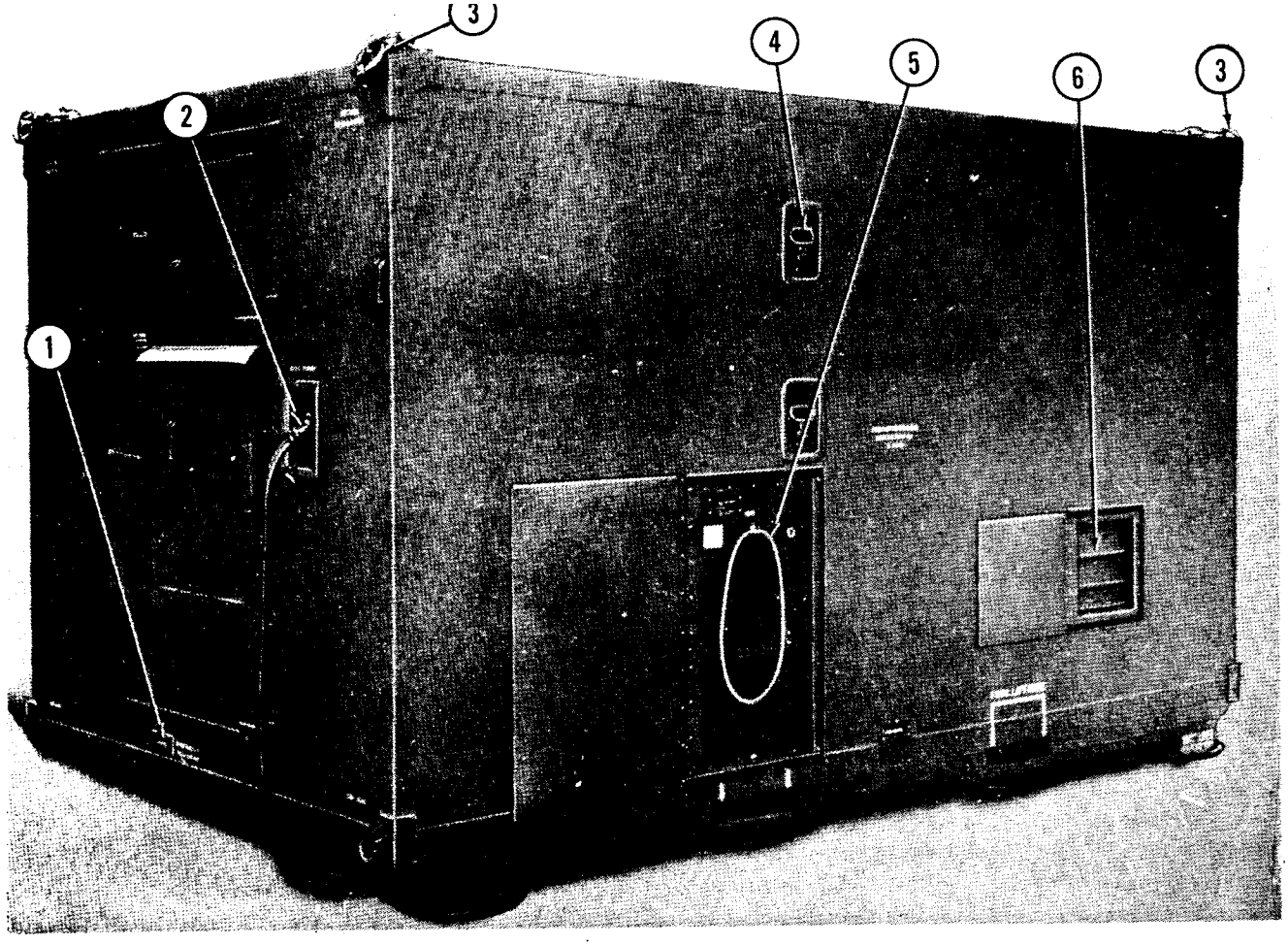
(3) Establish a fire plan and provide for adequate fire-fighting equipment and personnel.

(4) For further information, refer to TM 740-90-1 (Administrative Storage).

Section II. DESCRIPTION AND DATA

1-6. DESCRIPTION.

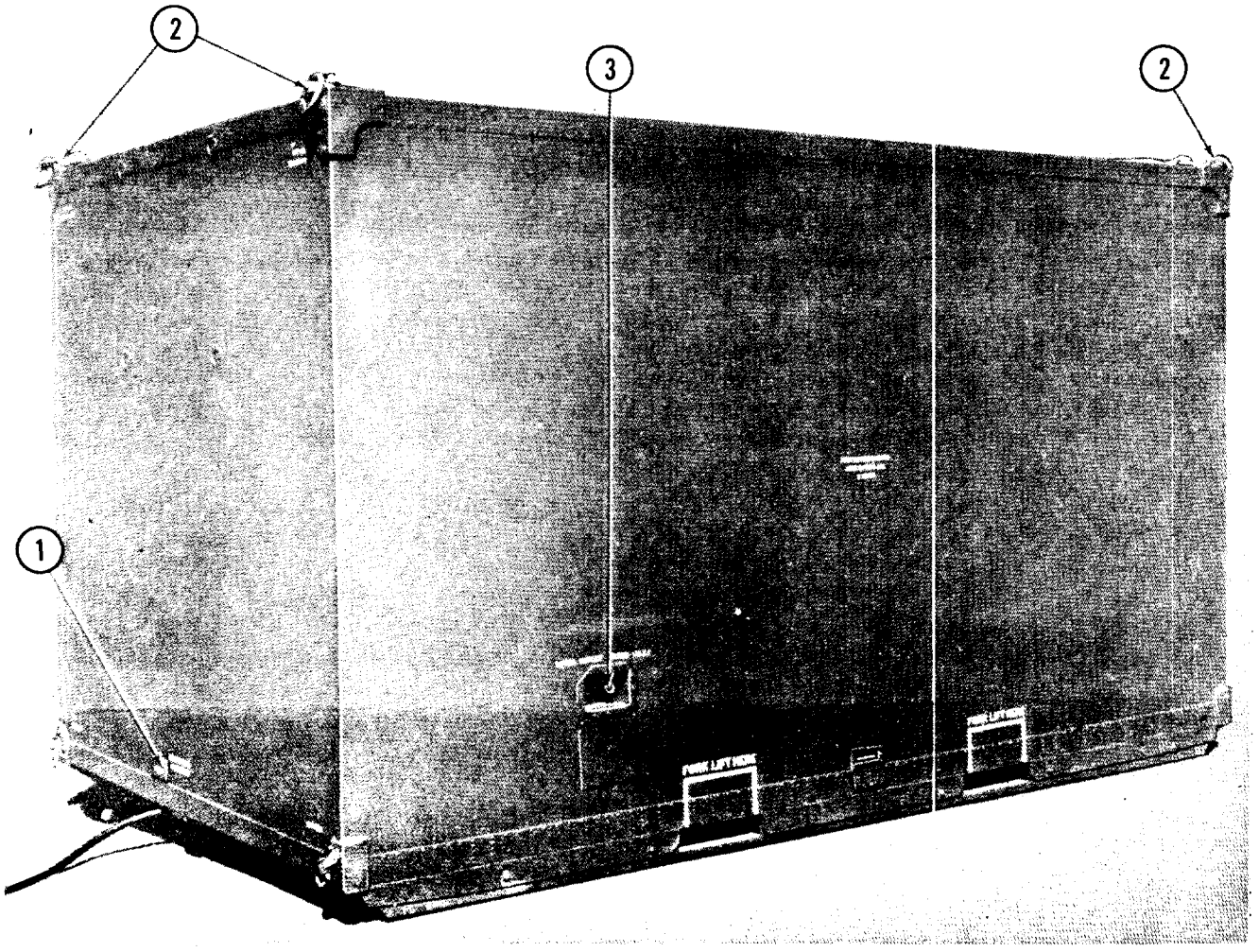
The laboratory is a completely self-contained unit that needs only an external power source, a water supply, and a waste-water disposal facility when in operation. The laboratory is essentially an S-280 B/G military shelter (figs. 1-1 and 1-2) that has been modified to accommodate all of the equipment, apparatus, instruments and supplies needed to conduct fuel quality testing in the forward areas. It is designed for rapid movement by ground or air transportation and for quick on site setup. The laboratory will function in an ambient temperature ranging from -40 degrees F to +125 degrees F (-40 degrees C to 51.5 degrees C).



TS 6640-213-14/1-1

1. Leveling device
2. Power cable junction box
3. Lifting and tiedown points
4. Tiedown device
5. Air conditioner vent
6. Exhaust fan outlet

Figure 1-1. Front Three-Quarter View of Airmobile Aviation Fuel Laboratory



TS 6640-213-14/1-2

1. Leveling device
2. Lift and tiedown points
3. External water connection

Figure 1-2. Rear Three-Quarter View of Airmobile Aviation Fuel Laboratory

NOTE

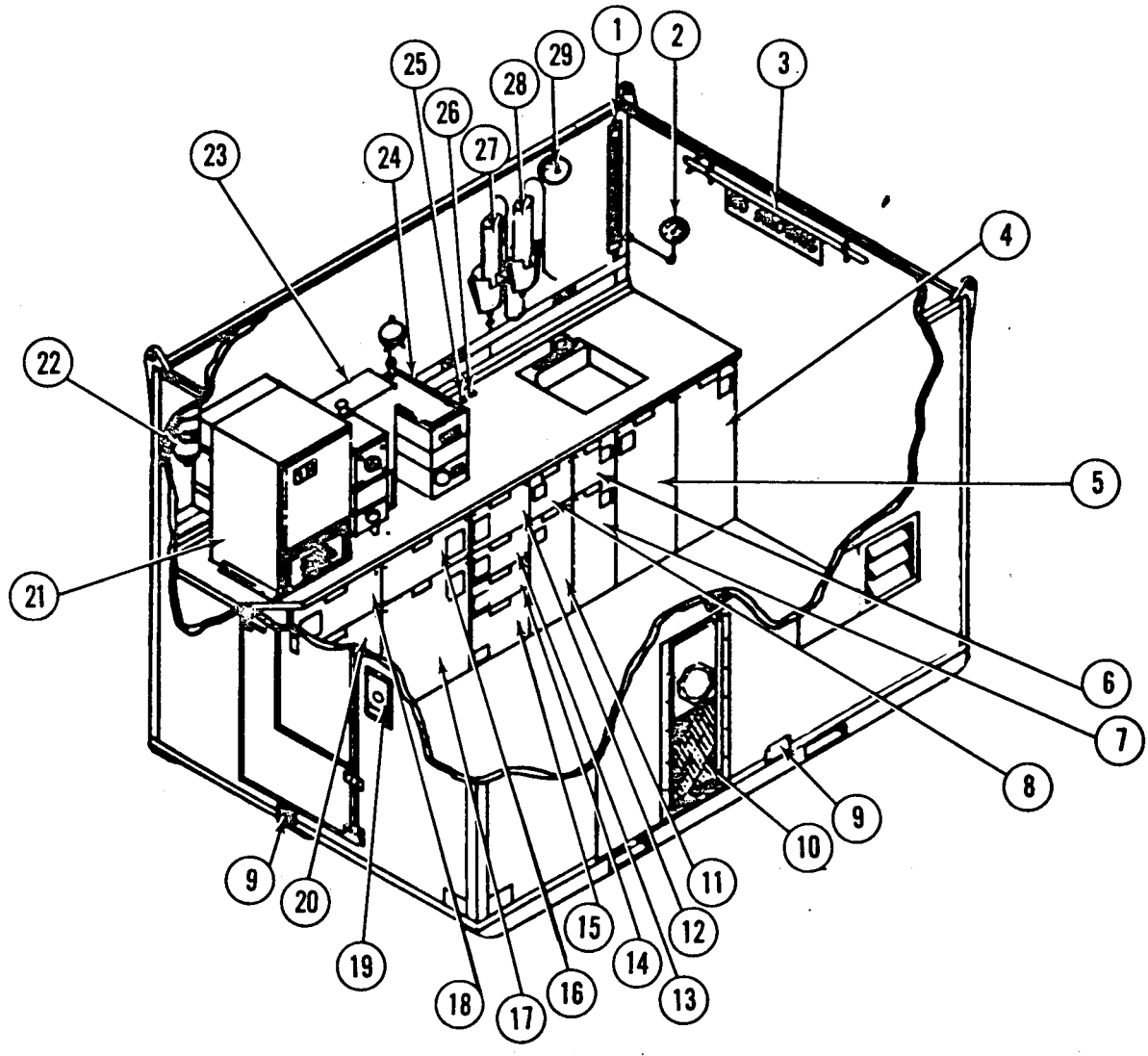
Throughout this manual, the term "front" refers to the part of the laboratory in which the door is located; the term "rear" to the opposite end. The terms "right" and "left" indicate the directions from the viewpoint of the operator as he stands facing the door or as he enters the door of the laboratory.

a. Shelter. The S-280 B/G military shelter is built of separate panels attached and bonded in such a way that the shelter is relatively airtight and waterproof. The roof, floor, end and side

panels are made of laminated foamed plastic bonded between aluminum alloy. The shelter is provided with lift/tiedown assemblies to permit the laboratory to be transported by aircraft or tied down and transported by truck. Skids on which the shelter is mounted permit it to be towed for short distances.

b. Utility Equipment. The laboratory requires electrical lines and/or a generator to supply electrical power, a water tank and pump or an external water source, and drains for the shelter floor, the air conditioning unit and the Reid vapor pressure bath to drain water away from the laboratory site. These items are discussed in Chapter 2.

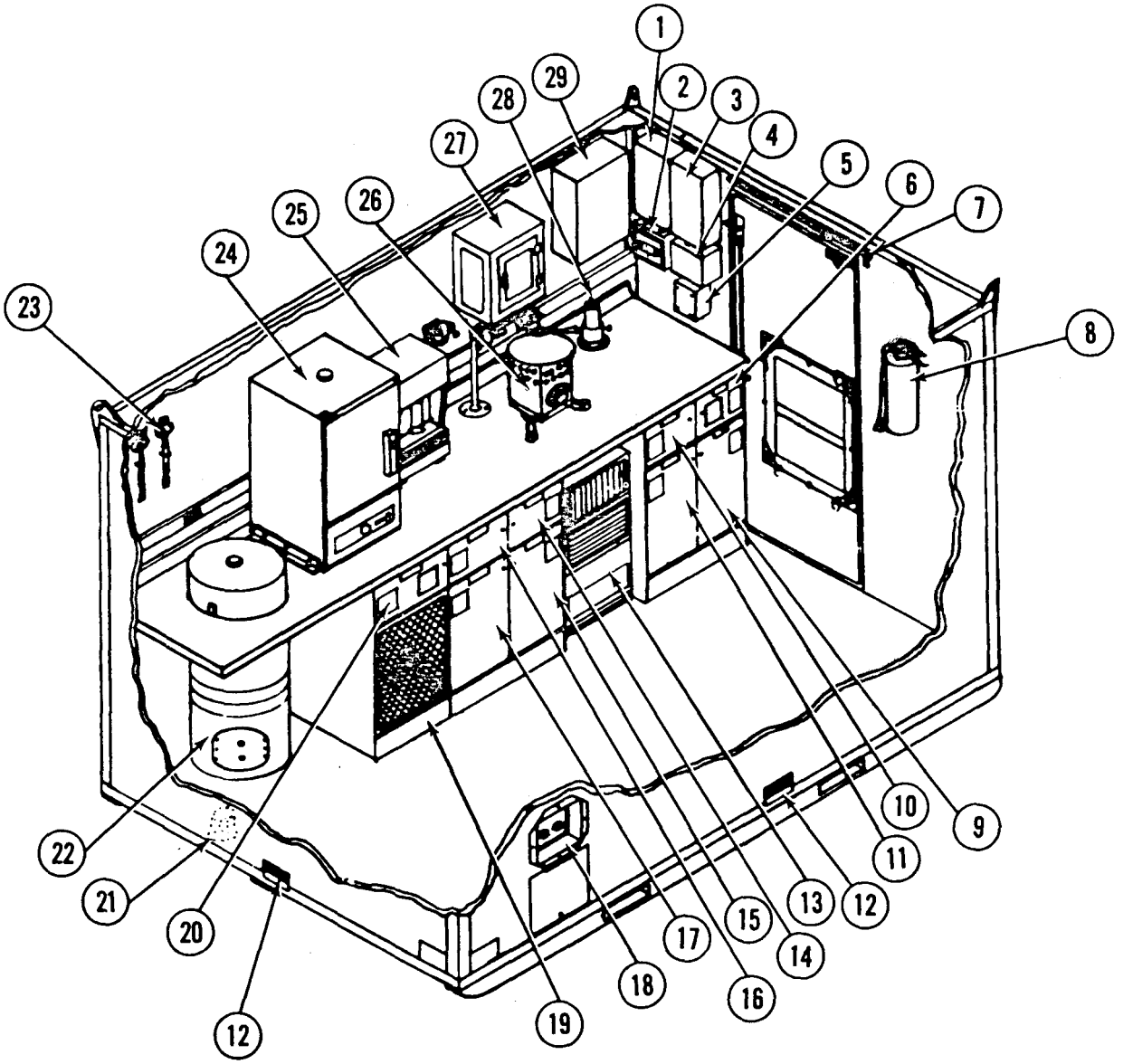
c. Test Equipment. A description of the test equipment and operating instructions are given in Chapter 2. Figures 1-3 and 1-4 are cutaway drawings showing the location of the equipment and apparatus, cabinets and drawers within the laboratory. Figures 1-5 and 1-6 are photographs of the laboratory interior showing equipment and other items.



TS 6640-213-14/1-3

1. Manometer
2. Reid vapor pressure gage location
3. Drum Thief, in stored
4. Cabinet No. 14
5. Cabinet No. 13
6. Drawer No. 11
7. Cabinet No. 12
8. Drawer No. 9
9. Leveling device
.0. Air conditioner
.1. Cabinet No. 10
.2. Drawer No. 5
.3. Drawer No. 6
.4. Drawer No. 7
15. Drawer No. 8
16. Drawer No. 3
17. Cabinet No. 4
18. Drawer No. 1
19. Power cable junction box
20. Cabinet No. 2
21. Ice maker
22. First aid kit
23. Distillation apparatus
24. Copper corrosion unit
25. Air pressure stopcock
26. Vacuum stopcock
27. Organic removal cartridge
28. Mixed resin cartridge
29. Barometer

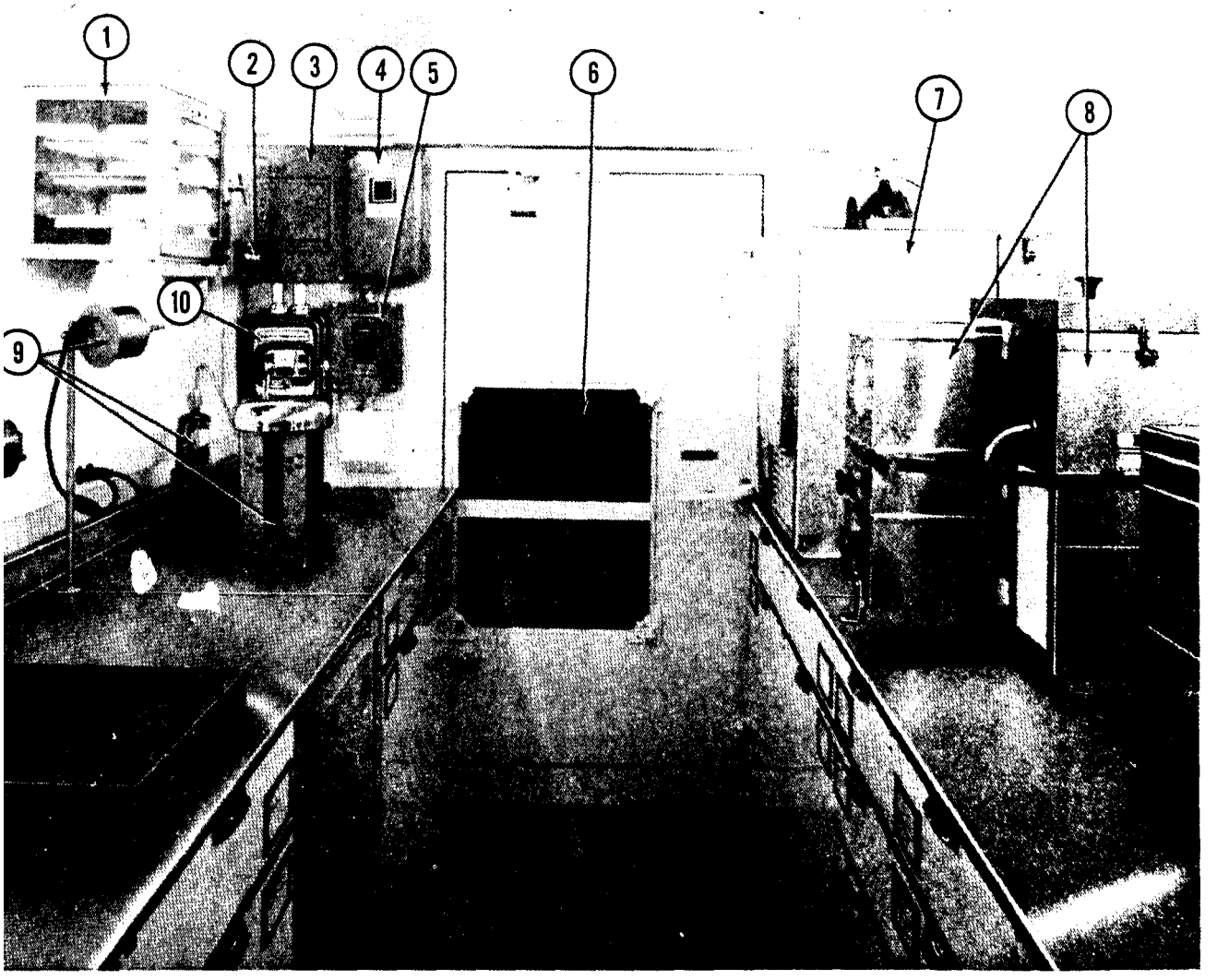
Figure 1-3. Cutaway Drawing Showing Location of Equipment, Apparatus, Cabinets and Drawers on the Left Side of the Laboratory.



TS 6640-213-14/1-4

1. Circuit breaker panel
2. Automatic Gas alarm
3. Main power contractor
4. Main power circuit breaker
5. Power cable junction box
6. Drawer No. 22
7. Grounding rod
8. Fire extinguisher
9. Cabinet No. 23
10. Drawer No. 20
11. Cabinet No. 21
12. Drawer No. 20
13. Air conditioner
14. Drawer No. 18
15. Cabinet No. 19
16. Drawer No. 16
17. Cabinet No. 17
18. External water connection
19. Exhaust fan
20. Drawer No. 15
21. Gas alarm detector unit
22. Reid vapor pressure bath
23. Reid vapor pressure bomb, with pressure gages
24. Oven
25. Analytical balance
26. Flashpoint tester
27. Desiccating cabinet
28. Propane cylinder
29. Main power control panel

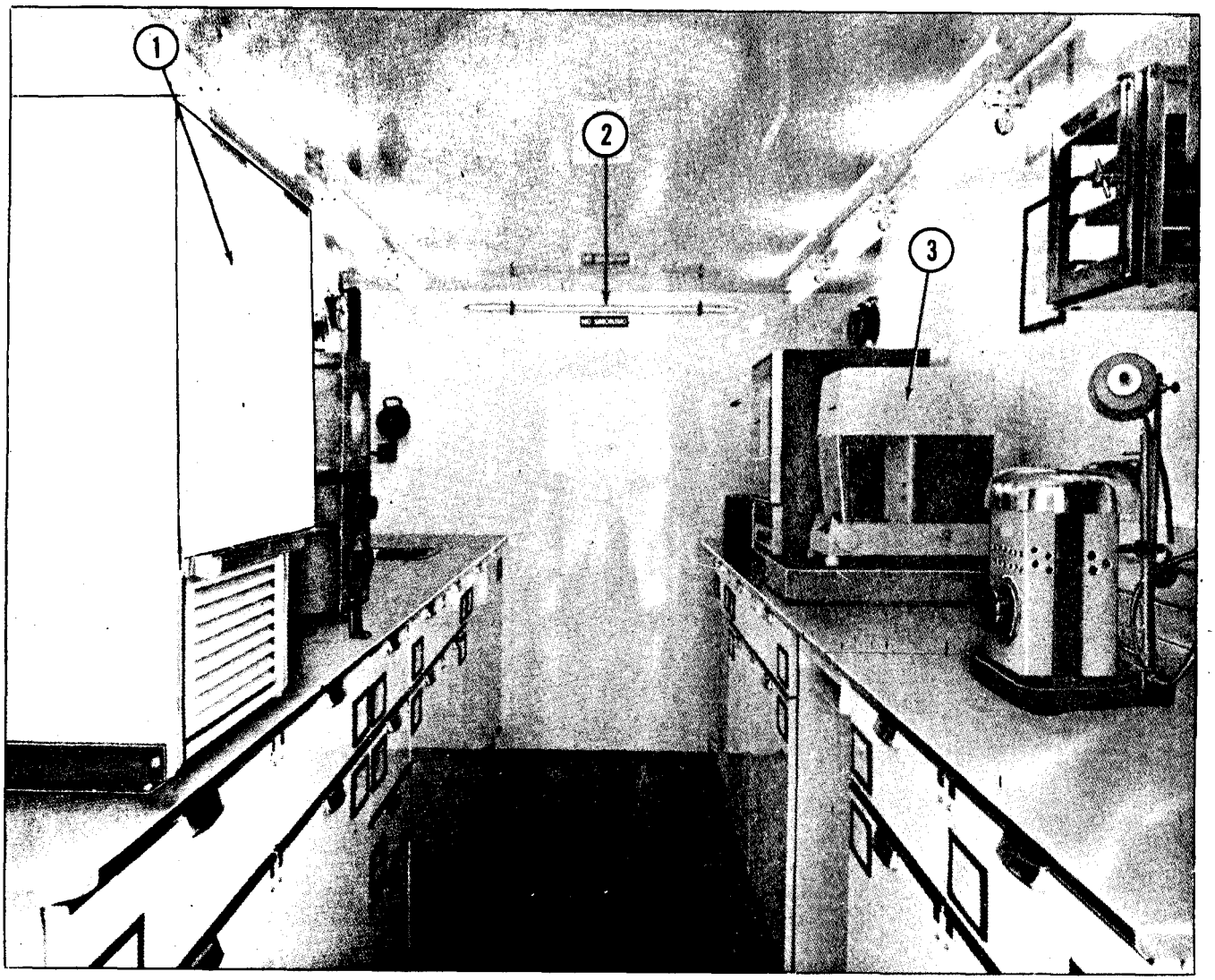
Figure 1-4. Cutaway Drawing Showing Location of Equipment, Apparatus, Cabinets and Drawers on the Right Side of the Laboratory.



TS 6640-213-14/1-5

1. Desiccating cabinet
2. Main power control panel
3. Circuit breaker panel
4. Main power contractor
5. Main power circuit breaker
6. Door vent
7. Ice maker
8. Distillation unit
9. Pensky Martens flashpoint equipment
10. Automatic gas alarm control box

Figure 1-5. Interior View of Front of Laboratory.



TS 6640-213-14/1-6

1. Ice maker
2. Drum thief
3. Analytical balance

Figure 1-6. Interior View of Rear of Laboratory.

1-7. TABULATED DATA.

Tabulated data on the laboratory are given below:

Shelter	Type S-280 B/G (NSN 5410-00-117-2868)
Dimensions:	
Length:	
Outside	142 in. (3.61 m)
Inside	138 in. (3.51 m)
Width:	
Outside	85-1/2 in. (2.17 m)
Inside	81-1/2 in. (2.07 m)
Height :	
Outside	82-1/2 in. (2.10 m)
Inside	74-1/2 in. (1.89 m)
Total Cube:	
Inside	480 CU. ft.
Weight:	3400 lb (1543.6 kilograms) avdp.
Electrical power requirements	15 KW., 60 Hz., 120-208 V., ac
Connection:	Quick disconnect, 4 pin.
Heating, ventilating, air conditioning	Vertical heater/air conditioner (NSN 4120-00-926-1137)
Cooling capacity:	9000 Btu/h.
Heating capacity:	6000 Btu/h.
Exhaust fan:	600 cfm; automatic louvered
Water sources:	
Internal:	20-gal reservoir (75.7 liters)
External:	Male garden-hose connector
Drain connections:	
Air conditioner:	l/2-inch hose connector
Sink:	Male garden hose

a. Electrical Data. Refer to figure 1-7 for the shelter electrical system wiring diagram.

b. Capabilities. The laboratory includes specific apparatus and general items of material to provide the following American Society for Testing and Materials (ASTM) and Federal test Method Standard No. 791 (FTMS) testing capabilities:

D-86	Distillation of Petroleum Products
D-93	Flash Point by Pensky-Martens Closed Tester
D-130	Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test
D-2276	Particulate Contaminant in Aviation Turbine Fuels
D-270	Sampling Petroleum and Petroleum Products
D-287	API Gravity of Crude Petroleum Products (Hydrometer Method)

D-323	Vapor Pressure of Petroleum Products (Reid Method)
D-1085	Gaging Petroleum and Petroleum Products
D-1086	Measuring the Temperature of Petroleum and Products
D-1094	Water Reaction of Aviation Fuels
D-1250	Petroleum Measurement Tables
D-1298	Density, Specific Gravity or API Gravity of Grade Petroleum Products by Hydrometer Method
CD-2276	Particulate Contaminant in Aviation Turbine Fuels
D-3240	Undissolved Water In Aviation Turbine Fuels (Aqua-G1O)
FTMS-5327.3	Determination of Fuel System Icing Inhibitor in Hydrocarbon Fuels

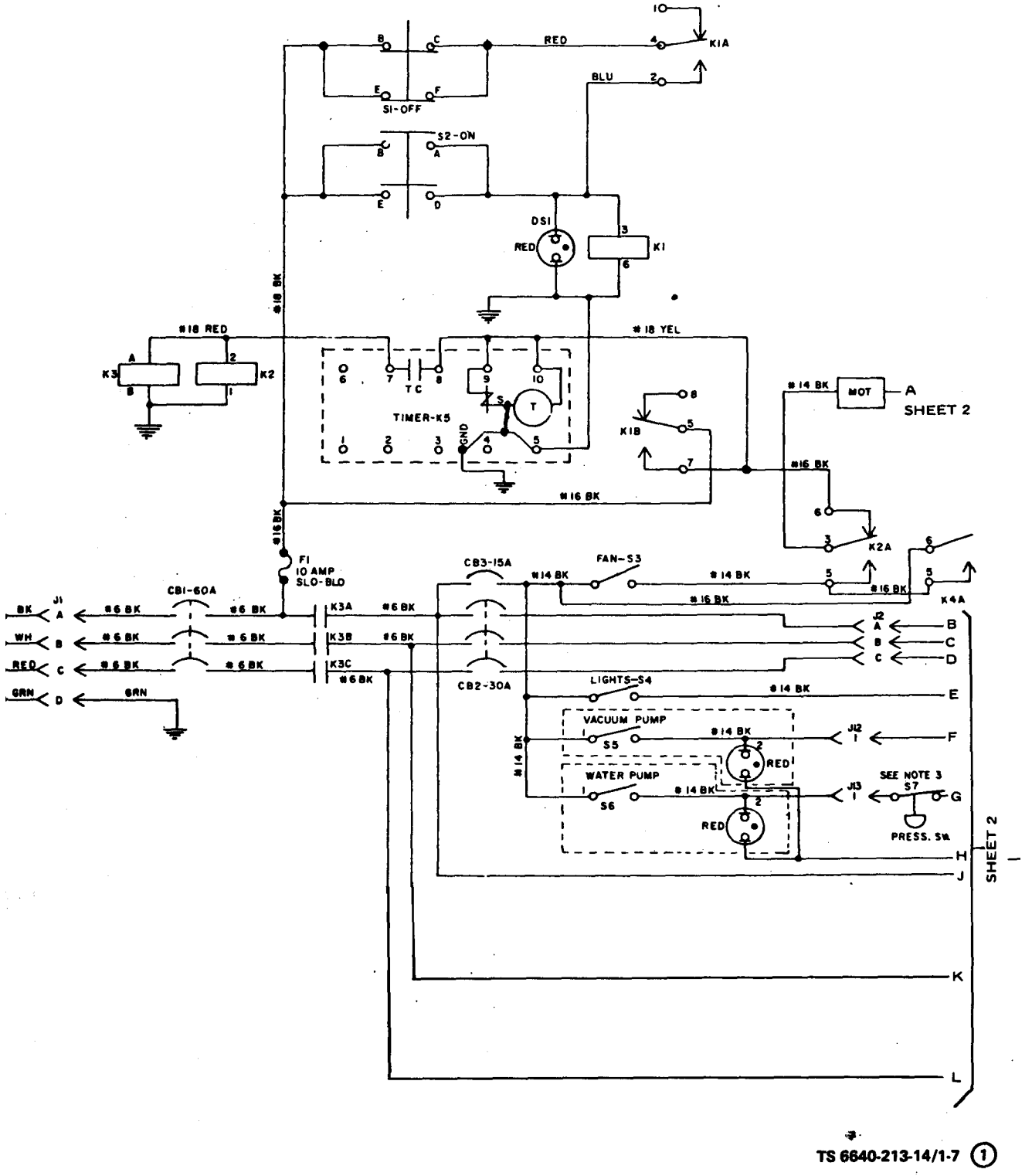


Figure 1-7. Electrical System, Wiring Diagram
(Sheet 1 of 2)

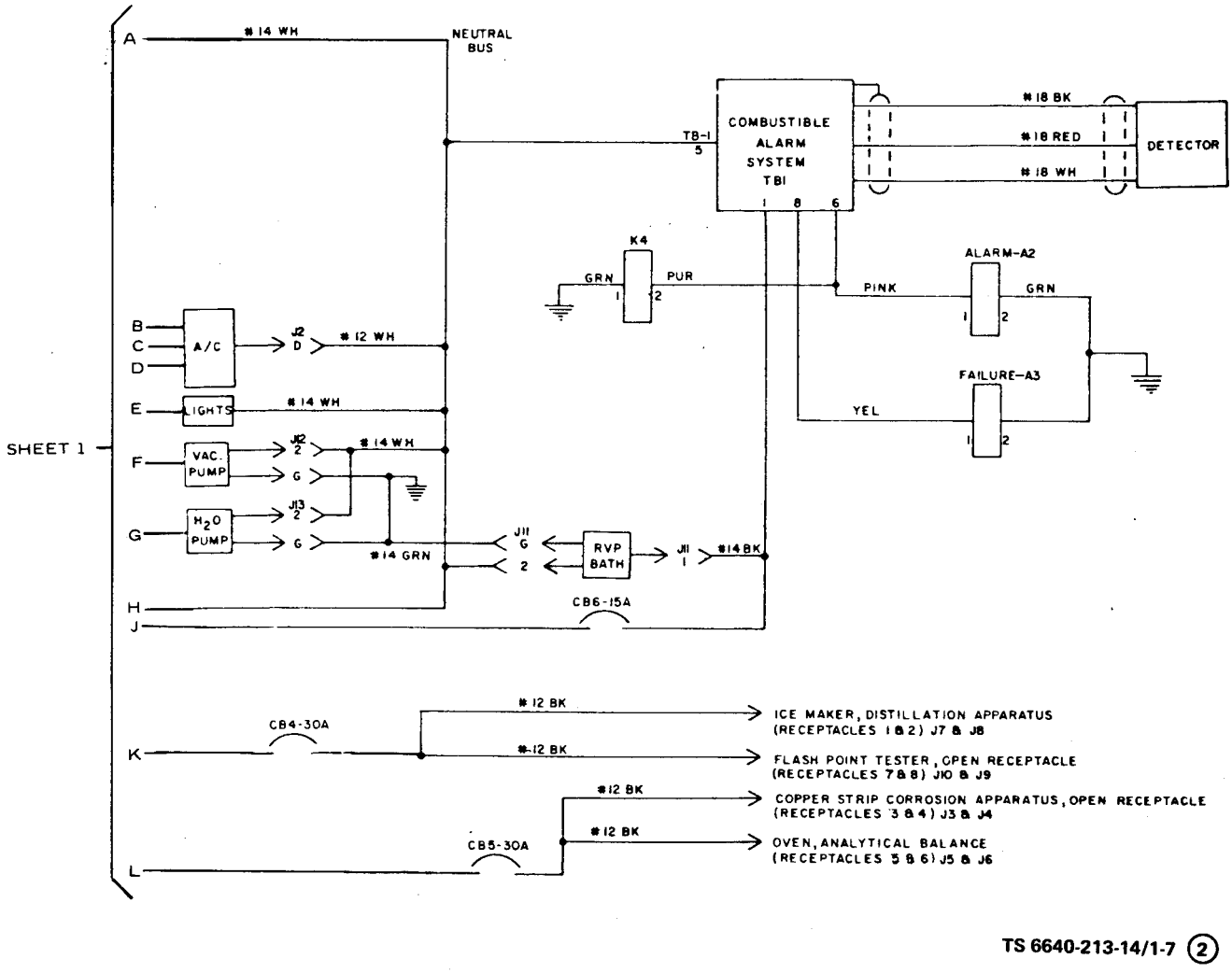


Figure 1-7. Electrical System, Wiring Diagram
(Sheet 2 of 2)

CHAPTER 2

OPERATING INSTRUCTIONS

2-1. GENERAL.

The instructions in this chapter are published for the information and guidance of personnel responsible for operation of the aviation fuel laboratory. The operator must know how to perform every operation of which the aviation fuel laboratory is capable. This chapter provides instructions on starting and stopping various items in the laboratory. Since nearly every job presents a different problem, the operator may have to vary given procedures to fit the individual job. Power to the laboratory is provided by a 15 kw, 60 Hz, 120-208 vac generator or equivalent electrical power from commercial source.

WARNING

Grounding for the laboratory is provided through the 4-wire cable from the power generator to the laboratory junction box (2, fig. l-l). Be sure generator and laboratory are properly grounded. Failure to observe this warning may result in serious injury or death.

WARNING

Main power circuit breaker CB-1, (4, fig. 1-4) must be in the ON position prior to starting generator. CB-1 shall NOT be manually shut off except in an emergency. Turning CB-1 ON with power applied could result in spark ignition of any combustible vapors that may be present in the laboratory.

WARNING

Ensure that the power cable is properly connected to the generator set. Color coding is as follows: Black wire - Phase A (Ll), White wire - Phase B (L2), Red wire - Phase C (L3), Green wire - Ground (G).

CAUTION

The ice maker and analytical balance may be adversely affected so that they are either inoperable or give incorrect readings if the laboratory is not properly leveled.

2-2 OPERATION UNDER USUAL CONDITIONS.

a. Laboratory and Equipment.

(1) Inspect the exterior of the laboratory thoroughly for visible damage sustained in transit, and repair any damage in accordance with TB 750-240 and TM 11-541O-213-14P.

(2) Level the laboratory to the site using the four special "oil-bubble-in-glass-vial", load-leveling indicators (2, fig. 2-l), to ensure that the laboratory is properly leveled on its foundation.

(3) Unlock the laboratory door. The keys to the unit are preshipped to the user to prevent pilferage during shipment; however, an extra key is provided (1, fig. 2-1).

WARNING

The purpose of the exhaust fan is to remove combustible or toxic gases from the laboratory. Insure access door is open before conducting any procedures in which the laboratory hood must be used. Failure to open to the access door can defeat the system and may result in injury or death to operating personnel.

(4) Enter the laboratory and remove the stored, 50-ft, four-conductor power cable. Connect the cable lugs to the generator terminal box with extreme care. Connect the male cable plug to the female connector housed in the junction box on the exterior of the laboratory, to the right of the door (19, fig. 1-3).

(5) Open and secure the access doors of the exhaust fan outlet and the air conditioner exhaust louvers (6, fig. 1-1). After opening the doors, examine the openings to be sure they are unobstructed.

(6) Activate the electrical power and water supply sources.

(7) Enter the laboratory and turn on the main power switch (4, fig. 2-2). Immediately return to the outdoors and allow the system to operate for 10 minutes to exhaust all noxious or dangerous vapor. (See para 2-2g.(1)(a) on air-purging).

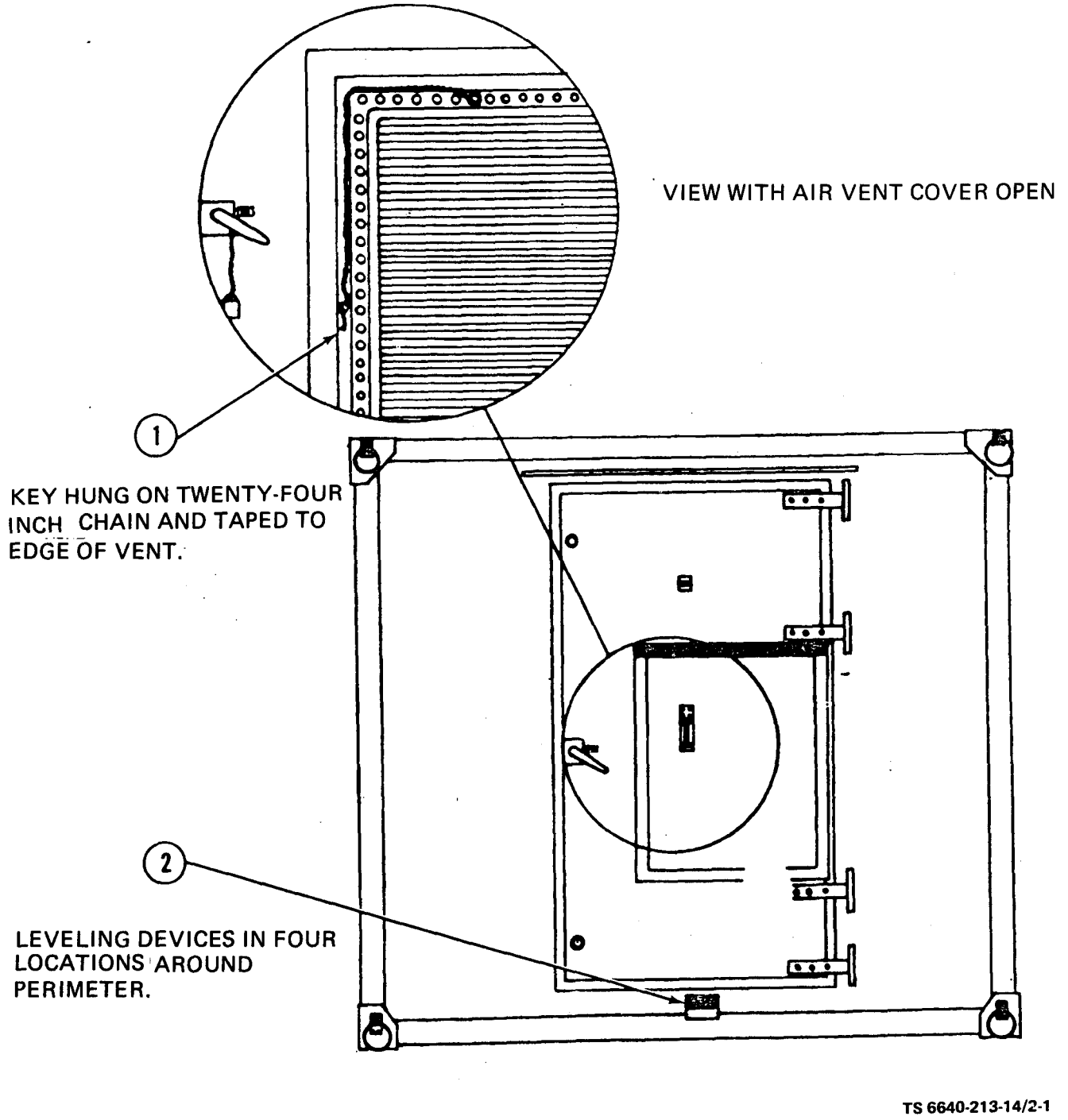


Figure 2-1. Location of Leveling Devices and Key.

(8) Reenter the laboratory and turn on the overhead lights by the switch located on the wall to the left of the door.

CAUTION

Fan rotation in reverse, as determined by the rotation arrow, indicates improper cable installation at the generator terminal box. Continued operation in reverse rotation will burn out the unit.

(9) Operate the air conditioning unit while an observer stays outside to watch the fan rotation. Operation of the unit should be in accordance with TM 5-4120-274-15. Internal laboratory temperature should be 75 degrees F to 79 degrees F (23.9 degrees C to 26.1 degrees C).

(10) Inspect the entire interior. Systematically inspect each item of equipment and all supplies located in the drawers and cabinets. A listing of everything is contained in Appendix B.

(a) Each cabinet door and each drawer is secured in the closed position with acorn nuts threaded onto bolts protruding through the surface. Remove the nuts and store them in a cloth bag for reuse during the next move of the laboratory. Cloth bags are located in the auxiliary drawer of cabinet No. 13 (5, fig. 1-3).

WARNING

Failure to remove the fire extinguisher shipment retainer bracket will hinder its use during an emergency.

(b) Shipment retainer brackets have been installed to prevent damage to equipment during shipment. The brackets are painted safety red. Remove the following brackets and store them for reuse during the next move of the laboratory.

1. One fire extinguisher bracket.
2. Two RVP bomb brackets.
3. One flashpoint tester bracket.

(11) Test the combustible gas alarm system (para 3-5d.).

NOTE

If a pressure water supply system is not available, the water must be supplied to the system manually (para 2-2 d. (2) (b).

b. Water Supply Connection. Attach a garden hose to the water supply connection. Before turning on the water to supply the laboratory, make sure that the reservoir gate valve (15, fig. 2-3) is closed.

c. Waste Drain Connections. Open the access door of the air conditioner. Uncoil the plastic tubing and attach it to the drain. Drop the tubing down outside the shelter to assure complete drainage of all condensate away from the air conditioning unit and the laboratory. Connect a length of garden hose to the sink drain and route it to a drainage ditch or to a previously prepared sump.

d. Utility Equipment and Automatic Alarm System.

(1) Utility Equipment and Electrical System.

WARNING

The air in the laboratory must be purged of combustion or toxic vapors before allowing personnel to enter. The exhaust (air-purging) system will operate for ten minutes. All other electrical circuits in the lab are inoperative during the purging cycle, but will activate automatically at its completion.

(a) Description. The electrical system (fig. 1-7) provides services to all laboratory electrical components, lights and utility receptacles. The system is powered by a 15 kw, 60 Hz; 120-208, vac generator through a four-conductor power cable. All of the major circuits have either circuit breaker or fuse protection against overcurrent. The electrical system includes an air-purging system and a combustible gas alarm system to assure the safe operation of the laboratory.

(b) Operation.

1. Momentarily depressing the main power switch S2 to ON causes relay K1 to be energized. Contacts KIA close, sealing in K1. Contacts KIB close, starting the fan and timer.

2. After 10 minutes, timer contacts 7 and 8 close, energizing relay K2 and contactor K3. Contacts K3A, K3B and K3C close, providing power to circuit breakers CB2 through CB6. (These circuit breakers provide power to the laboratory internal electrical components). Contacts K2A close, removing fan from KIB control.

NOTE

If fan local control switch S3 is OFF, the fan will be deenergized at this time. The electrical system is now in the normal mode of operation.

3. In the event of an ALARM or FAILURE from the combustible alarm system, relay K4 is energized, along with light/ buzzer. This causes contacts K4A to close, ensuring that the fan is energized regardless of the position of switch S3.

NOTE

If the “emergency” mode of operation, circuit breakers CB3 and CB6 must be on.

4. After the gas has been exhausted, or the failure corrected, the combustible alarm system must be manually reset. This causes relay K4 to become deenergized; contacts K4A open, and the fan control is returned to switch S3.

5. Depressing the main power switch S1 to OFF causes relay K1 to be deenergized. Contacts KIA open, isolating K1. Contacts KIB open, deenergizing the timer; and timer contacts 7 and 8 open, deenergizing relay K2 and contactor K3. This deenergizes the entire electrical system beyond circuit breaker CB1.

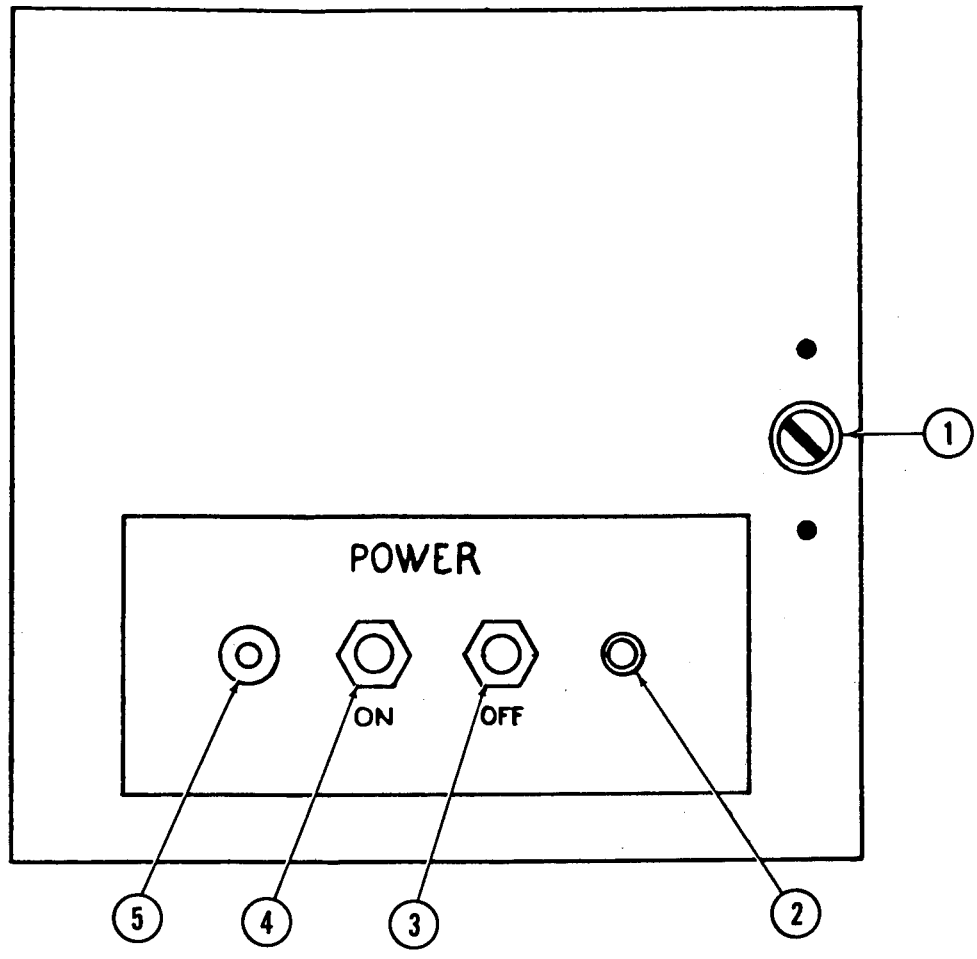
NOTE

Interruption of electrical power resets all electrical circuits to the original condition. Inital start-up procedures must be followed.

(2) Utility Equipment and Water System.

(a) Description. The water system (fig. 2-3) is described below.

1. Pump. The water pump is a 7-gpm centrifugal pump driven by a l/20-horsepower electric motor. The pump impeller is attached directly to the end of the motor shaft. The pump housing, which is bolted to the motor housing, is provided with a mechanical spring-loaded shaft seal to prevent-leakage around the shaft. Pump and motor are bolted to the floor beneath the sink and beside the water reservoir, to which the suction inlet of the pump is connected. The pump discharge outlet is connected to the sink supply line.



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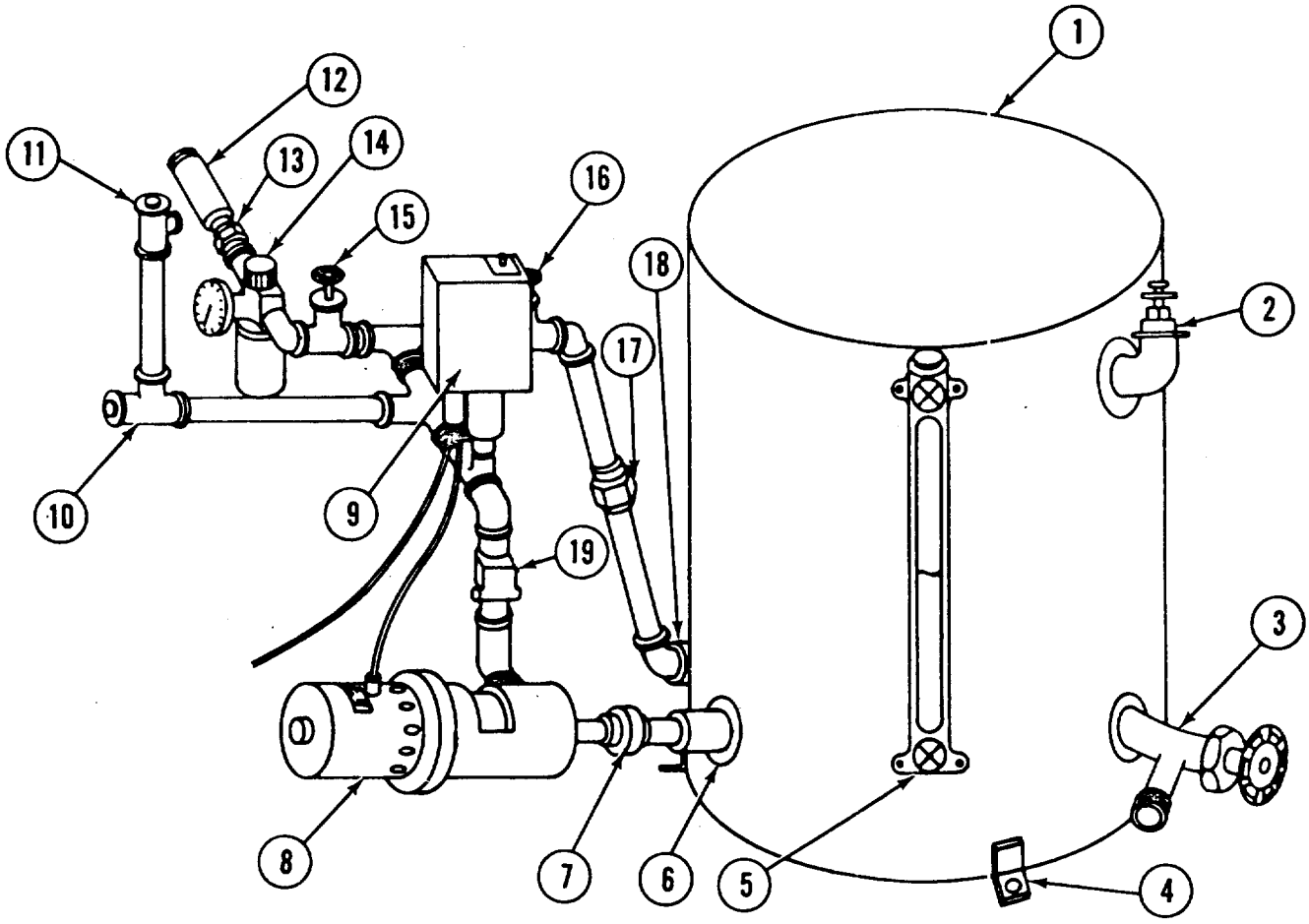
1. Door locking screw
2. Pilot lamp
3. OFF switch
4. ON switch
5. Fuse

Figure 2-2. Main Power Control Panel.



1. Tank
2. Air bleed valve and hand-fill port
3. Draincock
4. Mounting bracket
5. Sight gage
6. Outlet to pump (suction)
7. Union or heavy wall plastic tubing
8. Pump
9. Pressure switch
10. Outlet to water demineralizers
11. Water inlet to sink
12. Inlet from external water source
13. Union
14. Pressure regulator
15. Inlet gate valve (needle type)
16. Tank gate valve (needle type)
17. Union
18. Inlet to tank (pressure)
19. Check valve

Figure 2-3. Water System.

2. Pressure switch. A pressure switch (9, fig. 2-3) located in the water supply line to the sink automatically breaks the electrical circuit to the pump when the sink faucet is closed. The pressure switch is set to open at 11 psi and close at 4 psi, automatically starting the pump when the sink faucet is opened.

3. Check valve. A check valve (19, fig. 2-3) prevents water under pressure from reaching the pump when the external water supply system is in use.

4. Gate valve. Two gate valves provide the option of using water from either the reservoir or the external water source. The tank gate valve (16), when closed, prevents water under pressure from reaching the tank and the water pump. When open, it provides means of filling the water tank. The inlet gate valve (15) allows the flow of water from the external water source when open, it prevents water from being pumped out when closed.

5. Water tank. The capacity of the tank is 20 gallons (75.7 liters). An air bleed valve (2), located in the top right-hand corner of the tank in a threaded elbow, prevents vacuum or pressure buildup inside the tank above the water line while water is being pumped from or into the reservoir. Removing the air bleed plug from the elbow provides a port for filling the tank by hand. A sight gage (5) is used to indicate the height of water in the tank. On top of the sight gage is an air bleed valve that prevents vacuum or pressure buildup above the waterline in the sight gage.

6. Draincock. The tank has a draincock (3, fig. 2-3) to facilitate removal of all water from the system during transit or storage.

CAUTION

Open all valves and drain all the water in the system during transit or storage.

(b) Operating Instructions (fig. 2-3).

1. To fill the water tank by hand, proceed as follows:

(a) Remove the plug and air bleed valve (2) from the elbow.

(b) Open the sight gage air bleed valve (5).

(c) Using the funnel provided, fill the tank through the elbow fitting; use only potable water.

NOTE

The sight gage air bleed valve must be open to get a correct water level reading.

2. To fill the water tank by using an external water source proceed as follows:

(a) Open tank air bleed valve (2).

(b) Open tank sight gage air bleed valve (5).

(c) Close sink faucet.

(d) Close inlet gate valve (15).

(e) Open tank gate valve (16).

(f) Connect external water source to the inlet side of the water connection box located on the exterior of the laboratory (3, fig. 1-2) as follows:

(g) open inlet gate valve and turn on water source.

(h) Observe sight gage.

(i) When the tank is full, close inlet gate valve and turn off water source.

(J) Close tank gate valve.

CAUTION

Do not operate the water pump while using the external water source.

3. To operate the water system from an external source, proceed as follows:

(a) Close inlet gate valve.

(b) Close tank gate valve.

(c) Close sink faucet.

(d) Connect length of garden hose from outlet side of water connection box for use as a drain (18, fig. 1-4).

(e) Connect external water source to inlet side of water connection box,

(f) Slowly open inlet gate valve.

(g) SlOWlY open sink faucet and allow incoming water to force air from system.

4. To operate the water system from the tank supply, proceed as follows:

(a) Connect a length of garden hose from the outlet side of the water connection box (18, fig. 1-4) for use as a drain.

(b) Close the sink faucet.

(c) Close the inlet gate valve.

(d) Close the tank gate valve (16, fig. 2-3).

(e) Open the air bleed valve on the water tank sight gage.

(f) Start the pump using the ON-OFF switch located in a wire mold above and to the left of the sink.

(g) Slowly open the sink faucet and allow the pumped water to force air from the system.

(h) Check the pressure switch to make sure that the water pump stops operation when the sink faucet is closed and starts operating when the sink faucet is open. In the event the pump fails to respond when the faucet is opened or closed, rotate the adjustment screw on top of the switch to raise or lower the cutoff pressure accordingly.

NOTE

To prolong the life of the water pump, make it a standard practice to place the ON-OFF switch in OFF position when the water system is not in use.

(3) Utility Equipment and Air System.

(a) Description. Principal components of the air system are discussed below.

1. Pump. The vacuum-pressure, rotary-type, power-driven pump is a unit designed to produce a vacuum of 27 inches (68.6 cm) of mercury (Hg) to meet the macuum filtration requirements of the laboratory and to produce a pressure of 25 psi (1.76 kg/sq cm) maximum to meet the Reid vapor pressure (RVP) gage calibration requirements of the laboratory. The pump is located on the bottom of cabinet (No. 12) on the left-hand side of the laboratory next to the sink cabinet and in front of an air surge tank to which the positive pressure outlet is connected. Pump data are as follows:

Motor:	General Electric “Form G“ Split phase, 115V, 60 Hz, ac
Pump:	Vacuum down to 27 in. (68.6 cm) of Hg. Pressure up to 25 psi (1.76 kg/sq cm)
Dimensions:	15 in. long; 8 in. wide, 8-1/2 in. high,” overall (38.1 cm long, 20.3 cm wide, 21.6 cm high)

Pump assembly	includes:	Positive-negative pump, motor, positive and negative gages, and outlet filter silencers

2. Tank. The air suge tank ensures a continuous air flow. A relief valve, located on the air surge tank, is set to open at 25 psi (1.76 kg/sq cm). A T-fitting and a gate valve located in the air pressure line provide the option of delivering pressure either to the manometer or to the tabletop-mounted air stopcock for other operations. The manometer, located in the left-hand corner of the laboratory, reads the line pressure. A pressure regulator is placed in the pressure line in a position where it can be adjusted by a technician while he observes the manometer, or while he checks a Reid vapor pressure (RVP) gage connected to the end of the air pressure line. The vacuum outlet on the pump is connected directly to a tabletop-mounted stopcock located to the left of the sink.

(b) Operating Instructions.

CAUTION

Make sure that the pressure regulator is set for zero pressure before turning on the pump.

1. To supply air pressure to the tabletop-mounted stopcock (8), proceed as follows:

(a) Close the needle valve (3, fig. 2-4) in the line downstream of the T-fitting leading to manometer (9).

(b) Set the ON-OFF switch, located in wire mold to the left of the sink, in the ON position.

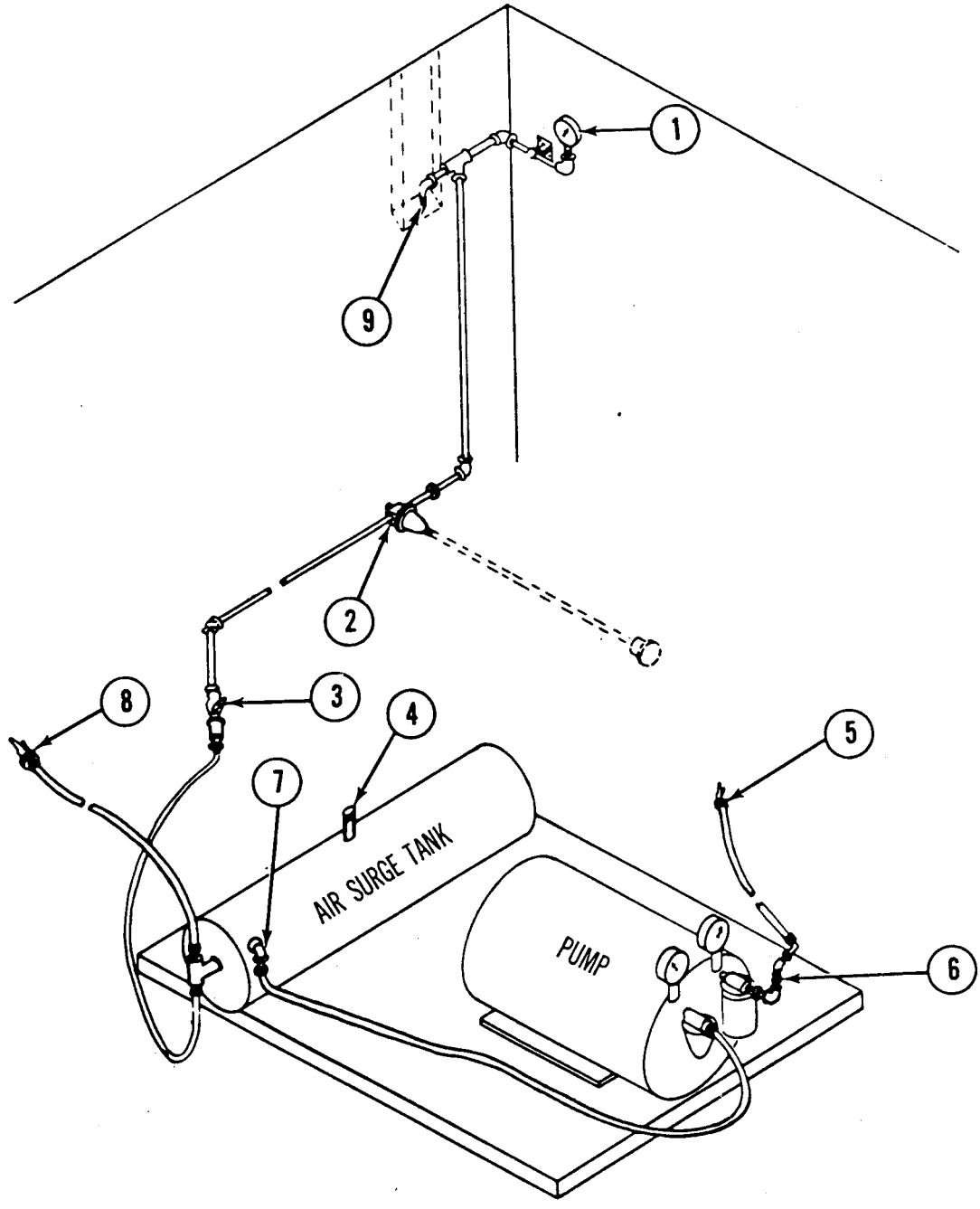
(c) Allow time for pressure to build up in the tank.

(d) Open and close the tabletop-mounted air stopcock marked "Air," as needed

NOTE

The 25 psi relief valve (4) relieves the pressure when 25 psi (1.76 kg/sq cm) pressure is reached in the tank. Do not operate the pump needlessly.

2. To supply air pressure to the manometer for calibrating RVP gages, proceed as follows:



1. Gage
2. Pressure regulator
3. Needle valve
4. Relief valve
5. Vacuum stopcock
6. Vacuum check valve
7. Air pressure check valve
8. Air stopcock
9. Manometer

Figure 2-4. Air System.

(a) Close the air tabletop-mounted stopcock (8).

(b) Close the valve to the manometer (9).

(c) Place the ON-OFF switch in the ON position.

(d) Allow time for pressure buildup in the air surge tank.

(e) Connect the RVP gage to the fitting.

(f) Open the valve (3) to the manometer (9).

(g) Adjust the air pressure regulator (2) until the manometer with the gage reading.

(h) Compare the pressure indicated on the manometer indicates the desired pressure.

e. Automatic Combustible Gas Alarm and Air-Purging Systems.

(1) Purpose and General Description.

(a) The automatic combustible gas alarm is a calibrated instrument designed to continuously monitor for combustible gas/air mixtures. It alerts personnel of combustible mixtures that could cause explosions and fires, and it automatically activates an air-purging system.

(b) The alarm system consists of a main control unit and a remote detector assembly. The main control unit (2, fig. 1-4) and 10, fig. 1-5) is in a protected nonhazardous area and connects electrically to the detector assembly (21, fig. 1-4). The alarm can operate using 115/230 volts ac, 50/60 cycles, or 12 volts dc, with 15 watts of power. The alarm is calibrated for propane and has a setting of 20 to 40 percent of the lower explosive limit (lel) of gasoline. The remote detector voltage is 5.5 volts dc. An indicating meter shows the concentration level of a sample being monitored, and adjustable dual level alarm circuits are triggered whenever a concentration exceeds the preset level or lower explosive limit (lel).

(2) Cabinet Assembly of the Alarm System. The cabinet assembly houses the electronics and control circuits necessary for instrument operation. Incoming power and detector leads enter the cabinet through 3/4 inch conduit fittings. The controls, fittings and connections are discussed below.

(a) Green Pilot Light. When the instrument power is on and the detector circuit is energized, the green pilot light comes on.

(b) Blue Fail Light. When there is equipment failure or malfunction, the blue fail light comes on.

(c) Amber Warn Light. The amber warn light comes on when a combustible gas condition exceeding the low alarm settng exists at the remote detector, or when the alarm test switch ((e) below) has been actuated.

(d) Red Alarm Light. The red alarm light comes on when a combustible gas condition exceeding the high alarm setting exists at the remote detector, or when the alarm test switch has been actuated.

(e) Alarm Test Switch. The alarm test switch is a momentary contact pushbutton switch incorporated with the warn light. When it is depressed electrically, there is a simulation of an alarm level of gas concentration at the remote detector. This switch provides a functional check of the analyzer and remote alarm circuit.

(f) Alarm Reset Switch. The alarm reset switch is a momentary contact pushbutton switch located on the cabinet door. Depressing the switch deactivates the holding circuits of the alarm and warning relays if a safe gas condition has been restored at the remote detector. If a safe condition does not exist, the unit cannot be reset.

(g) Indicator Meter. The indicator meter shows the concentration of combustible gas at the detection point.

(h) Terminals. Terminals are accessible when the front panel is open and the printed circuit card is removed. Terminals are provided for incoming power, remote detector leads, alarm and failure devices, and for external warning devices and recorder, if desired.

(3) Alarm System Detector. The detector consists of the body, detector element and shield assembly. The body houses the detector element and holds the shield in place. The element is a replaceable gas sensing unit that plugs directly into the body when the shield is removed. The shield assembly consists of a shield and a flashback screen, which prevents ignition of combustible gases. The detector, which is explosion proof, is located in an area where flammable gas or vapor may be released. It is mounted on a 3/4 inch conduit that leads to the cabinet assembly; the detector lead enters the cabinet through 3/4 inch conduit fittings.

(4) Placing the Alarm System in Operation.

(a) Initial Startup Procedures.

1. Turn on the power (the pilot light should come on). A 45-second delay disables the alarm circuits to permit instrument warmup. Allow the system to stabilize for 5 minutes.

2. Make sure that the remote detector is in a combustible gas-free area. The area surrounding the detector can be checked by using a portable combustible gas indicator.

3. Zero the indicating meter, use a small screwdriver to turn the zero adjuster on the printed circuit board. Turning the adjuster clockwise increases the reading.

4. Depress the warn/test button and verify an up-scale meter reading. The warn and alarm lights should come on. A 2-second delay on the alarm indication is provided.

(b) Initial Startup Adjustments.

1. Measure and adjust the detector voltage at the remote detector head, and adjust the "volt" control in the corresponding module as described in paragraph 3-5c.

2. Measure the detector voltage at the cabinet as follows:

(a) With instrument power on, connect the high-resistance, direct-current, voltmeter leads to the detector voltage test points on the printed circuit board (terminals B). Observe the polarity.

(b) Record the voltmeter reading. The reading recorded is the detector voltage without resistance due to detector lead length. This procedure provides a convenient means of checking the detector voltage at any time without disassembling the remote detector.

3. Expose the detector to a sample of combustible gas. See that the meter reads up-scale and that the alarms come on at the desired levels.

4. If the warn and alarm set points need to be adjusted, proceed as follows:

(a) Make sure that the detector is in a combustible gas-free environment.

(b) Remove the warn and alarm relays (first and last relays) from the printed circuit board.

(c) Turn the warn and alarm adjusters fully counterclockwise. Both the warn and alarm lights should come on.

(d) Turn the zero adjuster on the control module printed circuit board until the meter reads approximately 2 percent below the desired warn setting.

(e) Turn the warn adjuster slowly clockwise until the warn light goes off.

(f) Turn the zero adjuster slowly clockwise and see that the warn light comes on at the desired level (there is a 2-second delay on warn and alarm indication).

(g) Repeat steps (d), (e) and (f) for the alarm set point.

(5) Air-Purging System. The air-purging system is located in a cabinet opposite the sink. It consists of a grill and exhaust through wall mounted louver assembly and out of the laboratory at the rate of 600 cubic feet per minute (cfm).

NOTE

The air-purging system is also activated when the main power switch is turned on and it can be operated manually by the fan switch beneath the light switch.

f. Test Equipment.

(1) Double Beam Balance.

(a) Description. The double beam balance (NSN 6670-00-436-9857) is supplied for weighing chemicals that are to be used in various testing procedures. The upper beam is graduated from O to 10 grams in O.1-gram divisions. The lower beam is graduated from O to 200 grams in 10-gram divisions. Two removable, 6-inch (15.2 cm) diameter, stainless steel pans are supplied with the balance. The capacity of the balance without the use of loose weights is 210 grams. Since the capacity of the balance exceeds the beam capacity, the use of additional loose weights is necessary to take advantage of the full capacity. A set of 12 brass, tall-form, loose weights (NSN 6670-00-803-9680) is included with the laboratory equipment for use with the balance. The weights are positioned in a vinyl plastic block and they range in size from 1 to 1,000 grams.

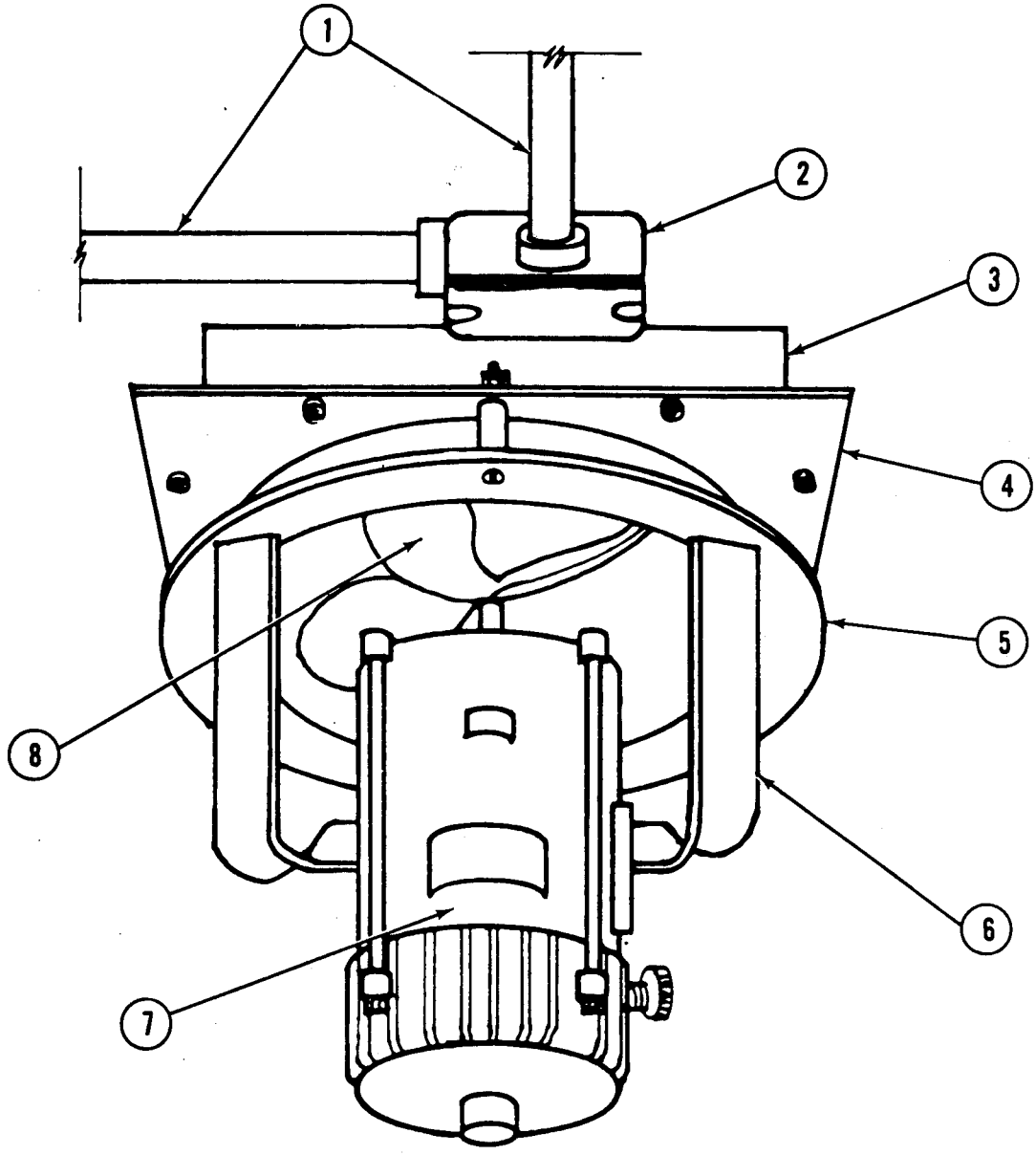
(b) Operating Procedures.

1. Set each poise at the zero mark.

2. Always check balance zero before each use. If the instrument does not balance at exactly zero, make the necessary corrections with the two knurled nuts on the front of the beam. When the balance" has been restored, lock the nuts against each other.

3. Place the specimen to be weighed on the left platform of the balance.

4. Move the lower poise to the right until the first notch is reached; this causes the right platform to drop. Move the poise back one notch; this should cause the right platform to rise again.



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1. Conduit
2. Junction box
3. Louver housing
4. Baffle plate
5. Guard
6. Mounting bracket
7. Motor
8. Fan

Figure 2-5. Exhaust Fan Assembly of the Air-Purging System.

5. Move the upper poise to the right until the scale is brought into balance with the pointer in the center of the dial or swinging an equal distance to the left and right.

6. Read the weight directly from the beams by adding the amounts indicated on the upper and lower beams.

7. If it is necessary to weigh above the beam capacity, place additional loose weights on the right platform until the total of these weights comes to within the beam capacity range of the weight of the specimen. The final balance is done by moving the sliding poises on the beams. The weight of the specimen is represented by the total of the weights on the right platform plus the

(2) Analytical Balance.

(a) Description. The analytical balance (fig. 2-6) is equipped with an automatic preweighing and single-knob taring system.

1. The balance has a full 1000-mg optical range with all-digital readout. The numbers to be read on the optical scale appear in a clear window; all neighboring valures are visible, but subdued, through a green filter.

2. The balance also has simplified table-level controls. Two knobs dial in the weights from 1 to 99 grams. The release lever is turned down and the weight is read to the last decimal place by superimposing a hairline on the optical scale with the micrometer drum knob. The weight application knobs and readout are arranged in a straight line, in their logical seuquence from left-to-right.

3. The pan, optical scale and controls are in a single field of view.

4. Sliding glass doors on either side of the balance provide access to the weighing chamber. A pan brake that acts on the bridle above the chamber provides damping of pan swing.

5. The weighing beam is made of polished aluminum alloy and the knives are precision-ground sythetic sapphires. All weights are cylindrical. The optical system is mounted in a precision alignment mechanism, which has a focusing control for maximum image sharpness. The projection system uses magnification to provide the reading image and the best reproducibility. The design principle is that of constant load (substitution) weighing.

After a sample has been placed on the pan, weight is removed mechanically until the system is in equilibrium. Always check balance zero before each use.

6. The analytical balance is equipped with an ionizer near the weighing pan. It is used to dissipate static electricity by emitting alpha radiation. Polonium 210 is used as a radiation source; it is toxic and the following precautions should be taken to prevent ingestion or inhalation of the solid material:

WARNING

Do not allow unauthorized personnel near the ionizer.

When the ionizer is no longer effective as a static eliminator and its use is to be discontinued, dispose of it as hazardous radioactive material. Do not discard it as scrap because the small quantity of remaining radioactive substance could be a potential hazard if it is mishandled.

WARNING

Sulfuric acid should not be stored with organic compounds. It is a strong oxidant and could cause fire if breakage occurred.

7. Performance data are as follows:

Weighing capacity:	
Weighing range	100 g
Taring in optical range	l g
Total	101 g
Taring ranges:	
Manual tare range (optional)	50 g
Mechanical taring (max. with built-in weights)	100 g
Optical range	l g
One optical division	10 mg
One micrometer precision (standard deviation) division (digital readability)	0.1 mg + 0.5 mg or -0.05 mg
Accuracy in optical range	+0.05 or -0.05 mg
Preweighing range, direct	0-100 g

(b) Operating Instructions. Specific instructions for uncrating the analytical balance, preparing it for use, and calibrating and making sensitivity adjustmnets are given in Chapter 3. Operating procedures are given below.

1. To weigh a sample of unknown weight, use the weight control knobs (7, fig. 2-6) to return the macroweight counter (6) to zero and use the micrometer drum knob (3) to zero and micrometer line on the optical scale (5). Then move the arresting lever

(2) into the preweigh (up) position (fig. 2-7). If the optical scale does not indicate zero, adjust the zero control knob (1, fig. 2-6).

2. After the scale is zeroed, arrest the balance by depressing the arresting lever to the arrest position (fig. 2-7). Next check zero in the full-release position (fig. 2-7). Place the arresting lever in the down position. Adjust the optical scale to zero by using the zero control knob (1, fig. 2-6). If zero adjustment cannot be made, refer to Chapter 3 for calbiration and maintenance instructions. Place the sample on the pan, close the glass doors and lift the arresting lever into the preweigh position. The coarse weight will then be indicated on the optical scale, (5, fig. 2-6) . Set the weight control knobs to show the same weight on the macroweight counter. Depress the arresting lever to the arrest position and, after a brief pause (about 3 seconds), move the arresting lever to the full-release position. When the optical scale comes to a stop, use the micrometer drum knob to move the scale pointer (micrometer line) over the next lower optical division of the moving scale. The readout can then follow from left to right: first the macro values from the macroweight counter, then the first two decimal places on the optical scale and the final two digits from the microscale. Return the fine adjustment back to zero at the completion of each weighing.

3. The taring capabilities of the balance can be used on containers weighing less than 1 gram by first zeroing the balance, and then placing the container on the pan. The reading on the optical scale is the tare weight of the container. After taring, if the container is to be filled with a specific weight, adjust the zero control knob to reflect zero on the optical scale and proceed as follows:

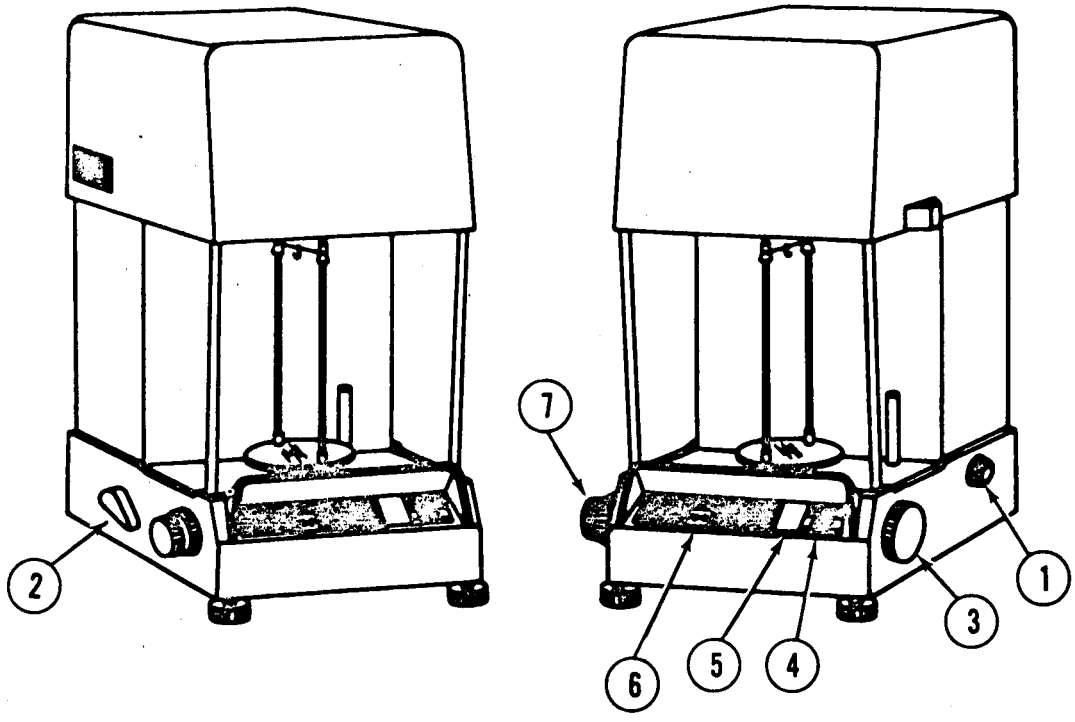
(a) Remove the container from the analytical balance and place it on the double beam balance. (Tongs should be used).

(b) Tare the container on the double beam balance. Add the tare weight and desired additional substance weight mathematically to get an approximate total. Proceed to fill the container.

(c) After obtaining the approximate total weight, remove the container from the double beam balance and place it on the pan of the analytical balance. (Tongs should be used).

(d) Adjust the final total weight by use of filter paper or a glass rod.

4. To tare containers over 1 gram, weigh the container as noted for any unknown weight. After taring, if the container is to be filled with a specific weight, adjust the zero control knob to reflect zero on the optical scale and leave the macro weight counter untouched. Follow steps (a), (b) and (c) in paragraph 3. above, and, by use of filter paper or a glass rod, adjust to the specific weight desired by accounting for the macro weight figure only.



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1. Zero control knob
2. Arresting lever
3. Micrometer drum knob
4. Microscale
5. Optical scale
6. Macro weight counter
7. Weight control knob

Figure 2-6. Analytical Balance.

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Figure 2-7. Arresting Lever Position of Analytical Balance.

NOTE

If a tared weighing boat is used, remove the tare ring and zero with the empty boat on the pan.

5. Weighing to a present weight is also a capability of the balance. Adjust the weight control knobs and, if necessary, the micrometer drum knob to the desired value. Preweigh step 3., move the arresting lever to the full-release position and adjust the weight by use of filter paper or a glass rod until the value is reached.

6. Correction of the weighing result can be made for conditions requiring absolute weighings. The switching weights are made of noncorrosive, nonmagnetic steel having a density of 7.88 g per ml. For a medium air density of 0.0012 g per roil, they are adjusted to match brass weights of density 8.4 g per ml. Differential weighings of the same material do not require correction. In case of absolute weighings, the result of the following formular has to be added to the weighting result:

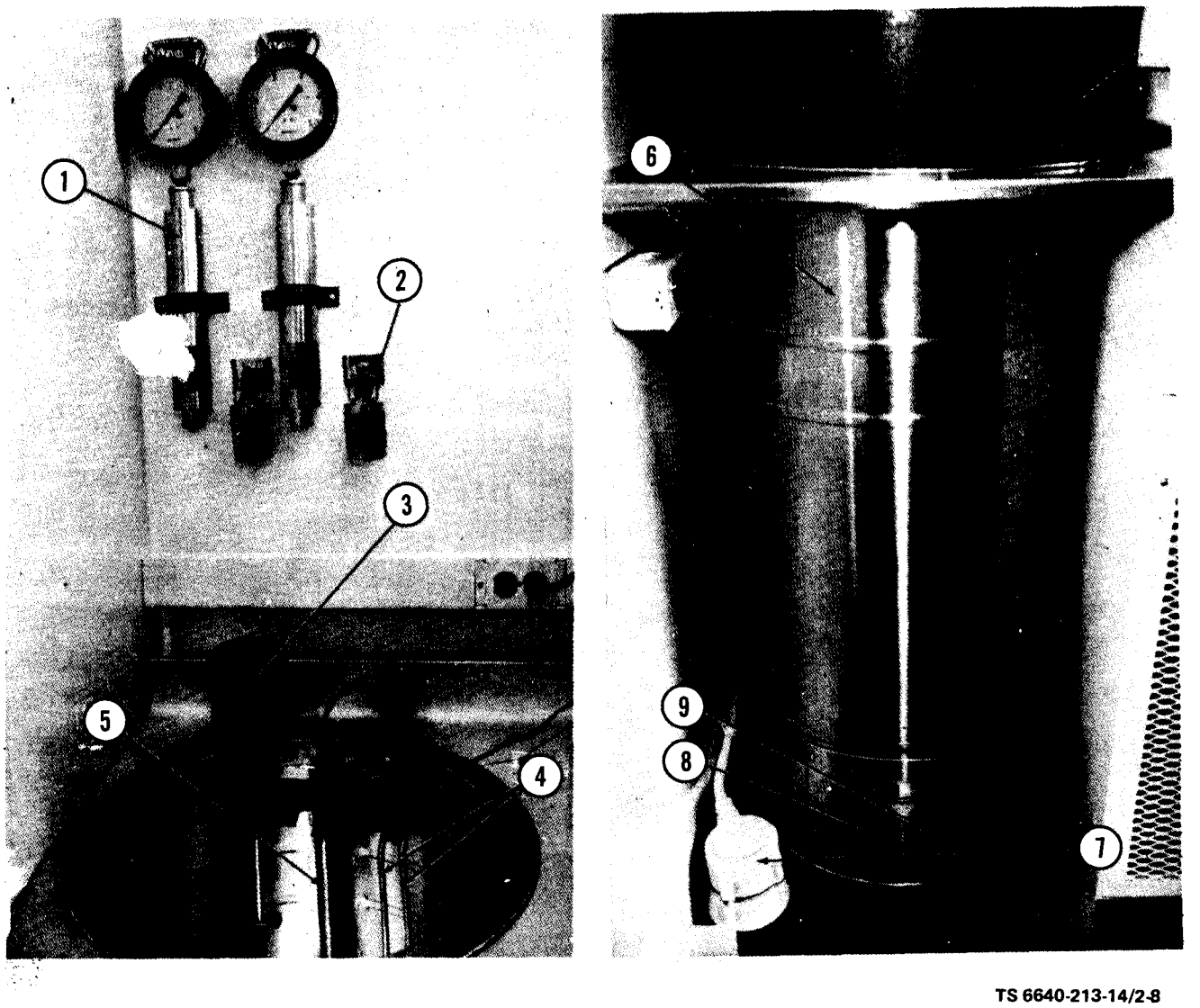
K (grams) = (1.61 m) - pl/pg + pl/pp

Herein:

m	=	reading of the balance in g,
P1	=	the density of the air in g/ml
Pg	=	the density of the switching weights in g/ml,
Pp	=	the density of the weighing material in g/ml

(3) Reid Vapor Pressure Apparatus.

(a) Description. The Reid vapor pressure (RVP) apparatus (fig. 2-8), designed and constructed to comply with ASTM test for RVP of petroleum (D-323), is mounted in the far right-hand corner of the laboratory within the laboratory table. The apparatus includes a stainless-steel, constant-temperature bath that is flush mounted in the tabletop. Over the bath are mounted a l/3-horsepower motor, a thermometer, a 500-watt “low lag” immersion heater controlled by a microset thermoregulator, and brackets for suspending the bombs. A standpipe stoppered drain is threaded into the bottom of the bath. The line switch, pilot light and electronic relay are mounted on a bar under the tank section of the bath assembly. The thermoregulator is adjustable. The maximum current carrying capacity is 15 milliamperes (ma).



1. Reid vapor pressure bomb and gage
2. Sample chamber
3. Stirrer motor
4. Heating element
5. Overflow outlet
6. Reid vapor pressure bath
7. Gas alarm detector unit
8. Control light
9. Bath switch

Figure 2-8. Reid Vapor Pressure Apparatus

(b) Operating Instructions.

CAUTION

Never turn on the switch unless the bath is filled with water, the heaters will burn out if they are not immersed.

1. Fill the bath and check and calibrate the thermoregulator in accordance with before-service maintenance in Chapter 3. Assure that the line cord is connected to the proper outlet. Turn on the line switch to energize the heater and stirrer-motor circuit.

2. Watch the pilot light, which indicates when heater is on. The light stays lit until the bath reaches 100 degrees F (37.9 degrees C). The thermo-regulator then controls the heater, as necessary, to maintain bath temperature at 98 degrees F to 102 degrees F (36.7 degrees C to 39 degrees C).

3. Proceed with test in accordance with ASTM D-323 .

(4) Manometer.

(a) Description.

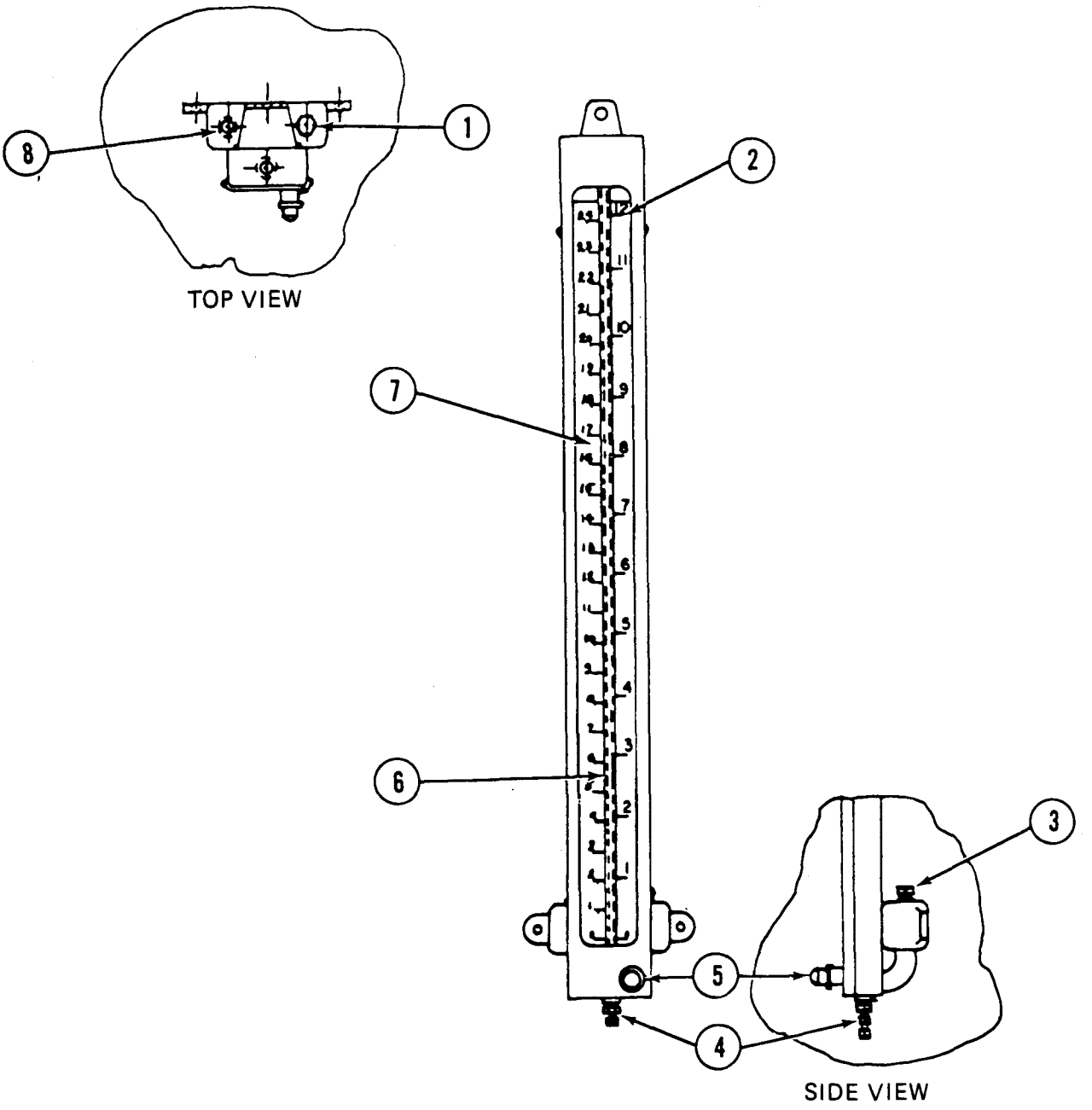
1. The manometer (fig. 2-9) is mounted on the left-hand wall in the corner to the right of the sink. The manometer is the primary basic standard of pressure measurement. It is used in the laboratory to calibrate the Reid vapor pressure gages.

2. The manometer consists of a glass column support within a frame and connected at the bottom by a U-shaped tube to the manometer fluid reservoir. It has a duplex-type scale calibrated in inches and tenths on the left side of the tube and in pounds and tenths, using mercury, on the right side. It is also equipped with a high-pressure connection, low-pressure connection, fill plug, drain plug, vent plug and a zero-scale adjustment knob.

(b) Operating Instructions

1. To measure pressure higher than atmospheric, connect line to the high-pressure connection on the fluid reservoir.

2. To measure vacuum, connect line to the low-pressure connection at top of indicating column.



1. Low pressure connection
2. Pounds and tenths scale
3. Fill plug
4. Drain plug
5. Zero adjustment
6. Glass tube
7. Inches and tenths scale
8. High-pressure connection

Figure 2-9. Manometer.

3. To measure a differential pressure, connect the line with higher pressure to the high-pressure connection, and the line with lower pressure to low-pressure connection.

4. To fill the mercury reservoir proceed as follows:

WARNING

If a mercury spill occurs, do not vacuum or sweep the area. This will disperse mercury throughout the laboratory. Spills may be cleaned up by using a glass tube of about 6 cm diameter drawn out to an opening of about 1 mm and connected by rubber tubing to a filter flask connected with a vacuum pump or aspirator, the flask acting as a trap. Control of mercury vapor should not be attempted with Flowers of Sulfur as this is not effective. Spills must be reported to the Environmental Science Officer providing services to the unit.

(a) Remove the fill plug on the well.

(b) Yent the instrument on the low pressure side, and assure zero adjustment at midscale.

(c) Using a glass funnel, slowly pour the mercury in the well until the indicating level is at approximately the zero graduation on the scale.

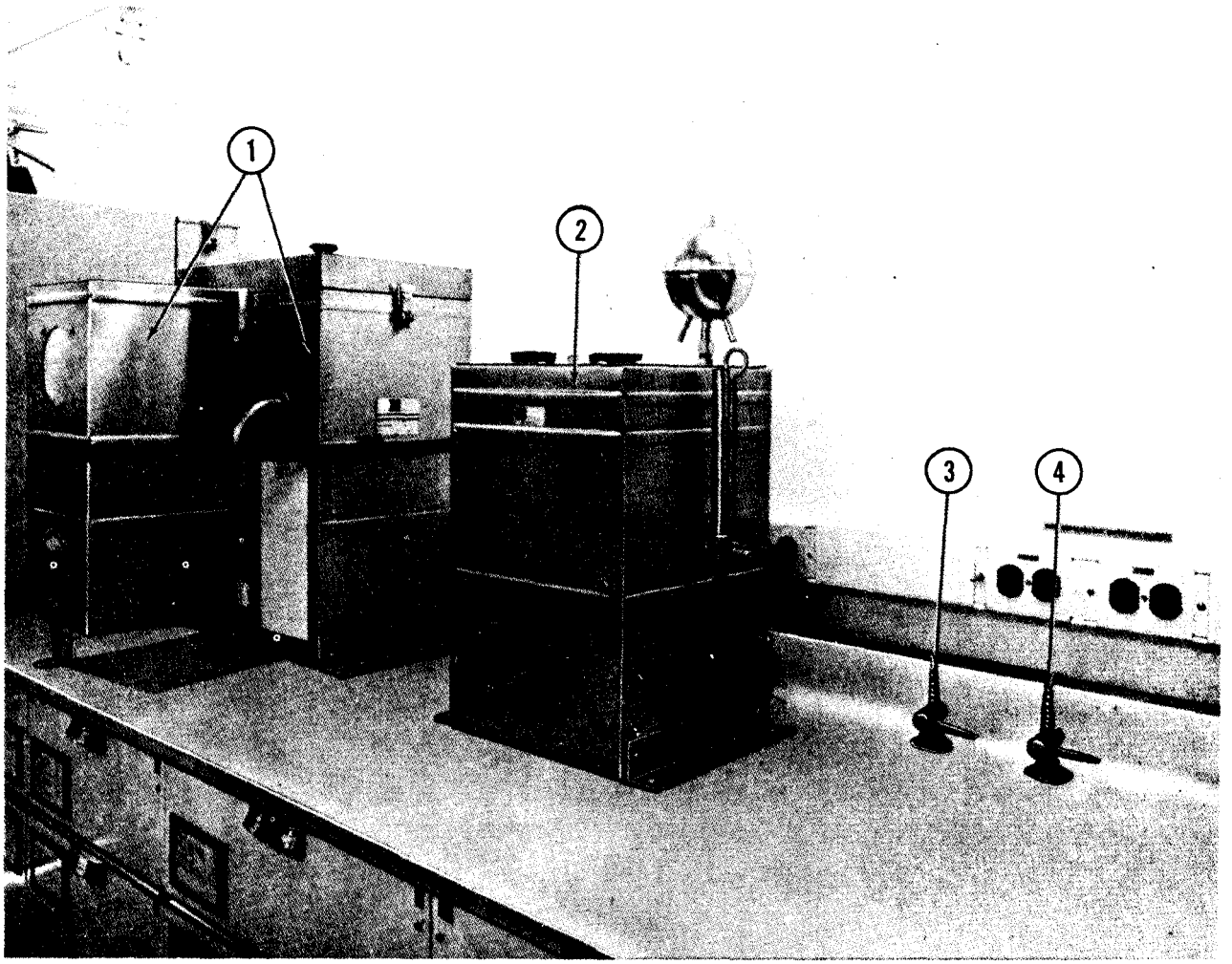
(d) Replace the plug tightly.

(e) Adjust the scale for the correct zero position in relation to the mercury meniscus.

5. To obtain consistent reading results, always observe the mercury meniscus in the smae way; read the meniscus at eye level.

(5) Distillation Test Apparatus.

(a) Description. The petroleum distillation test apparatus (fig. 2-10) is designed to provide for the test requirements of ASTM D-86. The unit consists of a shield assembly and a condenser assembly. The shield and condenser exteriors are constructed of stainless steel. The condenser interior is constructed of copper, insulated with a l-inch (25.4 mm) thickness of fiberglass. The ice-refrigerated condenser is equipped with a drain and overflow outlet and a distilled-fuel outlet. The shield encloses a 750-watt heater with autotransformer, two porcelain refractory blocks, observation window, and elevating device to allow proper alignment of the distillation flask to the condenser tube, a temperature control assembly, and an ON-OFF toggle switch. A wooden block is provided for support of the cooling jar and graduate.



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1. Distillation unit
2. Corrosion bath
3. Air pressure stopcock
4. Vacuum pressure valve

Figure 2-10. Distillation Test Apparatus and Copper Strip Corrosion Apparatus.

(b) Operating Instructions.

1. Push toggle switch to the ON position.

2. Turn the temperature-control knob clockwise to increase temperature; counterclockwise, to decrease temperature.

3. To operate the elevating control, turn the elevating control knob clockwise to raise the platform; counterclockwise, to lower the platform. Total platform vertical adjustment is three-fourths of an inch.

4. Consult ASTM D-86 petroleum testing references for detailed description of test procedure.

(6) Microporous Filtering Disk Holder.

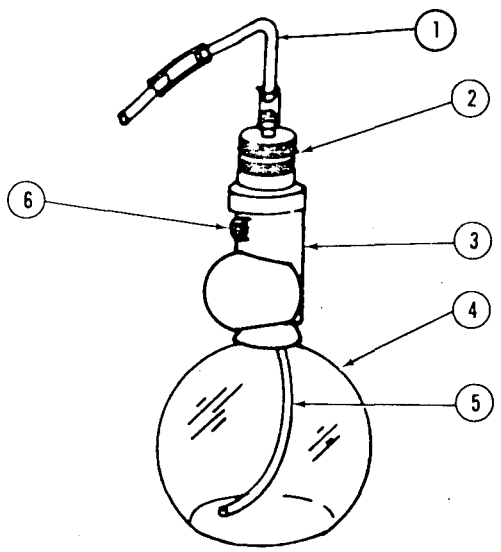
(a) Description. Pyrex filter holders are used in the laboratory to collect particulate material from liquids in accordance with ASTM D-2276. One gallon (3.785 liters) of liquid is filtered using the holder, a laboratory vacuum and a side-arm flask. The sample volume actually used must be reported.

(b) Operating Instructions. Complete instructions for preparation of the test and control membrane filters and field monitors are described in ASTM D-2276.

(7) Solvent Filtering Dispenser.

(a) Description.

1. The solvent filtering dispenser (fig. 2-11) cleans small volumes by millipore filtration at the point of use, which eliminates the need for precleaning and the possibility of contaminating clean liquids. The dispenser is a combination of a millipore filter holder and a Guth wash bottle. Hand pressure forces solvents through the millipore filter as they are needed. The dispenser consists of a pyrex l-liter flask with a neoprene bulb and stopper, a stainless steel filter holder and support screens with teflon gaskets and teflon tubing.



TS 6640-213-14/2-11

1. Delivery tube
2. Filter holder
3. Bulb
4. Flask
5. Uptake tube
6. Pressure release

Figure 2-11. Solvent Filtering Dispenser.

2. Dispenser Data.

(a) Filter area - Approximately 3.9 square centimeters (sq cm).

(b) Filter size - 25 millimeters (mm) diameter, type RA. (When used for ASTM test D-2276, 0.45 micro membrane filters are to be used).

(c) Pressure - Hand pressure only.

(d) Dimensions - 5 1/4 inches in diameter x 12 1/2 inches high (13.3 cm diameter x 31.8 cm high)

(b) Operating Instructions.

1. To dispense the fluid, place the index finger over the pressure hole on the front of the bulb and pump the unit by hand until fluid flows from the delivery tube. Once the bottle is pressurized, flow will continue until the pressure hole is uncovered.

2. To correct an air lock, loosen the filter holder cover one turn, while maintaining pressure in the bottle. When solvent begins to leak around the threads, retighten the cover.

(8) Water Detector Kit, Automotive/Aviation Fuel (AQUA-GLO Series II).

(a) Description. The portable, self-contained water detector kit (NSN 6640-00-244-9478) is used to detect the presence of undissolved water in automotive and aviaition fuel in accordance with ASTM method D-3240. It is battery powered and detects the presence of water within 1.5 parts per million (ppm). The fluorescence of a sample-soaked pad is automatically compared by a double photoelectric cell circuit with a permanent fluorescing standard. An ultraviolet light source is adjusted until a responding microammeter reads zero, which means that the sample and standart pads are glowing with equal intensity. The ultraviolet light source level crosses a scale and produces the test result readings.

(b) Operating Instructions.

1. Flushing the detector pad holder.

(a) Connect the detector pad holder assembly to the quick-disconnect coupler at the test point.

(b) Flush at least 1 gallon (3.785 liters) of sample through the assembly. Open and close the valve several times while flushing is taking place.

(c) Close the toggle valve and remove the entire assembly by disconnecting it at the quick-disconnect coupler.

2. Exposing the sample pad.

(a) Open the detector pad holder and remove a 25-mm detector pad from its sealed envelope with tweezers.

(b) Press the pad into the recess of the outlet half of the sample holder housing with yellow side exposed.

(c) Reassemble the detector pad holder by screwing both halves together firmly by hand.

(d) Reconnect the assembly at the quick-disconnect coupler. Open the toggle valve and allow 500 ml of test fluid to. pass through the detector pad.

NOTE

A 500 ml test is necessary for accurate results in the range of 1 to 10 ppm of water. A 100 ml test is suitable for determination of water content up to 13 to 60 ppm.

(e) Close the toggle valve and remove the entire assembly by actuating the quick-disconnect coupler.

3. Reading test results.

CAUTION

A pad must never be dried in air because it will pick up moisture from the air. A desiccator must be used if the pads are to be dried. Fuel damp means; a detector pad that has been pressed between paper towels as described in (b) below.

(a) Open the detector pad holder and remove the detector pad with tweezers. The point of the tweezers can be inserted under the pad through the notch in the rim of the recess.

(b) Press the detector pad between dry paper towels to remove excess fluid. Press firmly (about 5 lb) three or four times with heel of the hand, moving the pad with tweezers to a dry spot each time.

(c) Place the fuel-damp test pad under the flap on the bottom of the unit with the yellow side facing inward.

(d) Mount the meter assembly on the side of the unit-by sliding it into the tracks provided. Turn on the Aqua-Glo lamp by following the directions on the battery cover.

NOTE

Never leave the light on except while a reading is being taken; the battery will provide only 1 hour of light, and it takes 14 to 16 hours to recharge it.

(e) Adjust the lever on the back of the unit until the meter reads zero when the switch button on the meter is depressed.

4. Interpreting test results. The scale reads in parts per million where the lever crosses it if the test sample is 500 ml. The scale multiplying factor is 5 if a 100-ml test sample is used. The scale is calibrated for a fuel-damp test pad. Divide the scale reading by 1.2 if the test pad is read when it is not fuel damp, and if the water content is in the range of 1 to 8 ppm. A factor of 1.3 should be used if the water content is more than 8 ppm when the pad is dry.

5. Storing exposed pads. Exposed pads can be stored for long periods if kept in desiccant-dried containers. They change appreciably in open containers or envelopes.

NOTE

The vast majority of readings that are taken on aviation fuels do not indicate the presence of any free water. If the technician wishes to reassure himself that the detector pad is effective and the instrument is functioning, he can moisten his finger, touch it to the pad and view the pad in the-instrument.

6. Scale conversion chart. The water detector unit can be used to take undissolved or "free" water content readings regardless of the quality of fuel that has passed through the detector pad. Figure 2-12 gives the conversion from scale readings to water content for different sample volumes from 100 to 500 ml. The figure can be used to obtain scale multiplying factors for any sample volume, even if that volume is not an exact 100 ml increment. The unit can also be used to read water content when detector pads are of a different size than the ones that are supplied with the unit. The standard detector pad is 25 mm in diameter, but other pads are made that have a diameter of 37 and 47 mm. Be sure to use only 25 mm pads.

CAUTION

The Aqua-Glo calibration may not be accurate if additives are present. For example, certain additives used in heating oils will prevent water that is not dissolved in the fuel from reacting with the sodium fluorescein.

(a) Condition: 25 mm test pads.

(b) Example: A scale reading of 6 is recorded on a fuel damp, 25 mm test pad. The sample volume was 100 ml. Read up from the scale reading of 6 to 100 ml curve. Then read on the left-hand scale 30 ppm water content. Refer to TM 5-6630-216-12 for complete instructions covering the Water Detector Kit, Automotive Aviation Fuel.

(9) Pensky-Martens Flashpoint Tester.

(a) Description. The Pensky-Martens flashpoint tester is designed and manufactured in accordance with ASTM D-93. The apparatus consists of an electric heater with a three-heater switch, controlling rheostat, pilot lamp, stirrer and motor, a closed flash-cup mounted in an air bath, shutter, test flame burner, pilot burner and thermometers.

(b) Operating Instructions. Complete instructions for operating the Pensky-Martens flashpoint tester are described in ASTM D-93. No other special instructions are required.

(10) Copper Strip Corrosion Apparatus.

(a) Description. The copper strip corrsion apparatus (fig. 2-8) is designed to meet the requirements of ASTM D-130. The apparatus consists of a constant temperature bath having a temperature range from room-temperature to 109.4 degrees C to 110.6 degrees C), openings for four test bombs, four rubber stoppers, a thermometer well, copper Soxhlet condenser, thermostat and drain plug. It is also provided with two test bombs and an ASTM 12F thermometer having a range of minus 5 degrees F to plus 215 degrees F (-20.6 degrees C to 101.7 degrees C). The overall dimensions of the apparatus is 7-inches wide by 12-1/2 inches deep by 24 inches high (17.8 cm x 31.75 cm x 62.4 cm) and requires a minimum of 750 watts.

(b) Operating Instructions.

1. Fill the bath with water through the bomb hole.

2. Connect the power cord and turn the line switch to ON to heat the constant temperature bath to operating temperature.

3. Adjust the bath to the desired temperature by turning the graduated dial on the thermostat.

4. When the bath has reached the desired temperature, remove the rubber stoppers, insert the bombs through the openings into the rack provided and replace the rubber stoppers.

5. Connect a cooling waterline to one of the small tubes on the condenser and connect a drain line to the other. This will condense the steam coming from the bath and return the condensate to the bath. If the water supply is insufficient to operate the condenser, vent the steam directly into the atmosphere.

(11) Fuel Systems Icing Inhibitor Test Equipment. If the laboratory facility is required to determine fuel systems icing inhibitor (FSII) in hydrocarbon fuels, the apparatus, reagents and materials indicated in methods FTSM 5327.3 and FTSM 5340 should be procured as applicable. Enough glassware whould be procured to permit six tests to be performed simultaneously. If a sample of the

FSII actually used to inhibit the fuel tested is not available to determine the F factor, the following formula should be used to determine FSII results:

%FSII = 0.1614 (2.000 - VTNT)

where:

VT = milliliters of sodium thiosulfate solution, and

and

NT = normality of sodium thiosulfate solution.

(12) Utility Oven.

(a) Description. The utility oven (24, fig. 1-4) is permanently mounted on the countertop. It produces heat ranging from ambient to 200 degrees C (392 degrees F) and is used for baking, drying, conditioning and preheating. The cabinet-type, gravity-convection oven is equipped with dual hydraulic (safety) thermostats, two latticed metal shelves, hinged door with safeyty latch, adjustable ventilator, pilot lamp, ON-OFF toggle switch and a mercury-in-glass thermometer ranging from 0 degrees C to 200 degrees C (32 degrees F to 392 degrees F).

(b) Operating Instructions. Operate the utility oven as follows:

1. Insert the thermometer through the top of the shutter cap. Lower the thermometer bulb into the heating chamber as required, depending on type of thermometer used, to ensure a correct temperature reading. When possible, use only one shelf and leave ample space between objects for proper air circulation and maximum heat transfer. Never place materials on the oven floor or below the lowest shelf position. Shelves should not be overloaded, and should never be loaded from wall to wall.

NOTE

The exhaust vent shutter cap must be open during all operations.

2. Turn the line switch to ON. Reference points on the temperature control knob do not correspond with actual temperature settings. Temperature readings must be taken from the thermometer. To raise the temperature, turn the temperature-control knob clockwise until the pilot lamp indicates that heaters are on. Turn the knob counterclockwise to lower the tempterature. It may be necessary to back off slightly to take up lost motion in the thermostat mechanism, when turning temperature-control knob.

3. When the oven has reached the desired temperature, turn the temperature-control knob counterclockwise until the heat shuts off, as indicated when the pilot lamp goes out. Before making a final temperature adjustment, allow about 1 hour for oven heat to stabilize. If the oven has not reached the desired temperature after 1 hour, turn the temperature-control knob to raise or lower the temperature as required until desired temperature is attained.

NOTE

When the temperature moves from a high setting to a lower one, the safety pilot light may glow faintly until the new lower temperature is stabilized.

(13) Ice Maker.

(a) Description. The tank-type ice maker (21, fig. 1-3 and 1, fig. 1-6) has been designed to provide a continuous and automatic supply of ice cubes needed to cool the distillation bath. The ice maker is a simple, compressor-type freezer operating on 115-volt, 60 Hz power. It has a tank-type reservoir for a water source. The tank must be filled manually. The capacity of the ice maker is 19 pounds per 24 hours.

(b) Operating Instructions. Fill the water tank manually and turn on the line switch. Operate as a normal freezer unit and observe the following instructions:

1. Do not cut off air circulation from the front grill.

2. Make sure that the unit is operated in a level position.

3. Ruffle the ice or remove a few cubes each day.

4. Defrost the ice maker periodically.

5. When defrosting or stopping operating for a period of time, prop the door open 2 inches.

6. Do not use any electrical heating devices to defrost.

(14) Water Demineralize Unit.

(a) Description. The water demineralize unit (27 and 28, fig. 1-3) is wall mounted on the left-hand side above the sink. It consists of two water demineralizer cartridge brackets (3, fig. 2-13).

The cartridge color coded red contains mixed resin bed used to remove inorganic from water. The cartridge color coded balck contains a resin bed used to remove organics from water.

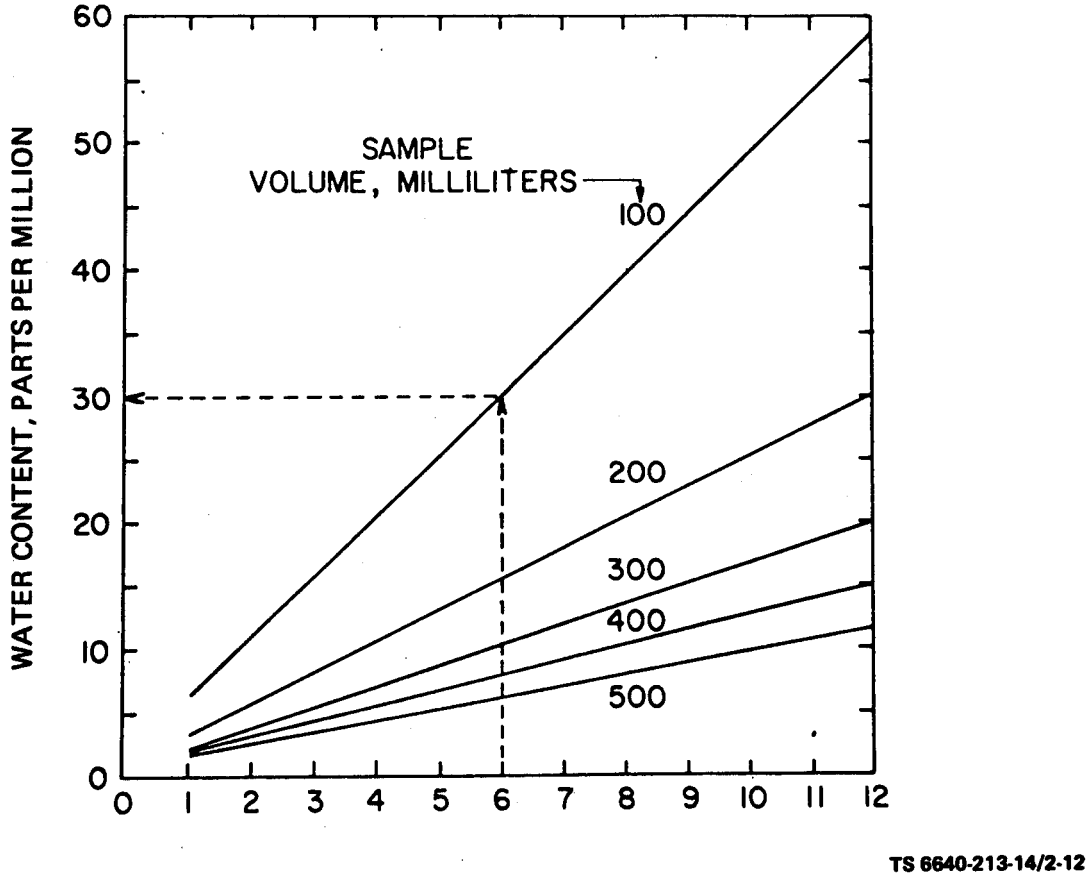
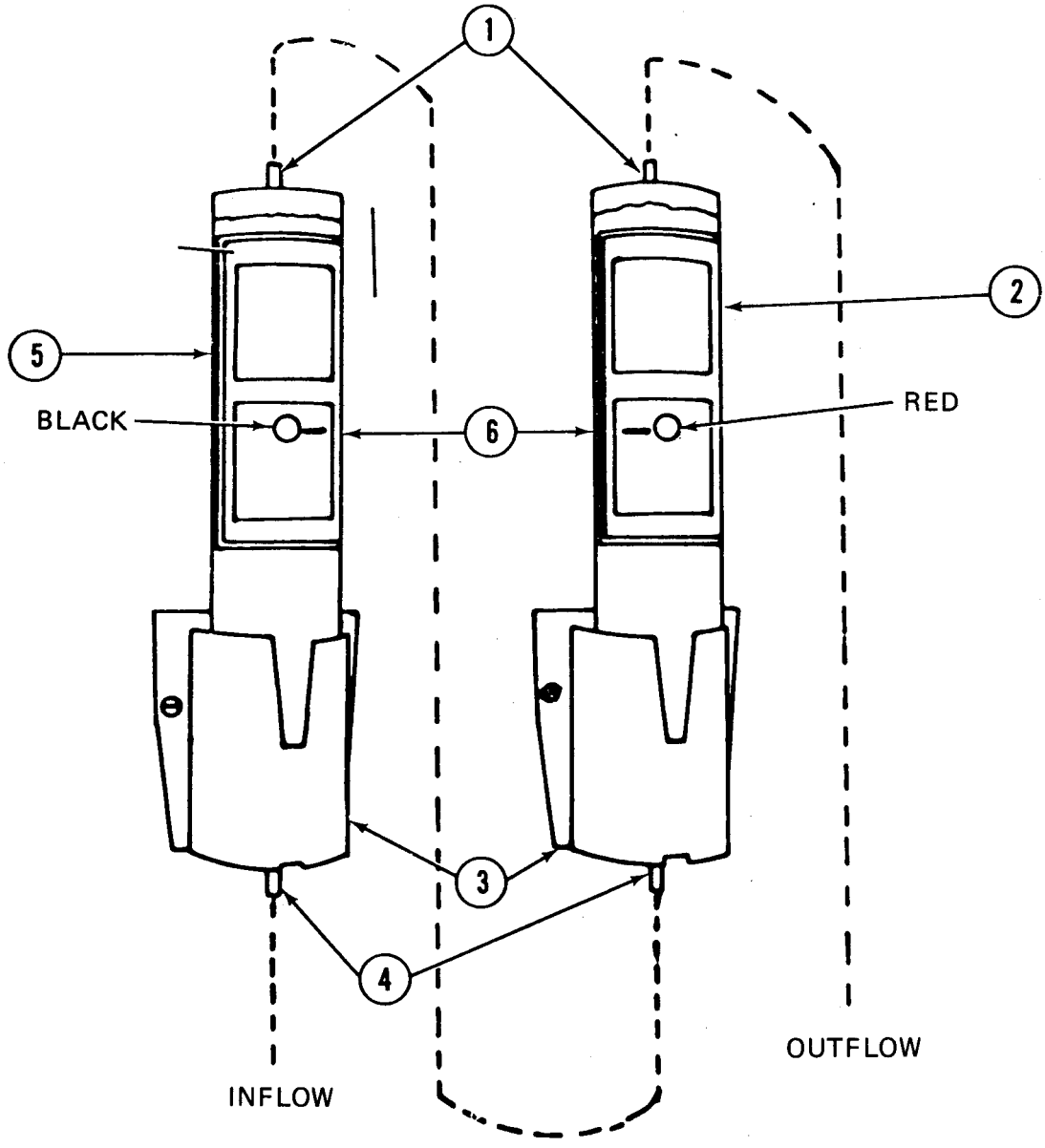


Figure 2-12. Detector Scale Conversion Chart - Free Water Content For Selected Sample Volumes.



1. Outlet ports
2. Mixed resin cartridge
3. Bracket, demineralizer
4. Inlet ports
5. Organic removal cartridge
6. Color code dots

Figure 2-13. Water Demineralizer Unit

CAUTION

Do not shut off or restrict the flow of the outlet tubing.

(b) Operating Instructions. Operate as follows:

1. Using 3/8-in. plastic or rubber tubing, connect the inlet hose nipple, at the bottom of the organic removal cartridge to the water supply. Connect the outlet hose nipple at the top of mixed resin cartridge to a suitable water container.

2. The basic limiting factor on flow rate is pressure (25 psig (1.76 kg/sq cm) design). The normal optimum flow rate is 10 gph. The direction of flow of the water through the cartridge must be from the bottom upward.

3. Water or other solutions purified by ion exchange resins are not necessarily free from odor, color or taste, which may make them unsuitable for some purposes. In some instances color, taste, or odor may be introduced to the finished product by trace quantities of either free amines or low molecular weight polymers which are present in the fresh, untreated resin. Generally, the amine odor will lessen or disappear after passage of a few gallons of water through the cartridge.

(15) Aneroid Barometer.

(a) Description.

1. The wall-mounted aneroid barometer (29, fig. 1-3) has a scale calibration of 26 to 31 inches (660 to 787 cm) hg and a pressure graduation of 0.10 inch (0.023 cm) of hg. It is 5 inches (12.7 cm) in diameter and has an overall depth of 2.5 inches (6.35 cm).

2. The basic unit used in the barometer is a round, thin metal box fitted inside a clamp in the form of a C. The clamp is called a C-spring. The metal box, or bellows, it sealed after practically all of the air has been removed. At this point the bellows would collapse due to the air pressure pushing against it from the outside. The C-spring keeps the bellows from collapsing since it holds the sides of the metal box apart and in balance. Changes in air pressure disturb this point of balance in respect to the atmosphere, and each slight movement is transmitted to the barometer pointer which is positioned over a dial graduated in 1/10 inches (0.254 cm) of mercury.

(b) Principle of Operation. Figures on the dial, 26 through 31, represent inches of mercury, the standard means of expressing atmospheric pressure. Read the indicating hand, the one cloest to the dial; it-responds readily to any change in atmospheric pressure. Use the set hand to note any change in pressure. Position the set hand directly over the indicating hand. A few hours after se'tting, not any change in pressure. Position the set hand directly over the indicating hand. A rise in pressure is indicated by movement of the indicating hand to the right. A fall in pressure is indicated by movement of the indicating hand to the left.

(16) Desiccating Cabinet.

(a) Description. The desiccating cabinet (27, fig. 1-4) is constructed of stainless steel with glass side panels. A molded rubber door gasket provides an airtight fit. A set of two shelf runners are provided to hold a shelf or a tray. The 8 by 9 5/8 inch (20.32 by 22.86 cm by 1.59 cm) tray is constructed of stainless steel, and the asbestos shelf has twelve 7/8 inch (2.22 cm) holes. A manual relief valve is located in the upper right-hand corner.

(b) Operating Instructions.

1. To close the door, it may be necessary to force the door tightly against the jamb before turning handle. Be sure that the square rods enter the top-and bottom keepers before tightening the locks.

NOTE

Do not turn the handle move than necessary to seal the door. Balance of movement should be reserved for future adjustment.

2. Before opening the door, normalize the pressure in the cabinet by opening the manual relief valve.

3. Place a thermometer in the cabinet with heated samples and note the temperature rise. Do not open the door until the temperature returns to ambient.

g. Safety.

(1) Safety Features.

(a) Air-Purging System. A 10 minute time-delay relay is provided in the electrical system. This prevents the supply of power to all electrical circuits except the exhaust fan for 10 minutes after the unit is connected to the external power source. Therefore, a 10 minute air-purge, which removes any accumulation of explosive or toxic fumes, must take place before any operations can be started.

(b) Automatic Gas Alarm. A combustible-gas-mixture alarm system for the detection of an accumulation of combustible gas is also provided in the laboratory. When a dangerous accumulation of

combustible gases is detected by the system, it automatically starts the exhaust fan of the air purging system, rings a warning buzzer, and turns on a red warning light.

(2) General Safety. Laboratory personnel and personnel who handle petroleum products in the field are exposed to the same hazards. In addition, laboratory personnel are exposed to chemicals. Also, if an accident occurs, they are exposed to the effects of vacuum and pressures in close quarters. Efficient laboratory operations must include all safety considerations. Operating procedures should be prepared for each laboratory so that emergencies may be dealt with when they occur.

CAUTION

Consult authority in charge of the laboratory when in doubt concerning any laboratory procedure operation.

Do not attempt to perform more than one test at a time, unless each test can be given the proper attention needed to complete it efficiently and safely. Give complete attention to tests in progress. Request assistance from another technician or notify the supervisor if it becomes necessary to leave the laboratory for even a brief period of time.

Do not attempt short cuts or improvisations, because laboratory procedures have been divised with a view to quality, efficiency and safety. Discuss any change to procedures with the supervisor.

Do not engage in any form of horseplay in the laboratory, because it diverts attention from testing or other operations in progress, and contributes to existing hazards.

Never taste a laboratory chemical. Never smell a chemical except when necessary, and then only by wafting a small amount of vapor with the hand toward the nose.

Systematically check the laboratory and its equipment at the end of each day to be sure than no hazardous situation can develop while the laboratory is unoccupied.

Bond and ground the laboratory to minimize potential differences between the objects and the ground.

(3) Fire Prevention. Fire prevention includes good housekeeping to eleminate combustible materials, proper handling of supplies and samples to control formation of flammable vapors or fumes, and proper regard for sources of igniton.

WARNING

Do not smoke in laboratory, confine smoking to permitted areas, and police those areas daily.

Keep gas jets closed when not in use. Check burners and connecting tubing frequently to be sure that they are not faulty. Replace defective tubing when it is discovered.

Never leave an open flame or electric heater unattended while in use. Make sure there is no open flame or heating element in use in the area when voltatile liquids are poured.

Discard organic products in authorized containers, never in sinks or drain systems.

Keep flammable products or other liquids away from sources of heat such as engine exhausts, open flames, and direct sunlight, and keep them away from circuit breakers, electrical switches and motors.

Never discard hot liquids in drains. Set them aside to cool in covered containers before discarding them.

Make sure that chemicals that are unsafe in close proximity are stored in separate areas.

Clean up immediately the areas of spills involving flammable or hazardous vapors or fumes.

When heating fluids which may superheat, use glass beads or fragments to prevent boiling over or spattering.

When diluting acids, pour acid into the water. Avoid pouring water into acid because this could cause spattering.

Make sure that equipment is fixed firmly in position before starting a heating operation.

Keep heat and open flames away from gas cylinders. Never drop a gas cylinder to the floor or ground.

Check electrical wiring and equipment for defective or loose connections or frayed insulations frequently. Check line load on circuits to prevent overloading individual circuits.

Report any deficiency immediately.

Maintain proper ventilation of the laboratory and storerooms to prevent accumulation of flammable vapors. Make sure that protective clothing is used at all times.

(4) Extinguishing Fires. A detailed discussion of petroleum fires and procedure for extinguishing fires is contained in FM 10-69. Any class of fire can start in a petroleum laboratory where personnel are not familiar with fire prevention. Two persons should always be in the laboratory in case of fire or injury to one of the people. The first thing to do in case of a fire involving flammable products is to notify the fire department. Laboratory personnel should then do what can be done safely with portable fire extinguishers until proper fire-fighting apparatus arrives. General rules for the use of fire extinguishers are as follows:

(a) Follow the manufacturer's operating instruction.

(b) Become familiar with the types of fire extinguishers in the laboratory and the class of fire they are intended for.

(c) Inspect all extinguishers monthly or more often, depending upon local fire regulations.

(d) Have pressure-type extinguishers tested hydrostatically every 5 years.

(e) Make frequent inspections to assure that all extinguishers are in their designated places and are readily accessible, that they have not been damaged or tampered with, that seals are intact, and that nozzles are not clogged.

(f) Assure that extinguishers are charged immediately after use.

(5) Handling Hazardous Materials.

(a) Acids.

WARNING

Sulfuric acid should not be stored with organic compounds. It is a strong oxidant and could cause fire if breakage occurred.

Use pyrex or equivalent glass container when diluting acids.

The heat generated when making acid solutions may break ordinary glassware. Pour the acid into the water. Never use cracked or broken glassware for any purpose.

Always wear goggles when preparing acid solutions or when handling solutions.

If acids come in contact with the skin or eyes, rinse immediately with large amounts of water, for at least 15 minutes, and seek medical attention particularly for acid splashes involving the eyes.

Under no circumstance should any base solution be applied to the area where the acid contacted.

(b) Hydrogen Peroxide.

WARNING

Handle 30 percent or stronger solutions of hydrogen peroxide cautiously to prevent contaminating the skin. Wash contaminated area thoroughly with water. Do not use an acid to dilute or neutralize a base on the skin. Use only large amounts of fresh water.

(c) Mercury.

WARNING

Never handle mercury with the bare hands, and never heat it in an open container. If mercury spill occurs, do not vacuum or sweep the area. This will disperse mercury throughout the laboratory. Spills may be cleaned up using a glass tube of about 6 cm diameter drawn out to an opening of about 1 mm and connected by rubber tubing to a filter flask connected with a vacuum pump or aspirator, the flask acting as a trap. Control of mercury vapor should not be attempted with Flowers of Sulphur as this is not effective. Spills must be reported to the Environmental Science Officer providing services to the unit.

(d) Chemical Containers.

1. Frequently check all chemical containers having vent caps and make sure they are operable.

2. Keep containers of volatile liquids as cool as possible. Remove caps or stoppers occasionally for venting, and take care to gradually release any ‘pressure that may have developed.

3. Store heavy or bulky containers of chemicals on the floor or as near the floor as possible.

4. Make sure that all containers are properly labeled. Never fill a container with material other than that indicated on the label.

5. Keep bottles of acid or alkalis on low shelves

(e) Bases.

WARNING

Use a pyrex or equivalent container when diluting bases, the heat generated when making base solutions may break ordinary glassware. Pour the base into the water. Never use cracked or broken glassware for any purpose. Always wear goggles when preparing and handling base solutions. If bases come in contact with the skin or eyes, rinse immediately with large amounts of water for at least 15 minutes and seek medical attention particular for base splashes involving the eyes. Under no circumstances should any acid solution be applied to the area where the base contacted.

(f) Caps (or Stoppers).

WARNING

Hold the cap in the hand when pouring a sample from a container; never place it on a bench or worktable where it could become contaminated. Be sure to return the cap to the contaner from which it was removed. Hold the cap of a reagent bottle between the fingers of the pouring hand when pouring from the bottle; never lay it on a surface that might be touched by personnel or their clothing.

Keep acid and caustic bottles tightly stoppered. Flush and dry the outside of the bottles before returning them to the reagent shelf. Wipe up any spills.

(g) Excess Chemicals or Reagents.

WARNING

Never return excess chemicals, reagents, or samples to the original container. Similarly, do not place spatulas or other objects in reagent containers for any reason.

(h) Gas Cylinders.

WARNING

Handle gas cylinders under high pressure cautiously; do not drop them on the ground or floor. Store gas cylinders away from sources of heat. Support or check gas cylinders to keep them from falling or rolling. Assure that protective caps are kept in place when cylinders are not in use. Never use grease or oil !on gas cylinder valves or on pressure regulators. Gas cylinders must be chained to prevent them from falling.

(i) Equipment Under Pressure of Vacuum.

CAUTION

Do not exceed the pressure or temperature designated as the safe upper limits for equipment used in a test or other operation. Periodically check all metal, rubber, or plastic tubing used in operations involving pressure or vacuum to be sure that the tubing has not become faulty. Replace defective tubing.

Release pressure cautiously when venting vessels under pressure.

WARNING

Wear goggles when opening air valves.

Make sure that proper shielding is provided when using vacuum apparatus made of glass.

(6) Handling and Using Equipment.

(a) Glassware.

1. Keep glassware used in testing clean. Wash the apparatus with solvent, soapy water, cleaning solution if necessary, tap water and distilled water, and then allow to drain dry. Rinse with acetone to fasten drying.

2. Make sure that the stopcock of glassware prepared for storage is free of grease. Store Teflon stopcocks, or their equivalent, loosely in the barrel and also keep free of grease. Glass. stopcocks and stoppers should be wrapped with a strip of paper prior to inserting into the barrel to prevent the surfaces from fusing together.

(b) Crucibles. Mark crucibles permanently with ink manufactured for this prupose. India ink or pencil markings cannot be used because they cannot withstand the high temperature that crucibles may be exposed to.

(c) Pipets. Prior to use, inspect pipets for damage to the tip. Use a suction bulb, not the mount, to draw the solution into the pipet. Remove the bulb and blot the tip with filter paper, and let the meniscus drop until it coincides with the etched reference line. Allow the solution to drain into an appropriate container.

(e) Centrifuge Tubes. Always balance opposing centrifuge tubes by weight. Do not open the centrifuge enclosure while it is in operation.

(f) Separator Funnels. Hold the separator funnel with one hand, securing the stopper firmly in place. Use the other hand to operate the stopcock. When the stopper is opened for venting, the outlet should be directed away from the operator for safety. Remove the stopper for rapid drainage.

(g) Corks. Bore corks on a soft wood surface after softening the cork with a roller. When inserting glass tubing or thermometers into a cork, cover the glass with a cloth or use a rubber guard and hold as near to, the cork as possible. Use stopcock grease or glycerine as a lubricant. Fire polish ends of glassware to avoid injury to personnel. Use corks in preference to rubber stoppers where heat or rubber solvents are involved, and use rubber stoppers where vacuum or pressure is involved.

(h) Thermometers. Thermometers may have bubbles or breaks in the column. To remove the separation or bubble, carefully heat the bulb so that the column of mercury slowly extends to the upper bulb of the thermometer, and then slowly cool the thermometer.

(i) Fume Hoods.

WARNING

Make sure that the laboratory is properly vented and that fume hoods are operating properly.

Use fume hoods when working with toxic vapors. Leave the area immediately if a material that gives off toxic vapors is spilled. Return to the area only after it has been ventilated, or is a self-contained breathing apparatus has been obtained.

(j) Ultraviolet Lamps. Shield ultraviolet lamps used in water detector kits so that operator's eyes are not directly exposed to the radiation. Ultraviolet radiation can cause permanent eye damage.

(7) Solvents and Solutions.

WARNING

Face shield, rubber gloves and rubber apron must be worn when preparing chromic acid solution.

(a) Prepare chromic acid cleaning solution by slowly adding 800 ml of concentrated sulfuric acid to 500 ml of a saturated solution of potassium dichromate and water. Prepare the solution in a sink, using a pyrex, or equivalent glassware container. Chromic acid is more effective as a cleaning agent when it is heated, but the solution should not be boiled. The solution is ineffective when it develops a greenish color and should be discarded.

WARNING

Handle the soluton with extreme care to avoid injury. A face shield and rubber gloves should be used.

(b) Store standard solutions so as to avoid atmospheric CO2 contamination.

WARNING

Never use high-temperature ovens to heat volatile fluids. An explosion may occur and injure personnel.

(c) Keep in mind the toxic and flammable properties of alcohols when preparing alcoholic solutions. Heat the solution using a hotplate, never an open flame, in a fume hood to increase the rate of solution. Always use pyrex, or equivalent glassware when preparing laboratory solutions. If a water-free solution is not necessary, dissolve the solute in a small quantity of distilled water before adding to the warm alcohol.

(d) Field conditions may require the substitution of solvents. In this case, the rule of "like dissolves like" should be followed. When in doubt as to the correct solvent to be substituted, consult the appropriate reference. For example, toluene could possibly be substituted for benzene in a solvent capacity, but n-hexane would not serve the purpose.

CHAPTER 3

OPERATOR/ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. OPERATOR AND ORGANIZATIONAL MAINTENANCE

3-1. GENERAL. Maintain the outside of the shelter in accordance with TM 11-5410-213-14P. Maintain the air conditioner/heater in accordance with TM 5-4120-274-15. Check the level indicators daily to maintain the shelter in proper position. Clean the stainless steel surface of drainboards, constant temperature baths, desiccating cabinet, and similar equipment by washing with a water-damp cloth and polishing with a dry cloth. Refer to table 3-1 for preventive maintenance checks and services.

3-2. ELECTRICAL SYSTEM. A troubleshooting chart for the electrical system is listed in table 3-2. Refer to figure 1-7 when necessary.

3-3. WATER SYSTEM.

a. Water Pump. The water pump needs no lubrication.

b. Water Tank. To clean the tank, remove the screws from the lid, remove the drain plug and allow the water remaining in the tank to drain into a suitable container. Wipe any dirt or silt from the tank with a clean cloth, and flush with clean water.

c. Before-Operation Service. Check piping for leaks or looseness. Make sure that the outlet valves are closed and that the tank contains sufficient water. Check the electrical connection to the pump motor.

d. During-Operation Service. Inspect the pump and motor assembly, being alert for unusual noises or smells that could indicate malfunction. Check the pump for leaks at the shaft. If the packing nut must be tightened, tighten it while the motor is operating and tighten it just enough to stop the leak; overtightening the nut could cause motor damage. Check the water piping for leaks and make sure that the faucet delivers full flow when open and does not leak when closed.

e. After-Operation Service. Refill the tank with potable water. Inspect motor, tank, pressure switch and piping for leaks. Make necessary repairs.

f. Troubleshooting. A troubleshooting chart for the water system is listed in table 3-3.

3-4. AIR SYSTEM.

a. General. Maintenance of the air system requires a periodic inspection of piping, fittings and components for leaks and looseness of component mounting. Make an inspection and make needed repairs prior to starting a test requiring this system.

Table 3-1. Preventive Maintenance Checks and Services (PMCS)

NOTE: Within designated interval, these checks are to be performed in the order listed.

B - Before
D - During
A - After
M - Monthly
M - Monthly
C - Combat Operability Check

Item No.	Interval B	D	A	W	M	C	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment is not Ready/Available
1	•						Vacuum Pump	Check if vacuum pump motor is lubricated and the vacuum pump is properly filled with oil.	
	•							Make certain all vacuum pump fittings are perfectly sealed.	
	•							Check the condition of drive belt, make sure belt is not too tight or too loose, check elt pulleys.	
	•							Check all connections for tightness.	
		•						Check oil level after pump as been running for at least 15 minutes. Oil level should e maintained between oil level marks when in peration.	
		•						Check for overheating.	
		•						Check for vacuum pipe connections and fittings for vacuum leaks.	
		•						Check vacuum pressure gage on control panel.	

Table 3-1. Preventive Maintenance Checks and Services (PMCS) - Continued

NOTE: Within designated interval, these checks are to be performed in the order listed.

B - Before
D - During
A - After
M - Monthly
M - Monthly
C - Combat Operability Check

Item No.	Interval B	D	A	W	M	C	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment is not Ready/Available
		•						Observe compressor gage for indications of unusual or unsatisfactory performance of compressor.	
		•						Check compressor air pipes for indications of leaks.	
2	•						Water Pump	Check piping for leaks or looseness. Make sure outlet valves are closed.	
	•							Make sure tank contains sufficient water.	
		•						Inspect pump and motor for unusual noises or smells that could indicate malfunction.	
		•						Make sure pump does not leak at shaft seal.	
		•						Make sure all outlet valves deliver full flow when open and do not leak when closed.	
			•					Remove fill cap from water tank and fill tank with water. Take care to prevent impurities from entering tank.	

Table 3-1. Preventive Maintenance Checks and Services (PMCS) - Continued

NOTE: Within designated interval, these checks are to be performed in the order listed.

B - Before
D - During
A - After
M - Monthly
M - Monthly
C - Combat Operability Check

Item No.	Interval B	D	A	W	M	C	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment is not Ready/Available
3					•		Reid Vapor Pressure Bomb Bath	Oil the stirrer motor approximately every 4 months, using a good grade of light machine oil (PL-5).	
4	•						Gas Analyzer	Inspect and note pilot lights show normal operation. Note meter readings and check any abnormal deviations from zero.	
				•				Note meter readings and adjust zeros if necessary while detectors are in a combustible gas-free environment. Refer to paragraph 3-5c if replacement of detector element is required.	

Table 3-2. Electrical System Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. NO POWER TO LABORATORY ELECTRICAL SYSTEM (PILOT LAMP DOES NOT LIGHT WHEN MAIN POWER SWITCH (ON PUSHBUTTON) IS DEPRESSED).

Step 1. Check for generator malfunction, due to power cable not properly connected.

a. Check generator and correct.

b. Make sure that power cable is connected properly.

Step 2. Check for tripped CB1 circuit breaker.

Locate and correct cause of overcurrent. Close CB1 circuit breaker.

Step 3, Check for missing or blown F1 fuse.

Locate and correct cause of overcurrent, if fuse is blown. Replace fuse F1.

2. NO POWER TO LABORATORY ELECTRICAL SYSTEM (PILOT LAMP DOES NOT LIGHT WHEN MAIN POWER SWITCH IS DEPRESSED).

Step 1. Check for defective relay K1, or timer.

Repair or replace relay K1 or timer.

NOTE

In an emergency, a defective timer may be temporarily bypassed by moving the pointer counterclockwise to the zero position. Repair or replace defective timer as soon as possible.

Step 2. Check for defective switch S1 or S2.

Repair or replace S1 or S2, or both.

Table 3-2. Electrical System Troubleshooting- Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Check for defective wiring in main power switch.

Check wiring and correct.

3. NO POWER TO ANY COMPONENTS EXCEPT TIMER AND FAN.

Check fordefective K3 contactor, or defective wiring in contactor panel or main power switch panel.

Repair or replace K3. Check wiring and correct.

4. FAN FAILSTOSTARTOR STOPS DURING OPERATION, IN "ALARM" MODE OF OPERATION. (FAN LOCAL CONTROL SWITCH S3 OFF.)

Check for defective K4 relay, or defective wiring inmain power control panel, or combustible alarm system or fan power circuit.

Repair or replace K4. Check wiring and correct.

5. NO LOCAL CONTROL OF FAN (FAN RUNS WITH LOCAL SWITCH S3 OFF. AFTER 10-MINUTE AIR PURGE).

Step 1. Check for defective K2 relay, or combustible alarm system malfunctioning causing K4 to be energized.

Repair or replace K2. Correct malfunction.

Step 2. Check for defective wiring in fan circuit or main power control panel.

Check wiring and correct.

6. POWER AVAILABLE TO ALL COMPONENTS PRIOR TO 10-MINUTE AIR PURGE (MAIN POWER SWITCH S1 ON).

Check for defective timer.

Repair or replace timer.

Table 3-2. Electrical System Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

7. COMBUSTIBLE ALARM SYSTEM FAILURE.

Check for failure in filament circuit or power supply.

Check and correct.

8. NO POWER TO AIR CONDITIONER.

Step 1. Check if circuit breaker CB2 is tripped.

Locate and correct cause of overcurrent, Close circuit breaker CB2.

Step 2. Check for malfunction in air conditioner, or defective wiring in air conditioner circuit.

Check and correct air conditioner or wiring.

9. NO POWER TO FAN (AFTER 10-MINUTE AIR-PURGE), LIGHTS, VACUUM PUMP, OR WATER PUMP.

Step 1. Check if circuit breaker CB3 tripped.

Locate and correct cause of overcurrent. Close circuit breaker CB3.

Step 2. Check for defective wiring.

Check wiring and correct.

10. NO POWER TO ICE MAKER, DISTILLATION APPARATUS, FLASH POINT TESTER, AND RECEPTACLE NO. 8.

Step 1. Check if circuit breaker CB4 is tripped.

Locate and correct cause of overcurrent, close CB4.

Step 2. Check for defective wiring.

Check wiring and correct.

Table 3-2. Electrical System Troubleshooting-Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
11. NO POWER TO COPPER STRIP CORROSION APPARATUS, OVEN, ANALYTICAL BALANCE, AND RECEPTACLE NO. 4.
Step 1. Check if circuit breaker CB5 tripped.
Locate and correct cause of overcurrent, close CB5.
Step 2. Check for defective wiring.
Check wiring and correct.
12. NO POWER TO COMBUSTIBLE ALARM SYSTEM AND RVP. BATH.
Step 1. Check fortripped circuit breaker CB6.
Locate and correct cause of overcurrent, close CB6.
Step2. Check for defective wiring.
Check wiring and correct,
13. WATER PUMP FAILS TO START OR STOPS DURING OPERATION.
Check for defective pressure switch.
Repair or replace switch.

Table 3-3. Water System Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. PUMP FAILS TO START OR STOPS DURING OPERATION.
Step 1. Check for defective wiring. Check wiring and correct.
Step 2. Check if current overload causes circuit breaker switch to open. Locate and correct cause for the overload. Close circuit breaker and restart the motor.
2. PUMP FAILS TO DELIVER WATER AT PROPER PRESSURE.
Step 1. Insufficient water, or motor speed too low. Fill tank. Check electrical system and correct applicable defect.
Step 2. Check for leak in shaft seal. Disassemble pump and replace seal.
Step 3. Water inlet clogged. Drain pump and tank, disassemble and clean suction pipe.
Step 4. Check for defective work impeller. Replace if defective.
3. PUMP VIBRATES OR OPERATES NOISILY.
Step 1. Check for foreign. matter in volute, or ensure mounting. Disassemble and clean. Tighten pump mounting bolts.

Table 3-3. Water System Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 2. Check for bent shaft, warped impeller, worn bearings. Remove and inspect volute. Replace defective parts.
4. MOTOR OVERHEATS.
Step 1. Check for mechanical defects inpumpor motor. Check motor for easy rotation and straight shaft, and correct condition as required.
Step 2. Packing nut too tight, or incorrect voltage. Adjust packing nut. Check electrical system and correct applicable defect.
5, MOTOR FAILS TO START OR HUMS.
Step 1. Incorrect electrical current. Pull plug, check for correct current as shown on motor nameplate.
Step 2. Defective plug, cord or switch. Examine plug, cord and switch, replace if defective.
Step 3. Check if unit is extremely cold. Bring unit to room temperature before starting. Assure the use of the proper weight pump oil for ambient operating temperature.
6. MOTOR STOPS DURING OPERATION.
Step 1. Check for defective wiring. Check wiring and correct.

Table 3-3. Water System Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Check if current overload causes circuit breaker switch No. 3 to open.

Locate and correct cause for overload. Close circuit breaker and restart motor.

Step 3. Check if mechanical or electrical overload causes safety overload device or motor to automatically turn current off.

Locate and correct cause for overload. Allow unit to cool before restarting.

7. PUMP FAILS TO DELIVER AIR AT PROPER PRESSURE.

Step 1. Motor speed too low.

Check electrical system and correct applicable defect.

Step 2. Check if excessive oiling or heavy oil causes a vane or vanes to stick in rotor.

Flush the pump.

Step 3. Check for leaks in system.

Check entire system (piping, hose, fittings, valves, seals and other components) and correct defect.

Step 4. Check if inlet or outlet ports clogged.

Inspect inlet and outlet ports. Make necessary corrections.

Step 5. Check if negative side of system not vented to atmosphere causes low pressure on positive side of system not vented to atmosphere causes inefficient negative pressure.

Ensure proper venting of negative side of system when positive side is being used. Ensure proper venting of positive side of system when negative side is being used.

Table 3-3. Water System Troubleshooting-Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 6. Check for incorrect top clearance between rotor and pump housing. Disassemble pump and realign rotor.
8. PUMP VIBRATES OR OPERATES NOISILY.
Step 1. Check for loose mounting. Tighten pump mounting bolts.
Step 2. Check if foreign matter has entered the pump. Clean the pump by flushing.
Step 3. Check if foreign matter has entered the pump and cannot be removed by flushing. Disassemble and clean the pump.
Step 4. Check if rotor and housing are touching causing a metallic clanging. Disassemble the pump and realign motor.
9. PROPER CLEARANCE BETWEEN ROTOR AND PUMP HOUSING CANNOT BE MAINTAINED.
Worn paper gaskets on motor side of the pump body. Disassemble the pump, remove and replace gaskets.

b. Vacuum Pump.

(1) Lubrication. Use the correct and the proper amount of oil; excessive lubrication rarely does as much harm as inadequate lubrication. Only nondetergent oils may be used. Recommended lubricating oils are listed below.

(a) SAE 10 non-detergent for ambients below 100 degrees F (37.9 degrees C) (fig. 3-1).

CAUTION

This is a dry air pump, and liquids must not be allowed to enter the intake. In vacuum filtration, a second side-arm flask should be used as a trap, connected between the side arm of the filtrate receiving flask and the pump vacuum air inlet (fig. 3-2). With aqueous liquids, a small amount of silica gel in the trap flask will absorb any water vapor and prevent rusting.

NOTE

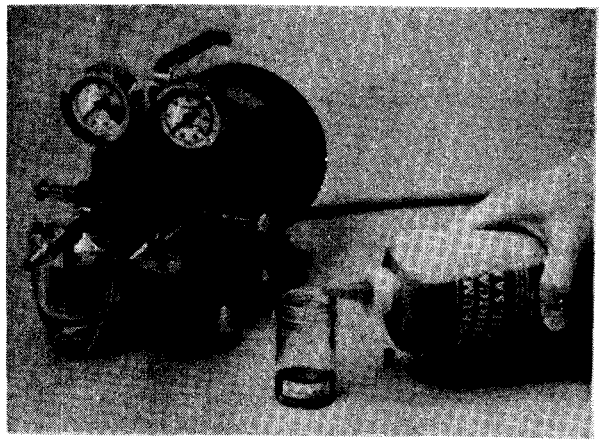
To ensure proper lubrication of the rotor and pump vanes, before using the pump for the first time, connect the pump to the proper electrical outlet and run it free to the atmosphere (without load) for about 5 minutes. This precaution should be repeated whenever the pump is used for vacuum filtering aqueous solutions, to prevent rusting due to entrained water vapor.

(b) Military Symbol PE-10 (MIL-L-21260, Type I).

(c) Military Symbol 2110 (MIL-L-15016, Rev A).

(2) Starting. If motor fails to start or hums, pull the plug and check for correct voltage as shown on the motor nameplate. Also examine the plug and switch. Some motors are equipped with overloads that turn the current off automatically when subjected to mechanical or electrical overload. If the unit is extremely cold, bring it to room temperature before starting.

(3) Flushing. Most pump trouble can be corrected by flushing rather than taking the pump apart. A noisy or inefficient pump is frequently nothing more serious than a vane or vanes stuck in a rotor slot due to excessive oiling or heavy oil. Remove the inlet and outlet accessories and add a tablespoon of kerosene slowly at the intake while the unit is running. Lay unit on its side with outlet downward so kerosene will work out again. Return the pump to the upright position, place three to five drops of oil in the intake port and reattach the accessories.



TS 6640-213-14/3-1

Figure 3-1. Fill Inlet to Marked Level with SAE 10 Lubricating Oil.

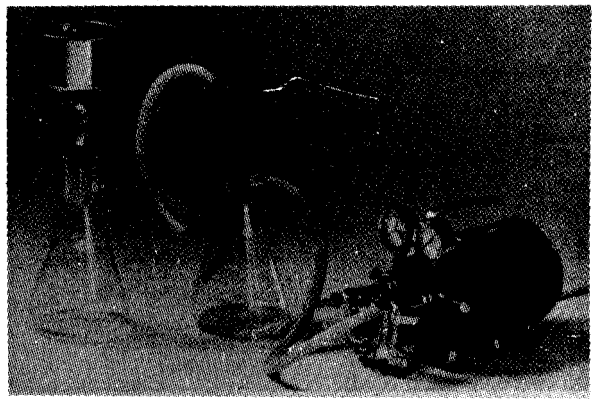


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Figure 3-2. Second Side-Arm Flask Connected in Series Keeps Liquid Droplets or Water Vapor Out of Pump.

CAUTION

DO NOT at any time remove the rotor from the rotor housing. Wash vanes, end plate and pump chamber with solvent. Dry and relubricate lightly.

(4) Disassembly. If foreign matter has entered the pump, try flushing. If this does not eliminate the foreign matter, remove only the end plate and the four vanes.

(5) Alignment. If the air system fails to produce the proper vacuum or pressure, the top clearance between the rotor and body may have increased. A metallic clanging could mean the rotor and body are touching. Remove the end plate only and set top clearante between 0.0005 and 0.001 inch (0.013 mm to 0.037, mm). This can be done by tapping lightly with a miniature hammer on the pump body, either top or bottom, depending upon whether the clearance is too great or too little. The rotor should be turned while setting clearance so that all points on the circumference of the rotor will clear. The end clearance, total for both sides of rotor, may vary from 0.0015 to 0.002 inch (0.038 mm to 0.05 mm). This clearance is maintained by means of paper gaskets on the motor side of the body.

CAUTION

Do not loosen bolts on either the body or rear end plate (bracket).

(6) Operation.

(a) Plug in pump motor to the proper electrical outlet, and connect the appropriate hose adapter to the intended load (vacuum or pressure). The adapter fittings are clearly marked. For pressure operation, hose clamps should be used.

(b) Turn on the pump, and adjust vacuum or pressure to the. desired level by turning the stem of the regulator valve located under the appropriate gage while watching the gage indication (fig. 3-3).

(c) In vacuum operation, air flow through the pump inlet is greatly reduced, also reducing lubrication by the oil mist picked up from the oiler wick. Therefore the pump should be run without load (no connected vacuum flask) at least 2 to 3 minutes for every hour of vacuum operation. It is good practice to do this at the end of each filtration, in filtering small or moderate volumes.

(d) If vacuum cannot be interrupted for these short intervals, an accessory Siphon Oiler will provide lubrication for continuous operation. Remove the vacuum regulator valve, and install the Oiler in its place, filled to the marked level with SAE 10 oil. The vent hole required for siphon action causes a slight reduction in maximum vacuum. Refill the Oiler after every 20 to 50 hours of operation. The Oiler must be removed and the regulator valve replaced, if the pump is later used as a pressure source.

(7) Troubleshooting. A troubleshooting chart for the air system is listed in table 3-4.

3-5. AUTOMATIC COMBUSTIBLE GAS ALARM.

a. Inspections.

(1) Daily

(a) Inspect the instrument and pilot lights to see that they show normal operation.

(b) Check the meter readings and investigate any abnormal deviations from zero.

(2) Weekly. Check meter readings and adjust zeros if necessary while detectors are in a combustible gas-free environment.

(3) Periodic. Check response of the instrument periodically by exposing the detector to a sample of combustible gas of known concentration.

b. Services.

(1) Replace pilot, alarm and fail lights when found defective in operation.

(2) Calibrate the instrument, as follows:

(a) Expose the detector to a known concentration of combustible gas in the air.

(b) Correct meter reading by adjusting the gain adjuster on the printed circuit board using a known concentration of gas or the test and calibration kit, which can be obtained commercially.

(c) Replace the detector element (c.(2) below) whenever it is no longer possible to make the zero adjustments within the span of the zero adjuster on the corresponding control module. Check detector voltage between the detector voltage test points on the printed circuit board each time the element is replaced.

c. Detector Voltage Measurement and Element Replacement.

(1) Voltage measurement. Two people are required to perform the initial detector voltage settings and measurement - one person at the control unit (fig. 3-4) and one preson at the remote detector (A, fig. 3-5 and item 7, fig. 2-8). Refer to figure 3-5 and proceed as follows:

Table 3-4. Air System Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. MOTOR FAILS TO START OR HUMS.
Step 1. Check for incorrect electrical current. Pull plug, check for correct current as shown on motor nameplate.
Step 2. Check for defective plug, cord, or switch. Examine plug, cord, and switch. Replace if defective.
Step 3. Check if unit is extremely cold. Bring unit to room temperature before starting. Assure the use of the proper weight pump oil for ambient operating temperature.
2. MOTOR STOPS DURING OPERATION,
Step 1. Check for defective wiring. Check wiring and correct.
Step 2. Check if current overload causes circuit breaker switch CB 3 to open. Locate and correct cause for overload, close circuit breaker and restart motor.
Step 3. Mechanical or electrical overload causes safety overload device or motor to automatically turn current off. Locate and correct cause for overload. Allow unit to cool before restarting.

Table 3-4. Air System Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
3. PUMP FAILS TO DELIVER AIR AT PROPER PRESSURE.
Step 1. Check if motor speed low.
Check electrical system and correct applicable defect.
Step 2. Check if excessive oiling or heavy oil causes a vane or vanes to stick in rotor.
Flush the pump as indicated in sub para. (3) above.
Step 3. Check for leaks in system.
Check entire system (piping, hose, fittings, valves, seals, and other components) and correct defect.
Step 4. Check for clogged inlet or outlet parts.
Inspect inlet and outlet parts. Make correction as necessary,
Step 5. Negative side of system not vented to atmosphere causes low pressure on positive side of system.
Insure proper venting of negative side of system when positive side is being used.
Step 6. Positive side of system not vented to atmosphere causes inefficient negative pressure.
Insure proper venting of positive side of system when negative side is being used.

Table 3-4. Air System Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
3. PUMP FAILS TO DELIVER AIR AT PROPER PRESSURE. - Continued
Step 7. Incorrect top clearance between rotor and pump housing. Disassemble (sub para. (4) above) and realign rotor (sub para. (5) above).
4. PUMP VIBRATES OR OPERATES NOISILY.
Step 1. Check for loose mounting. Tighten pump mounting bolts.
Step 2. Check foreign matter which has entered the pump. Clean the pump by flushing (sub para. (3) above).
Step 3. Check for foreign matter which has entered the pump and cannot be removed by flushing. Disassemble and clean pumps (sub para. (4) above).
Step 4. Rotor and housing are touching causing a metallic clanging. Disassemble the pump (sub para. (4) above) and realign rotor (sub para. (5) above).
5. PROPER CLEARANCE BETWEEN ROTOR AND PUMP HOUSING CANNOT BE MAINTAINED.
Worn paper gaskets on motor side of the pump body. Disassemble the pump (sub para. (4) above), remove and replace gaskets.

(a) Turn instrument power off.

(b) Loosen the setscrew holding the shield assembly to the body and unscrew the shield assembly from the body.

(c) Remove the detector element.

(d) Insert the test socket adapter (23-4027) into the body and insert the detector element into the test socket adapter.

(e) Using a direct-current voltmeter (0-10 volt range), clip the voltmeter leads to terminals A(+) and R(-).

(f) Turn the instrument power on and adjust the detector voltage, using the voltage adjuster on the printed circuit board. The detector voltage must be 5.5 volts dc. Clockwise rotation increases voltage.

(g) Turn the instrument power off and remove the test socket adapter.

(h) Insert detector element into the body and reassemble the detector. Tighten all parts securely and turn the power on.

(2) Element replacement. To replace the detector element, follow procedure in (l)(a), (b) (c) and (h) above.

d. Fail Indications. A fail relay and fail light are provided to monitor equipment operations. If equipment failure occurs, the blue fail lights comes on; external failure terminals, switch and alarm circuits are disabled to prevent false alarms. Fail indications may be caused by:

(1) A short or open circuit in the detector circuit.

(2) Detector voltage being set abnormally low.

(3) Excessive negative meter drift.

e. Power Supply. The power supply is designed to maintain a constant voltage to the detector circuits despite variations in the input voltage. If the voltage at test points B on the printed circuit board is incorrect and cannot be brought to the correct value by adjusting the voltage adjuster, proceed as follows:

(1) Make sure that the module is fully inserted into its socket.

(2) Check fuse (or circuit breaker). Lights will be off on all modules if fuse is burned out (or circuit breaker has tripped).

(3) Check the detector and replace if necessary.

(4) If voltage is still incorrect after element replacement, replace the printed ciruit board (fig. 3-5) .

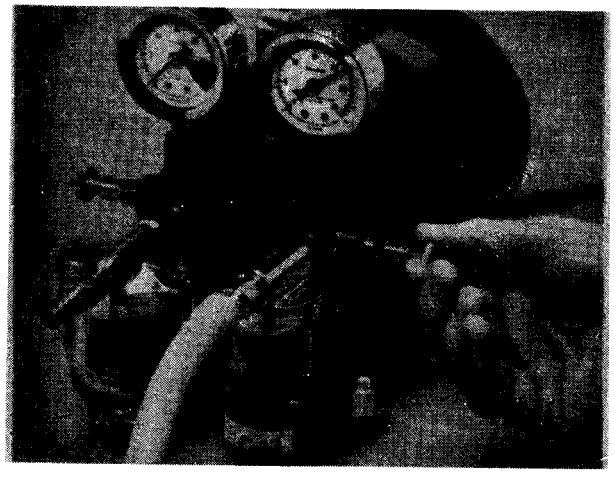

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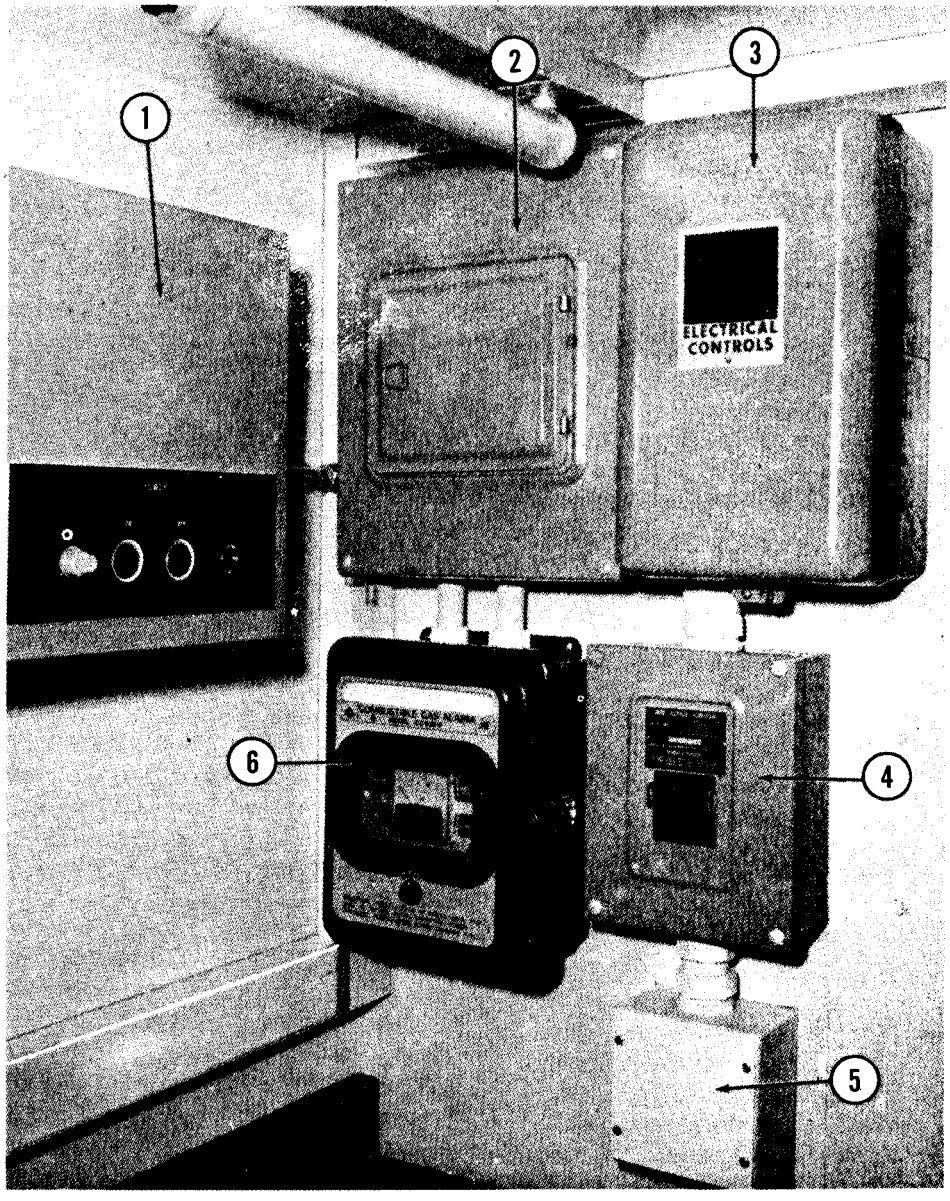
Figure 3-3. Adjusting Vacuum Level by Turning Valve Stem of Inlet Regulator Valve.

3-6. ANALYTICAL BALANCE.

a. Calibration Procedures.

(1) Zero the balance by rotating the weight control knob (7, fig. 2-6)' until the macro weight counter (6) shows zero; and then rotating the micrometer drum knob (3) until the optical weight counter is zeroed, or until the micrometer line is as nearly on zero as the mechanical lash in the knob control will allow; and finally, rotating the zero control knob (1) until zero shows on the micro weight counter (4). If the exact zeroing of the micro weight counter cannot be achieved, "zero-point adjust" the balance as noted in paragraph (4) below. If the range of the zero control knob does not permit zeropoint adjustment; the range must be readjusted as noted in paragraph (5) below. If the macro weight counter cannot be zeropoint adjusted, the range of the weight control knobs must be adjusted as described in paragraph (6) below.

(2) Scale illumination can be adjusted by assuring proper bulb contact to provide maximum bulb brightness. If additional illumination is desired, remove the hood and loosen the knurled head screw (19, fig. 3-6) which holds the cover on the recessed lamp housing in the left rear of the balance. Slide the cover from side to side and up and down until the desired illumination is obtained. Tighten the knurled head screws firmly while holding the cover in position. A replacement bulb is available and is stored in the lower spare mount.



TS 6640-213-14/3-4

1. Main power control panel
2. Circuit breaker panel
3. Main power contactor
4. Main power circuit breaker
5. Power cable junction box
6. Automatic gas alarm panel

Figure 3-4. Electrical Controls in Right Front Corner of Laboratory.

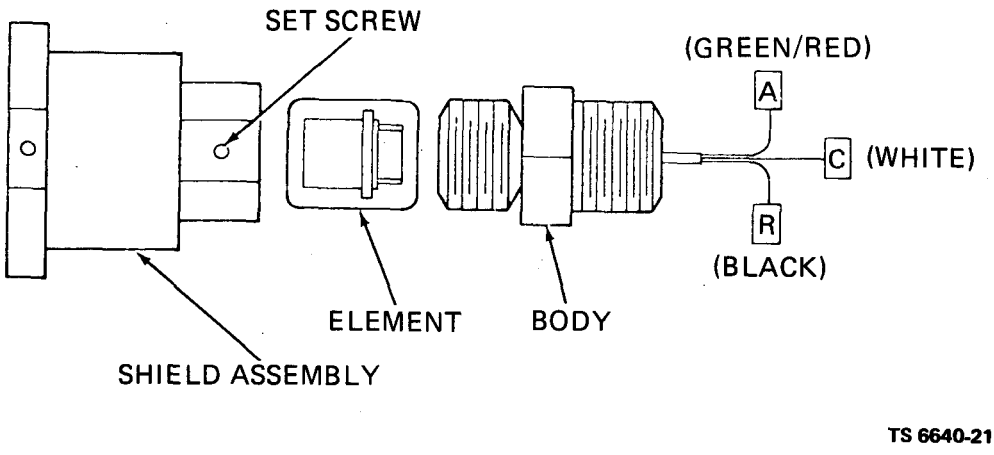
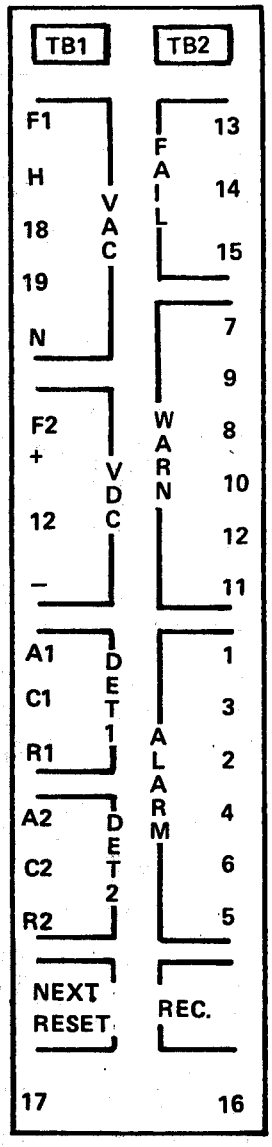
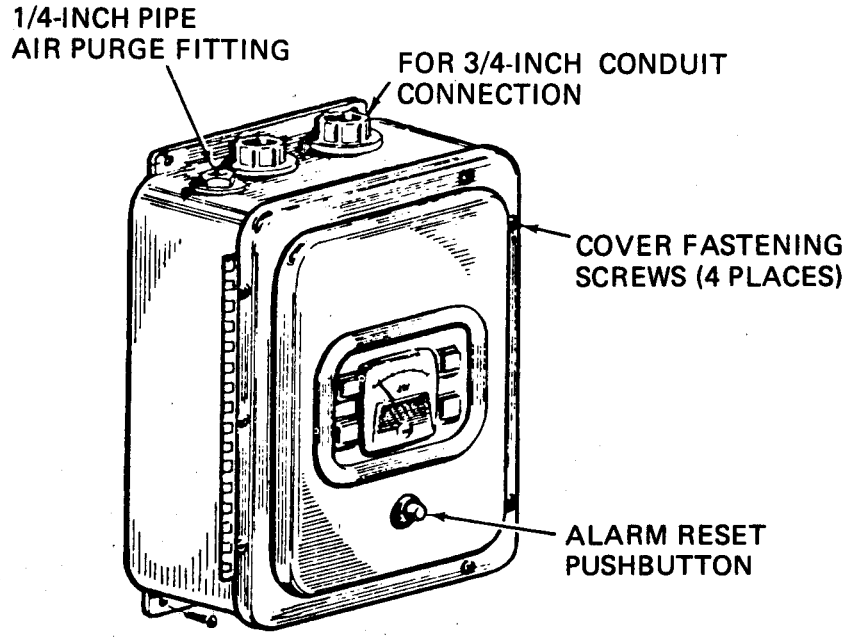


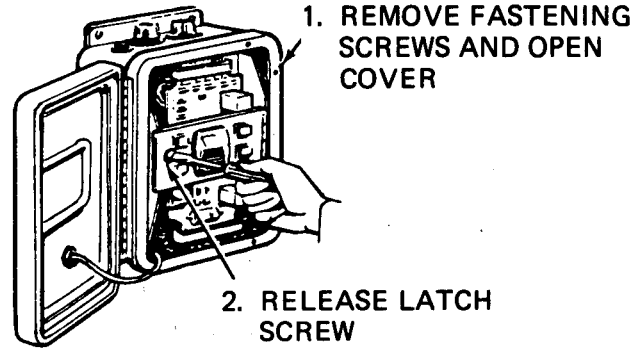
Figure 3-5. Alarm System Detector and Control Unit Disassembled (Sheet 1 of 2)



TERMINAL STRIP CONNECTION DESIGNATIONS



TO GAIN ACCESS TO TERMINALS:



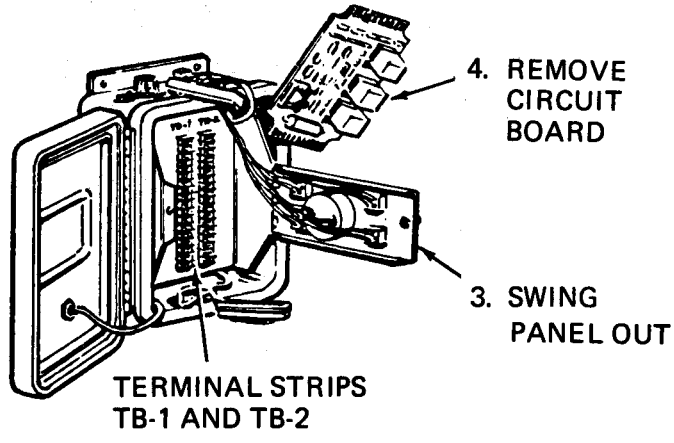


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Figure 3-5. Alarm System Detector and Control Unit Disassembled (Sheet 2 of 2)

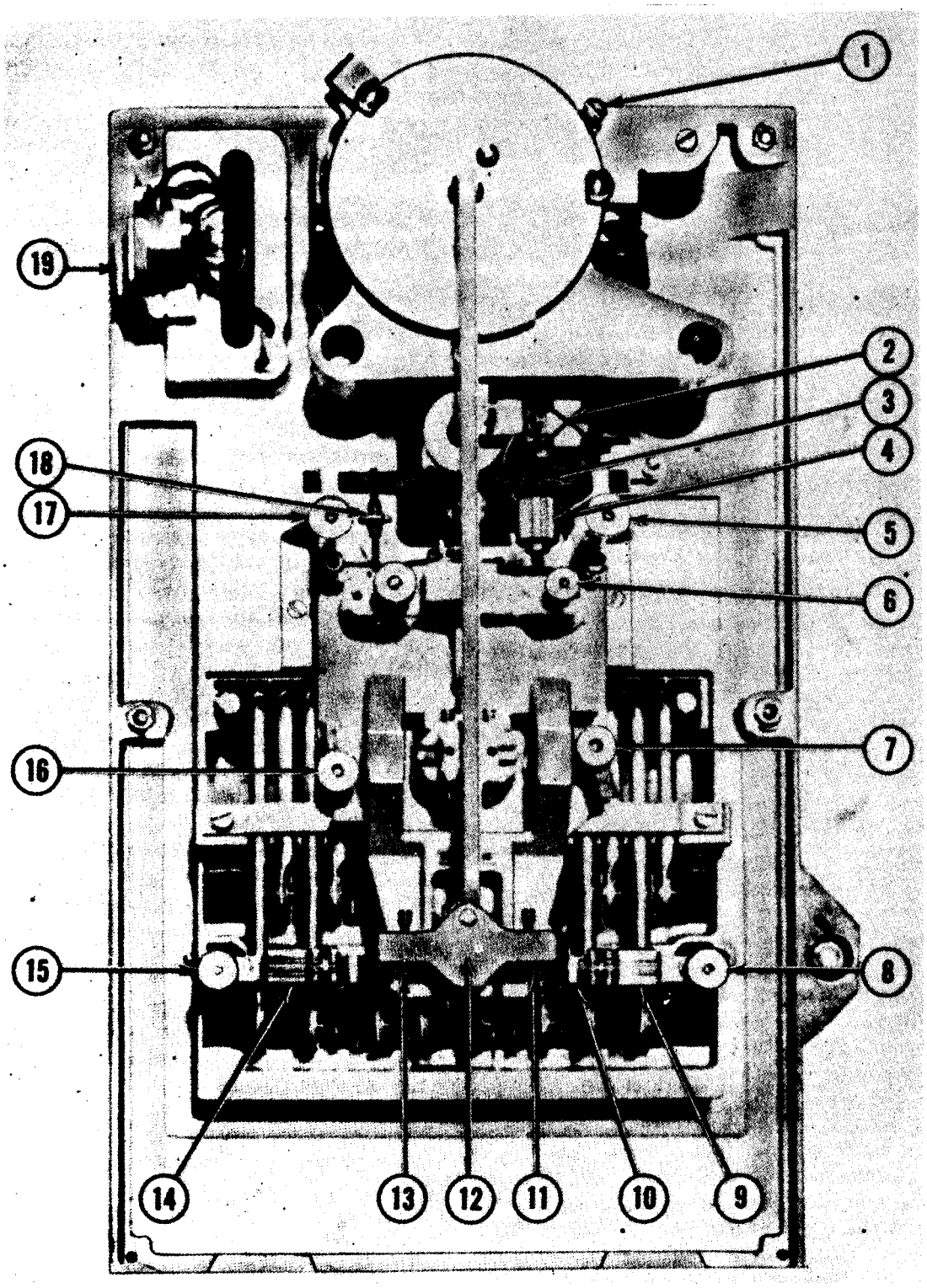


Figure 3-6. Top View, of Analytical Balance.

Legend for figure 3-6:

1. Screw
2. Mechanical taring suspension
3. Safety pin
4. Knurled screw
5. Red nut
6. Knurled nut
7. Red nut
8. Knurled nut
9. Screw weight
10. Weight carriage
11. Arrestment pin
12. Weight carriage bridle
13. Arrestment pin
14. Screw weight
15. Knurled nut
16. Red nut
17. Red nut
18. Knurled knob
19. Knurled head screw

(3) Weight counter focusing is controlled by. the long knurled knob-located below the screws-(l) at the rear of the weight counter. Carefully adjust the knob until the desired focus is achieved on the optical weight counter.

(4) Zeropoint adjustment is made by first rotating the weight control knobs (7, fig. 2-6) and micrometer drum knob (3) until the macro weight counter (6) and optical weight counter (5) are returned to zero. Move the arresting lever (2) into the pre-weigh position (fig. 2-7), and adjust the macro weight counter (4, fig. 2-6) to zero by turning the zero control knob (1, fig. 2-6).

(5) Range adjustment of the zero ontrol knob has the effect of recentering the knob. Set the knob in the center of its adjusting range without regard to the micro weight counter reading.

Arrest the beam by moving arresting lever to ,the arrest position (fig. 2-7). Remove the balance hood and adjust the knurled knob (18, fig. 3-6) until the optical and macro weight counters are zeroed. If the weight counter deviation is too great, zero the knob midrange as described in paragraph (6) below.

(6) Macro weight counter zero adjustments begin with the zero calibration described in paragraph (1) above. Then arrest the beam and remove the hood. Loosen locking screw on the knurled screw (4, fig. 3-6) and adjust the scale by turning the knurled screw as required to zero the macro weight counter. Retighten the locking screw, release the beam and check the zero again. Repeat the connection if the deviation now exceeds one weight counter division. As soon as the deviation is reduced to one weight counter division, replace the hood and use the zero control knob to adjust to zero.

(7) Check sensitivity by rotating the weight control knobs until 01 appears on the macro weight counter while the beam is arrested. Place a l-g weight on the pan, release the beam and check the zero on the optical weight counter as described in paragraph (1) above. Now, rotate the weight control knobs to show zero on the macro weight counter. Let the optical scale swing in and read the result. If the full deflection on 0100 is not obtained, adjust the sensitivity by turning the knurled nut (6, fig. 3-6) to adjust the scale accordingly. Turn the weight control knob so tht 01 appears on

the macro weight counter and set the zero as described in paragraph (4) above. Then, recheck the sensitivity,If required, readjust the sensitivity, set the zero, and recheck. Continue the sequence until the balance is correctly adjusted.

NOTE

Whenever the tare boat is to be used, the tare ring is to be removed. The boat and ring have identical weight.

CAUTION

If the beam is not arrested when the transportation arresting device is removed, serious damage to the balance may result.

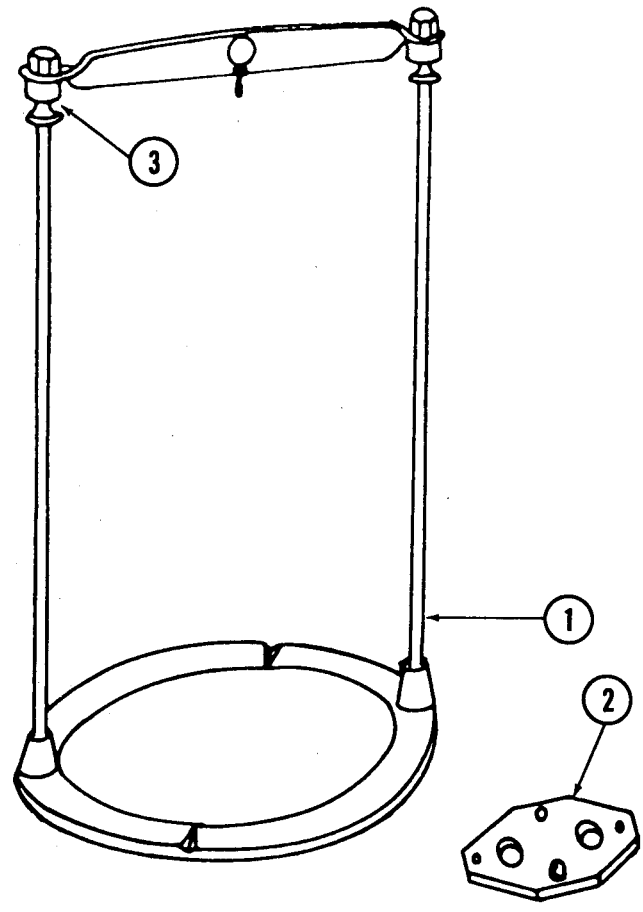
b. Uncrating and Preparing the Balance for Use.

(1) Uncrating. The analytical balance is packed in the original carton and strapped to the multilane shock-absorber support. The multilane support is the normal work surface on which the balance rests.

(a) Cut away the straps and carefully open the carton at the top.

(b) Lift the balance out of the carton and place it on the support. Remove the plastic shroud and set it aside, but do not destroy it.

(c) Remove the accessory carton from the weighing compartment after removing the strips of tape on the sliding doors. The accessory carton contains the weighing pan (1, fig. 3-7), stirrup bearing plate (2), chamois leather and camel's hair brush. The former items must be installed in the balance; the latter should be stored for use in cleaning.



1. Weighing pan
2. Stirrup bearing plate
3. Bridle stirrup recess

Figure 3-7. Weighing Pan and Stirrup Bearing Plate.

(d) Place the arresting lever in the arrest position (fig. 2-7) and then remove the hood from the top of balance housing.

(2) Preparing the balance for use.

(a) Place all weight indicators at maximum settings. To do this, move the knobs (1, 3 and 7, fig. 3-3) until the reading 99.9999g appears.

(b) Loosen the read nuts (17, 5, 16 and 7) on both sides of the beam until the springs underneath can be swung aside by at least 90 degrees. Then retighten the red nuts to prevent accidental spring movement.

(c) Remove the safety pin (3) and store it for future use.

(d) Remove the transport arrestment of the mechanical taring suspension (2). Also remove the rubber band from the weight carriage bridle (12), which is attached to the knurled nuts (15 and 8) to hold the weight carriage bridle without movement.

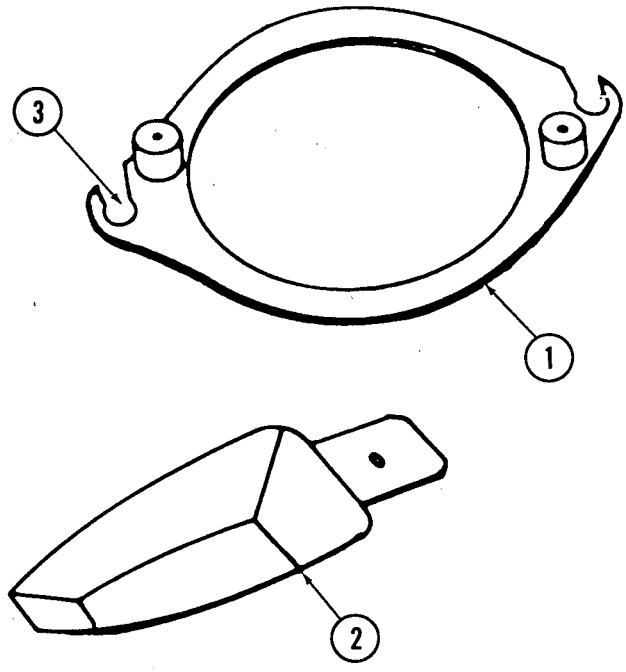
(e) Open both doors and remove the two knurled head screws in the top of the weighing chamber. Remove the plate and remove the two knurled nuts to which the rubber bands are attached. Remove the weight carriage, remove the cardboard and the foam rubber from the weight carriage and replace it. Save the cardboard, foam rubber and wooden blocks for future use. Replace plate and knurled head screws.

(f) Check knives and bearings to be sure they are clean; even fingerprints are unacceptable since they may result in corrosive etching. See instructions in c. below for detailed cleaning procedures.

(g) Install the stirrup bearing plate on the end knife by placing it on the arrestment pins (11 and 13, fig. 3-6) so that the engraved marking “V” on the plate top faces toward the front of the balance.

(h) Lift the weight carriage (10) and raise the weight carriage bridle up and place it on the stirrup bearing plate so that the support pins on the weight carriage bridle are set into the notches on the top of the bearing plate.

(i) If the tare boat (2, fig. 3-8) is to be used, the screw weights (9 and 14, fig. 3-6) must be removed from the left and right side of the weight carriage bridle. These weights correspond to the weight of the tare boat and the tare ring (1, fig. 3-8) respectively. Retighten the knurled nuts adjacent to the screw weights and store the screw weights in the beam compartment (top) of the balance. Place the tare ring notch (3, fig. 3-8) on the weighing pan bridle stirrup recess (3, fig. 3-7) and attach the weighing pan bridle to the hook that extends down into the weighing compartment. The open end of the hook on the weighing pan bridle crosspiece must face toward the right of the balance when the weighing pan is installed and the two small weights on the tare ring must point down.



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1. Tare ring
2. Tare boat
3. Tare ring notch

Figure 3-8. Tare Ring and Tare Boat.

(j) Replace the hood and check the zero. Calibrate. if necessary. Readjust the sensitivity since thee enter of gravity may have shifted in a vertical direction because of the displacement of the large zero screw. (See a.(7) above for adjusting sensitivity.)

NOTE

All removed parts, including plastic shroud, cardboard and plywood blocks should be retained for use when preparing to move the laboratory. Place all the parts in the carton and store in the cabinet location indicated.

c. Cleaning.

(1) Weights. From time to time the weights of the balance should be cleaned with the camel's brush or chamois leather.

(a) To remove the weights, arrest the beam and take off the hood. Move all the knobs to the maximum setting so that the scales show 99.9999.

(b) Remove the weighing pan from the weighing compartment. Lift the weight carriage (10, fig. 3-6) and swing the weight carriage bridle forward to detach it from the stirrup bearing plate. Unscrew the two large knurled head screws in the ceiling of the weighing compartment and remove the partition. Unscrew knurled nuts (8 and 15, fig. 3-6). Separate the upper part of the weight carriage from the lower part; hold the lower part and switch the weight decade slowly from 9 to 8 to 7, and on down to zero. While doing this, remove the corresponding weights, which will be lying freely in their respective hooks.

(c) Clean the weights thoroughly. Not even fingerprints should remain on their surface. Handle weights with forceps only.

CAUTION

Do not attempt to repair the balance. Only a skilled service repairman with factory facilities available should attempt repairs. Adjustment and calibration can be accomplished by the laboratory technician.

(d) After cleaning, reassemble the balance, check the zero, and adjust sensitivity, if necessary.

(2) Weighing compartment.

(a) To clean weighing compartment interior, arrest the balance; remove the weighing pan; and wipe the interior clean, using a water-damp chamois. Wring chamois dry and wipe again, removing all traces of water. Remove dust particles using camel's hair brush.

(b) Clean and replace weighing pan. Sliding glass doors may be removed for cleaning.

(c) Wipe the exterior of tha balance clean, using water-damp chamois. Do not attempt to clean balance mechanism other than the weights and knives unless the balance malfunctions.

3-7. REID VAPOR PRESSURE APPARATUS.

WARNING

When filling the Reid Vapor Pressure (RVP) Bomb Bath, exercise extreme caution in adding the required ten (10) parts per million (ppm) (0.1 ml/liters) of Copper Sulfate. Do not exceed this proportion, as twelve (12) ppm (0.12 ml/liters) of Copper Sulfate is poisonous.

a. Operator Services.

(1) Before-operation services.

(a) Assure that the overflow pipe is tight and fill the bath with water up to the level of the overflow pipe. The position of the overflow pipe is set to maintain the level of the water at least 1 inch (25.4 mm) above the immersed bomb, as specified by ASTM D323.

(b) Check the thermo-regulator for the presence of gas bubbles in the mercury column. If bubbles are present or the mercury in the column is separated, heat the bulb gently in a beaker of water or oil until the bubbles are driven up into the expansion chamber. Cool slowly in a vertical position, allowing the mercury to recede slowly to form a solid column without bubbles or separation.

(2) After-operation services.

(a) To drain the bath, unscrew the overflow pipe until it is free; lift the small pipe out of the bath or push it to the side until all the water is drained out.

(b) Wipe all components with a clean, damp cloth.

(3) Lubricating. Through the oil cap of the motor, apply several drops of a good grade machine oil, such as PE1, every 4 months.

(4) Calibrating the thermoregulator. To calibrate the thermoregulator, immerse the regulator in the bath at a temperature lower than that at which the bath is to be regulated. Place a calibrated ASTM D323 No. 18F thermometer in the bath. Bring bath temperature up to 96 degrees F to 98 degrees F (35.6 degrees C to 36.7 degrees C), rotate the micro-set magnetic coupler until the indicator light on the control box is out; rotate the magnetic coupler until the indicator light is on; continue making minor adjustments until the bath temperature is maintained at 99.8 degrees F to 100.2 degrees F (37.5 degrees C to 37.8 degrees C).

b. Troubleshooting. Table 3-5 is a troubleshooting chart for the Reid Vapor Pressure Apparatus.

3-8. MANOMETER.

a. Cleaning. Clean the glass tube, when necessary, to remove deposits of oxidized mercury from the interior surface. Drain the mercury and remove the top and bottom plugs on the tube. A suitable brush with either naphtha or acetone moved rapidly up and down in the tube will provide efficient tube cleaning. Refill the manometer, reservoir with clean mercury. Refer to instructions on filling the reservoir (para. 2-2, f. (4) (b) 4).

Table 3-5. Reid Vapor Pressure Apparatus Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. LOSS OF TEMPERATURE CONTROL OF BATH WATER.
Improper water level.
Add water asrequired uptooverflow tube level.
2. BATH DRAIN HAS BEEN OPENED BUT WATER DOES NOT RUN OUT.
Plugged or bent drain tube under shelter.
Check drain tube. Make applicable corrections.

b. Troubleshooting. Table 3-6 is a troubleshooting chart for the manometer.

c. Calibration. The manometer is used to verify the accuracy of the Reid Vapor pressure (RVP) gages. Mercury is used as the indicating fluid. The manometer is equipped with a double scale graduated in inches of mercury and pounds per square inch (psi). The scale has provisions for zero adjustment; it must be adjusted to the zero position prior to verifying gage accuracy. The accuracy of the manometer is verified by use of a certified master gage having a range of O to 15 psi graduated in increments of 0.1 psi and an accuracy of + or - 0.05 percent. Recommend A-level calibration frequency is 180 days.

3-9 . DISTILLATION TEST APPARATUS.

a. Cleaning. Use a clean cloth and a mild soap-and-water solution to clean the interior and exterior of the distillation unit.

CAUTION

Be careful not to damage the seal surfaces on funnel and base, as this may cause leakage. Chromic acid may be used occasionally to remove heavy stains from the fitted glass.

b. Inspection. Inspect distillation test apparatus for defective switches, indicator lamps, defective heaters or defective auto-transformers. Inspect power cord and plug for loose wiring or frayed insulation. Check mechanical parts for freedom of operation, check glass observation window for breakage or cracks. Repair or replace as necessary.

c. Replacement. To replace the distillation test apparatus from its installation on top of the counter, the following procedure is required.

(1) Remove power cord from outlet and any water located in condenser unit.

(2) Remove drawer located under apparatus, and remove attaching, screws, washers and nuts, securing attaching brackets to apparatus.

(3) Lift to separate the shield assembly from the condenser and disconnect the connector between the assemblies and remove from laboratory bench.

3-10. MICROPOROUS FILTERING DISK HOLDER.

CAUTION

Be careful not to damage the sealing surfaces on funnel and base, as this may cause leakage. Chromic acid may be used occasionally to remove heavy stains from the fritted glass.

Table 3-6. Manometer Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. NO PRESSURE READING.
Step 1. Pressure is not being applied to either, or both sidesof the instrument. Check for plugged or leaking pressure lines. Make applicable corrections.
Step 2. Atmospheric pressure connection not vented to atmosphere. Check atmosphere pressure connection and ensure proper venting.
Step 3. Foreign particles in internal passages of the meter are blocking the flow. Remove mercury from meter and check internal passages for foreign particles. Clean instrument as required.
2. HIGH OR LOW PRESSURE READINGS.
Step 1. Check for leaks or obstructions. Check lines for leaks or obstructions. Make applicable corrections,
Step 2. Check if tubing and/or mercury may contain foreign particle matter. Disassemble and clean instrument. Replace mercury.
Step 3. Check for improper zero setting. Check zero setting. Make proper adjustment.

a. Clean all parts throughly with a sponge, hot water and a nonabrasive powdered cleanser.

b. Rinse all parts thoroughly with hot tap water and then with distilled water. Allow all parts to air-dry throughly; do not wipe dry. Compressed air may be used to remove traces of moisture.

3-11. SOLVENT FILTERING DISPENSER.

a, Cleaning Parts. Wash the parts of the filter holder in mild detergent, rinse thoroughly and air-dry to minimize particulate contamination.

b. Aligning Parts. When the holder is assembled, the cover is loaded with a flat teflon gasket, a metal support screen, a Millipore filter, another metal support screen, and another flat teflon gasket. The cover is fitted to the uptake tube, and the delivery tube is aligned with the pressure hole on the front of the neoprene bulb.

3-12. WATER DETECTOR KIT, AUTOMOTIVE-AVIATION FUEL.

CAUTION

Never leave the light switch in the ON position if the light has not come on. The batteries can be destroyed or rendered incapable of sustaining a recharge.

a. Checking Battery Charge. Push the light switch down and outward at the same time and hold for 3 seconds. Release pressure on the switch button slowly. If the light does not come on, repeat the procedure. If the light does not operate after the second attempt, recharge the batteries.

b. Recharging Battery. To recharge a battery, remove it from the instrument and place it in the standard recharger, Model J-330. The recharger requires a 110-volt, 60 Hz, power source.

NOTE

Although the battery cannot be overcharged, do not allow it to remain in the recharger for more than two weeks without use.

Replacing the Ultraviolet Tube. To replace the ultraviolet tube,unmscrew the four roundhead machine screws from the bottom of the unit to allow removal of the entire bottom half of the assembly. Pull the metal reflector shield out of its slot to expose the tube. Remove the tube by grasping both ends at the same time and rotating the entire tube in either direction, one-quarter turn. Lift the tube from its holder. Install the new tube by reversing the above proced-ure. Refer to TM 5-6330-216-12 for complete maintenance procedure on the Water Detector Kit.

3-13. PENSKY-MARTENS FLASHPOINT TESTER.

a. Lubrication. Oil the stirrer motor every 1.000 hours of use with light lubricating oil. Oil moving parts of the tester mechanism as often as needed, with light lubricating oil.

b. Cleaning. Never use gasoline, acetone, or other low-flashpoint solvents for cleaning flash cups. Use kerosene or other high-flashpoint solvents as cleaning agents.

3-14. COPPER STRIP CORROSION APPARATUS.

To clean the apparatus, open the drain valve and allow the bath water to drain into the sink. Clean the inside of tha bath with a mild soap and water solution and a cloth. Rinse throughly. Polish the bath exterior with a soft, dry cloth.

3-15. OVEN .

a. Cleaning. Use a clean cloth and a mild soap-and-water solution to clean the interior and exterior when the oven is cool. Refer to Chapter 4 for adjustment and repair of the oven.

3-16. ICE MAKER.

a. Daily Maintenance. Refill the water tank as required by demand of the ice cube supply.

b. Periodic Maintenance. Inspect the unit for frost buildup. Defrost the unit as required. Empty and clean the secondary evaporator moisture collector.

c. Defrosting.

(1) Locate the main switch behind the grill and place it in the OFF position.

(2) Remove the ice bucket.

(3) Prop the door open at least 1 inch to permit air circulation to dry the interior and prevent bacterial growth and offensive odor.

(4) Empty and clean the ice bucket.

(5) After the unit has defrosted, replace the cleaned ice bucket, remove the door prop and return the main switch to the ON position.

CAUTION

Do not use solvent, abrasives or other cleaners that may contaminate the ice cubes.

d. Cleaning. Clean the interior of the icemaker with a cloth soaked in a mild soap and water solution. Rinse and wipe dry with a clean cloth. Clean and polish the exterior of the ice maker as required using water-damp chamois.

e. Lubrication. The icemaker does not need lubrication.

3-17. WATER DEMINERALIZER UNIT.

Mixed bed demineralizer cartridges should be replaced when the resin in the lower three-fourths of the cartridge changes from purple to yellow. Cartridges should be kept away from-heat and the seals should not be removed until ready for use. The exhange capacity will be greatly reduced if the resins are allowed to dry completely. Resins shrink because of moisture loss and the cartridge may not appear full. The resins will expand when wet and will fill the cartridge.

3-18. ANEROID BAROMETER.

a. The aneroid barometer has an adjusting back plate, which should be set for the alititude location of the laboratory. This permits direct readings in terms of equivalent sea level pressure.

b. Dust the barometer with a dry cloth or dustung brush.

3-19. DESICCATING CABINET.

Remove and replace the molded door gasket periodically to assure a tight fit. Wipe clean with a dry cloth.

Section II. CALIBRATION INSTRUCTIONS

3-20. **CALIBRATION LEVELS AND REFERENCES.**

a. Calibration requirements for test equipment requiring A-level calibration in this laboratory can be identified by reference to TB 750-236 under the following appropriate TB's.

(1) Weight set class 5 (5mg to 50gm)	TB 9-6670-254-50
(2) Pressure gage (0-5 lb).	TB 9-6685-319-50
(3) Thermometer (ASTM certified)	TB 9-6685-314-50
(4) Hydrometer	TB 9-6630-201-50
(5) Multimeter	TB 9-6625-961-50

b. The calibration procedures and requirements given in this section are identified for the aviation fuel surveillance laboratory as C-level requirements and will be performed by qualified laboratory personnel assigned to this laboratory.

3-21. ANALYTICAL BALANCE.

The analytical balance provided is a single arm instrument. It has weighing capacity of 100 grams. When provided with the manual taring accessories, the weighing capacity is increased to 150 gm. The precision (standard deviation) of the balance is + or - 0.05 milligrams (mg), digital redability is 0.1 mg, and accuracy in the optical range is + or - 0.05 mg$_e$ ASTM E-319 procedures are recommended for evaluating performance and verifying the accuracy of the balance. These procedures determine the precision with which balance can compare known weight loads; i.e., the built-in weights of the balance and a known weight load. Section 5, ASTM E-319 outlines procedures for preparation of the balance for evaluation, and section 8 outlines procedures for evaluating balance accuracy. Ap precision weight set (class S) must be used to evaluate balance performance. The verification evaluation of the balances are performed by operating ersonnel. The double beam balance may be evaluated using the above procedures. The standard deviation of the double balance is + or - 0.1 gm.

3-22. REID VAPOR GAGES (RVP).

The RVP gages msut be verified for accuracy after each test when vapor pressure of motor gasolines is being determined. When determining the vapor pressure of aviation fuels (aviation gasoline and turbine engine fuel) the gage must be verified for accuracy before and after each test by operating personnel. The accuracy of RVP gages is verified by using the manometer. When the gage reading and the manometer reading differ by 1 percent or less, the gage is considered accurate; i.e., the gage correction factor must not be greater than 0.05 psi for O to 15 pound gages or 0.15 psi for O to 15 pound gages. If the readings differ by more than 1 percent the gage is considered inaccurate and must be repaired or replaced.

3-23. THERMOMETERS.

a. Accuracy Requirements. The routine laboratory thermometers, ASTM 9F, 12F and 58F, have scales including 32 degrees F (O degrees C) and must be verified for accuracy by determining the ice point. ASTM 18F shall be verified at 100 degrees F (37.8 degrees C) ASTM 7F, low-distillation thermometers, must be verified for accuracy at 200 degrees F (93.3 degrees C). ASTM 10F, Pensky-Marten, high range thermometer, must be verified for accuracy at 212 degrees F (100 degrees C). ASTM 7F, 10F and 18F must be verified for accuracy by direct comparison with a certified precision thermometer. The two certified precision thermometers (ASTM 64F and 68F) must be certified by the A-level calibration facility. The precision thermometer must be certified at 360-day intervals. The error of the certified thermometers cannot be more than the maximum scale error of the specification (ASTM E-l).

b. Procedures for Determining Ice Point. The ice point may be determined by either of the following methods:

(1) Method one.

(a) Ice used to determine the ice point must be made for chemical-pure (distilled or deionized) water.

(b) Crush or shave ice, avoiding contact with chemically unclean objects. Fill a chemically clean Dewar jar with the crushed or shaved ice and add precooled chemical-pure water to form a slush, but not enough to float the ice.

(c) Immerse the thermometer to be tested in the ice bath to a depth that covers the 32 degrees F (O degrees C) graduation. Gently pack the ice around thermometer stem. As the ice melts, drain off excess water and add crushed or shave ice to maintain the slush condition.

(d) The thermometer shall remain immersed in the ice bath long enough to assure that the thermometer being tested and the ice bath have reached equilibrium (at least 3 minutes). Raise the thermometer a few millimeters to expose the meniscus and gently tap the stem and observe the reading. Successive readings taken at intervals of at least 1 minute should agree within 0.1 of a scale division.

(2) Method two. An alternate method of observing the ice point is to heap the ice around the stem above the 32 degrees F (O degrees C) division and form a channel in the ice to permit observation of the meniscus. Temperature readings may then be made without raising the thermometer. The initial reading is taken after the thermometer and bath have reached equilibrium; successive readings are taken at intervals of at least 1 minute.

(3) Calculating results. Record the ice point reading and compare it with the previous ice point reading. If the ice point is higher or lower than 32 degrees F, all other temperature readings of the thermometer must be correspondingly increased or decreased; i.e., if the observed ice point is above 32 degrees F, the correction factor is added to the observed reading; if the observed ice point is below 32 degrees F, the correction factor is subtracted from the observed reading. Example: Observed ice point 33 degrees F, add 1 degree F to all observed readings; observed ice point is 31 degrees F, subtract 1 degree F from all observed readings.

c. Preparation of Thermometer. The thermometer is prepared for ice point determination by one of the following methods:

(1) The thermometer is maintained at room temperature (70 degrees F) (21.1 degrees C) for at least 72 hours prior to determine ice point.

(2) The thermometer is heated to a specified temperature and the ice point is determined immediately after heating, or within a stated time period. If the ice point is determined after heating, a note indicating the temperature to which the thermometer was heated and the observed ice point must appear in the certification sheet. The routine laboratory thermometers must be accurate to + or - 0.6 degrees F.

CHAPTER 4

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

4-1. SPECIAL TOOLS AND EQUIPMENT.

There are no special tools or equipment required for maintenance of the laboratory.

4-2. MAINTENANCE REPAIR PARTS.

Repair parts and equipment covering direct and general support maintenance of the laboratory are listed in Appendix C.

Section II. TROUBLESHOOTING

4-3. SCOPE.

a. This section contains repair, adjusting and troubleshooting information and tests for locating and correcting most troubles which may develop for items which require direct support and general support maintenance.

b. This manual cannot list all possible malfunctions that may occur, or all tests or inspections and corrective actions. If a malfunction is not listed, or is not corrected by listed corrective actions, you should notify higher lever maintenance.

4-4. OVEN.

a. Compound Adjustment, Repair, or Replacement. Before making adjustment or repairs, or before replacing components, disconnect the unit from it electrical source and remove the shelves and thermometer.

(1) Oven door. If heat loss occurs, inspect the door closure. The plate on the door that engages the magnetic catch on the cabinet is adjustable. Loosen or tighten it, as applicable, to assure proper door closure. Also inspoect the door gasket to make certain it fits firmly against the cabinet at all points. Replace the gasket, if damaged.

(2) Pilot light. Access to the back side of the control panel is gained by removing the two top and two bottom screws that hold. it in place. When replacement of the pilot lights is necessary tag the lead wires with respect to their relative positions, detach them from the light, and push it outward from the back of the panel. Press the new light into this opening and attach the proper wires to it. Be sure the red portion is on the right side.

(3) Switch. The switch is held in place by means of spring clips. To replace it, tag the lead wires with respect to their relative positions and detach them from the switch, compress the clips, and push the switch outward from the back of panel. Press in the new switch and attach the proper wires to it.

CAUTION

Do not crimp or sharply bend the thermostat bulb capillaries.

(4) Thermostat. When the safety thermostat takes over control of the chamber temperature the control thermostat is faulty. When thermostat failure occurs, it is simpler and quicker to install the entire assembly because a certain amount of calibration and adjustment is necessary if only part of the unit is replaced. Replace the entire thermostat assembly as follows:

(a) Disengage the thermostat bulbs from the retaining clamps by twisting the clips at the bottom of the chamber.

(b) Carefully remove the bottom diffuser panel and remove the control panel.

(c) Disconnect the electrical leads to the thermostat assembly. Remove the control knob setscrews and the screws holding the assembly to the control panel.

(d) Work the thermostat bulbs out of the chamber.

(e) Reverse the above procedure to install the new thermostat assembly.

(5) Heater. Replace a defective heater as follows:

(a) Disengage both thermostat bulbs from the retaining clips on the bottom diffuser panel in the chamber.

(b) Remove the bottom diffuser panel by removing the retaining screws. Work the thermostat bulbs upright and lift the panel out of the chamber, carefully sliding the bulbs through it while noting the hole through which the bulbs were placed.

(c) Disconnect the heater from the bus bars. Do not allow the bus bars to slip down through the porcelain insulators or the control panel will have to be removed to push the bars back.

(d) Lift the heater fro# the chamber, install the new heater, and reconnect the bus bars.

(e) Work the two thermostat bulbs through the hole previously marked in the bottom diffuser panel.

(f) Replace the panel and secure it.

Table 4-1. Oven Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. LOSS OF HEAT CONTROL.
Check for thermostat malfunction,
Replace thermostat if defective.
2. FLUCTUATION OF TEMPERATURES.
Step 1. Check if vent shutter cap is closed,
Open vent shutter cap to maximum.
Step 2. Check if chamber is improperly loaded.
Redistribute load.
Step 3. Check if insufficient time for temperature to stabilize.
Allow one hour for temperature stabilization,
Step 4. Check if line voltage fluctuates.
Check line voltage and correct defect,
Step 5. Check for intermittent failure of switch, thermostat or wiring,
Check and correct defect.
3. HEAT LOSS.
Worn door gasket, or door catch malfunction.
Replace door gasket if damaged, adjust door catch.
4. CHAMBER DOES NOT HEAT.
Step 1, Check if line voltage, switch or electrical connection is malfunc - tioning.

Table 4-1. Oven Troubleshooting-Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Check and correct applicable defect.
step 2. Check if heater is malfunctioning,
Check heater for continuity. Replace if damaged.
5. PILOT LIGHT DOES NOT COME ON.
Step 1. Check for wiring malfunction.
Check wiring and correct applicable defect.
Step 2. Check if lamp is burned out.
Replace lamp.

(g) Carefully work the bulbs back into place and secure them.

c. Troubleshooting. A troubleshooting chart for the oven is listed in table 4-1.

4-5. ICE MAKER.

a. Changing Geared Motor. Change the geared motor as follows:

(1) Remove the aluminum clamp holding the shutoff arm and remove the three Phillips head screws around outer edge of geared motor.

(2) Pull forward on the geared motor and cut the two thin black wires leading to wire nuts. The motor can now be lifted out.

(3) Splice in the wires from the new geared motor and re-mount it with the same three Phillips head screws.

b. Changing the Ice-Release Heater. Change the ice-release heater as follows:

(1) Take out the hex head screws from the aluminum clamp in the top front surface of the inner liner.

(2) Remove both rear panels and pull the suction line outward so that the ice mechanism and evaporator can be pulled thorugh the front of the cabinet.

(3) Remove the insulation from bottom of the freezing mold.

(4) Loosen the geared motor from its mounting. Taking care not to break the two black wires, move the motor aside and remove the four Phillips head screws from behind the geared motor; the screws clamp the freezing mold to the black plastic housing.

(5) Pry the old-ice release heater out of the groove in the bottom of the freezing mold and place a small amount of sealing compound in the groove.

(6) Squeeze in the new heater and reassemble.

Changing Water Valve Switch. Change the water valve switch, (3, fig. 4-1) as follows:

(1) Remove the white plastic front cover (1, fig. 4-1) by loosening the screw (2) two turns.

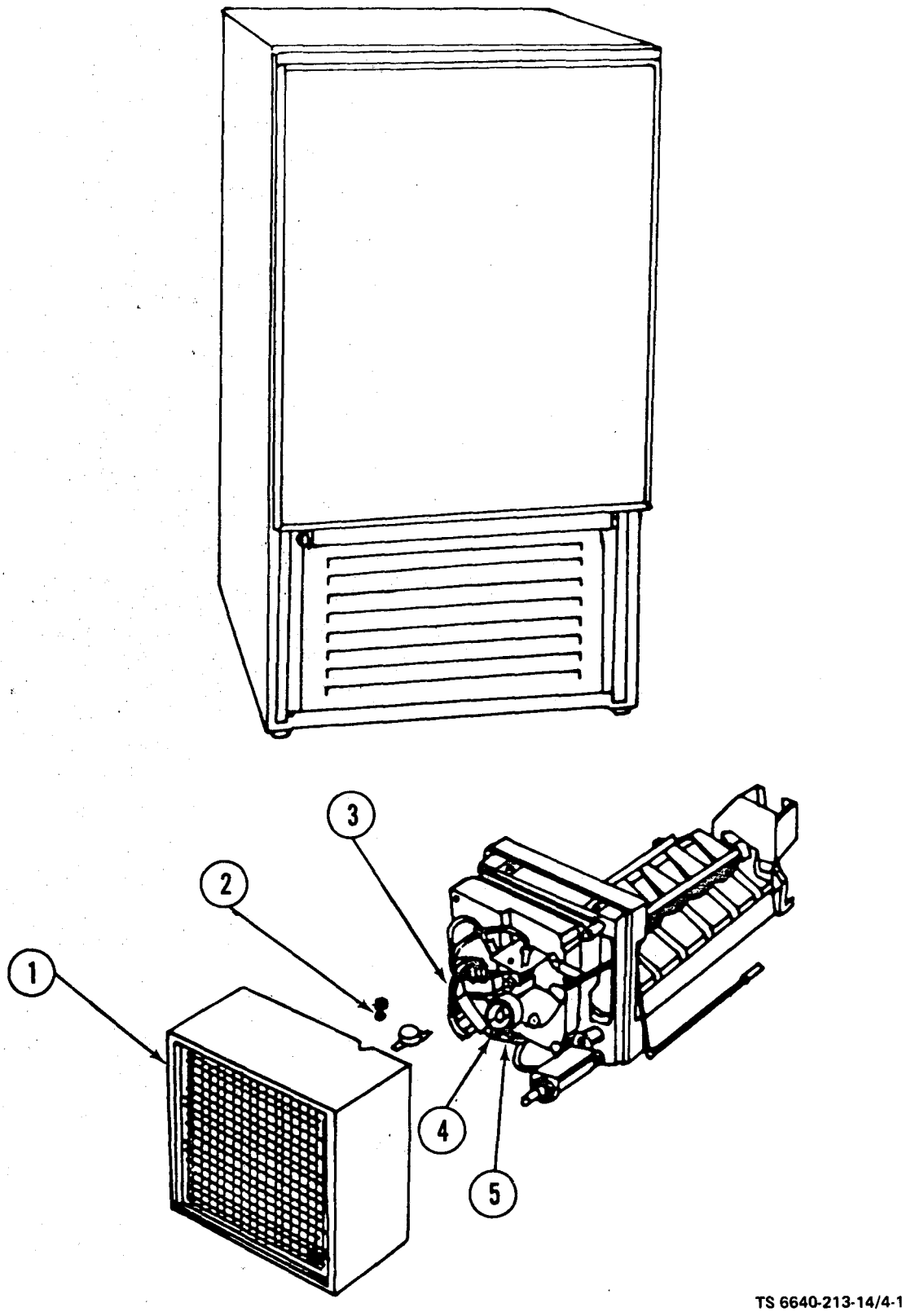

Figure 4-1. Ice Maker.

Legend for figure 4-1:

1. Plastic front cover
2. Screw
3. Water valve switch
4. Holding switch
5. Timing can

(2) Pull forward to remove the front cover and expose the water valve switch.

(3) Remove the one screw that holds the switch, and then remove the old switch.

(4) Install the new switch and adjust the water flow to 5 1/2 ounces per cycle (approx 2/3 cup). Setting the switch closer to the timing cam (5) increases the water flow; raising the switch away from the timing cam decreases the water flow.

d. Changing the Holding Switch. Change the holding switch (4, fig. 4-1) as follows:

(1) Remove the front cover.

(2) Remove the switch mounting attachments, disconnect the wires, and remove the defective holding switch.

(3) To install the new switch, attach wires and set the switch so that the small black button on-the switch is not depressed when it is in the cutout notch on the timing cam.

e. Changing the Temperature Control. Change the temperature control as follows:

(1) Locate the defective control in rear of the cabinet.

(2) Remove the old control and install the new one.

(3) To reset the new control, remove it from the rear of the ice maker, take off the fiber cover, and turn the small brass screw counterclockwise one complete turn the lower the temperature setting. To raise the temperature setting, turn the brass screw clockwise one complete turn.

f. Replacing Motor Coupling. Replace a broken or worn motor coupling as follows:

(1) Disconnect the shutoff arm from the geared motor housing, and remove the three Phillips head screws located around the outer edge of the motor.

(2) Pull the motor forward to provide access to the motor coupling.

(3) Remove and replace the defective motor coupling; make sure that the ejector blades are to the left and are one-quarter of an inch above the edge of the mold.

Adjusting the Bin-Arm Switch. Adjust the bin-arm switch as follows:

(1) Remove the front cover.

(2) Slide the bin-arm switch to the right or left, as needed, until the switch clicks off and back on when the arm is within 1 inch of the freezing mechanism.

h. Troubleshooting. A troubleshooting chart for the ice maker is listed in table 4-2.

4-6. CLASS S WEIGHTS.

The class S weights must be certified at 720-day intervals by the A-level calibration facility. The weight must be certified within the following tolerances.

Gram Weights	Minimum	Maximum
100 grams	99.99975 grams	100.00025 grams
50 grams	49.99988 grams	50.00012 grams
20 grams	19.999926 grams	20.000074 grams
10 grams	9.999926 grams	10.000074 grams
5 grams	4.999926 grams	5.000054 grams
2 grams	1.999946 grams	2.000054 grams
1 gram	0.999946 grams	1.000054 grams

4-7. REID VAPOR PRESSURE APPARTUS.

a. Before Operation Service. Insure that the overflow pipe is tight. Fill bath with water up to level of overflow pipe.

WARNING

A solution of copper sulfate in water is poisonous.

NOTE

The position of the overflow pipe is set to maintain the level of the water at least l-inch above the immersed bomb, as specified by ASTM. Add 1/2 gram of copper sulphate to the bath to create a solution of 10 ppm to minimize algae growth.

Table 4-2. Ice Maker Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. WATER IN ICE BUCKET.
Step 1. Ice maker is not level, causing water to run out of freezing unit into bucket. Level ice maker.
Step 2. Check for poor gasket seal, or obstruction holding door open and causing ice cubes to thaw. Replace door seal or remove obstruction from door. Assure that the ice bucket is pushed in far enough.
2. ICE CUBES STICK TOGETHER.
Step 1. Check if ice maker is not level, causing water to spill from freezing mold into ice bucket. Level ice maker.
Step 2. Check for faulty door seal, causing frost on ice cubes on top. Replace door seal.
Step 3. Check if front grill is blocked by obstruction, causing poor air circulation. Remove obstruction.
Step 4. Check if a hot plate or other heat source is too near the front grille, causing hot air to enter the unit. Move hot plate or other heat source to another location.

Table 4-2. Ice Maker Troubleshooting -Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
3. UNIT NEEDS DEFROSTING WEEKLY.
Step 1. Check if hot airis entering the front grille, causing unit to frost up. Assure that cool air supply is entering front grille.
Step 2. Check for poor door seal, causing frost-forming warm air to enter storage compartment or the door is not closed tightely. Replace door seal if defective. Always ensure that the door is properly closed.
Step 3. Check if chemical content of the water has changed, causing the water to freeze at a different temperature. See paragraph 4-5 (e).
4. THE ICE MAKER IS FREEZING UP, STOPPING ICE CUBE PRODUCTION.
Slow current leakage through electric solenoid valve, causing continuous freezing. Replace solenoid valve.
5. ICE MAKER FAILS TO PRODUCE ICE.
Step 1. Ejector blades are frozen in and cannot eject the cubes. Defrost and restart the ice maker.
Step 2. Faulty door switch causing malfunction of ice maker. Replace door switch.
Step 3. Low voltage or switch in unit compartment is in OFF position. Check line voltage. Place switch in ON position.

Table 4-2. Ice Maker Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 4. Water tank is empty.

Refill water tank.

Step 5. Icemaker has become tipped backwards, causing a frost buildup on the suction line, preventing ice production. (See 12 below.)

Relevel the ice maker.

6. ICE IS SOFT AND WET.

Step 1. Temperature control setting is too warm.

Locate temperature control through rear of cabinet. Turn contro1 to the right.

Step 2. Door is not completely closed.

Close door properly.

Step 3. Ice bucket is too far out, preventing door from closing.

Reposition ice bucket.

Step 4. Air intake grille is obstructed.

Remove obstruction.

7. ICE MAKER FAILS TO SHUT OFF AUTOMATICALLY AFTER ICE. BUCKET IS FULL.

Step 1. Shutoff arm switch is not working properly.

Replace switch (para. 4-5d.).

Step 2. Shutoff arm is frozen in ice (para. 12).

Defrost ice maker and restart.

Table 4-2. Ice Maker Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
8. ICE MAKER FAILS TO MAKE ENOUGH ICE.
Step 1. Temperature control is set too cold.
Turn temperature control to the left.
Step 2. Fan motor is not operating.
Check motor, correct malfunction.
Step 3. The condenser coil behind grille is dirty, causing malfunction.
Clean coil.
9. ICE CUBES ARE CLOUDY.
Air is being trapped as water freezes rapidly.
No remedy required.
10. TOO MUCH WATER COMING INTO FREEZING MOLD.
Step 1. Water valve switch has malfunctioned.
Test switch by depressing the button on top. Note click or tension as switch is being depressed. Adjust or replace switch as required (para. 4-5d.).
Step 2. Check if water control has failed.
Replace control (para. 4-5c.).
Step 3. Check if leakage through the solenoid valve has occurred.
Replace solenoid valve.
11. WATER IS FLOWING OVER THE FREEZING MOLD.
Ice maker is not level.
Level ice maker.

Table 4-2. Ice Maker Troubleshooting -Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

12. WATER IS RUNNING FROM MOLD INTO MECHANISM HOUSING BEHIND WHITE COVER AND THE MICROSWITCHES ARE BECOMING CORRODED AND INOPERATIVE.

Ice maker is not level.

Level ice maker and replace inoperative microswitches.

13. ICE MAKER MOLD IS NOT LEVEL.

Mold mounting has vibrated loose.

Place level on mold. Adjust and retighten mold mounting.

14. CUBES STICKING TOGETHER.

Step 1. Check for poor door seal.

Adjust or replace seal.

Step 2. Check if temperature control improperly adjusted.

Adjust temperature control (para. 4-5e.).

Step 3. Check if ice maker is not level.

Level ice maker.

Step 4. Check for poor air circulation.

Remove obstruction from grille.

Step 5. Check if ice has fused together on standing.

Ruffle or disturb ice daily.

Table 4-2. Ice Maker Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
15. ICE MAKER IS HOOKED UP BUT NO WATER COMES IN.
Step 1. Check if water has not been turned on at saddle valve clamp or at the unit compartment. Turn on valves.
Step 2. Check if the two wires to the solenoid valve behind the grille have become loose or disconnected. Reconnect the wires.
Step 3. Check if ice maker has not been activated. Activate ice maker by reaching in with hands to pull the ejector blades one turn around.
16. THE ICE MAKER IS REFRIGERATING BUT FAILS TO PRODUCE CUBES.
Step 1. Water not turned on at saddle valve clamp. Turn on saddle valve.
Step 2. Check if solenoid valve has malfunctioned. Replace valve.
Step 3. Check if the ejector blades are frozen into the ice maker mold. Defrost and restart ice maker.
Step 4. Check for a broken or worn coupling. Replace coupling.
Step 5. Check for defective door switch. Adjust or replace door switch.

Table 4-2. Ice Maker Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
17. DOOR PANEL DOES NOT HIT OR OPERATE DOOR SWITCH.
Check for defective door switch.
Replace door switch, or fix by gluing a one-eighth inch pieceof plastic to the door panel directly opposite the door switch.
18. ICE MAKER FAILS TO EJECT CUBES.
Step 1. Door switch malfunction.
Replace switch.
Step 2. Check if ejector blades are frozen.
Defrost and restart ice maker.
Step 3. Check if timing cam is out of adjustment.
Adjust timing cam by loosening screws, pulling blades three-sixteenths ofan inch above the edge of the mold and retightening the timing cams screws.
Step 4. Check for faulty limit switch.
If defective replace switch.
Step 5. Check for excessively worn coupling.
Replace coupling.
19. COMPRESSOR IS INOPERATIVE.
Step 1. Check for low line voltage.
Correct defect.

Table 4-2. Ice Maker Troubleshooting-Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
20. CUBES ON TOP OF BUCKET ARE FROSTY.
Step 1. Check for poor gasket seal.
Replace seal.
Step 2. Check if cubes have not been disturbed in a longtime.
Remove top layer of cubes.
21. BLACK BUTTONS ON WATER VALVE SWITCH, HOLDING SWITCH AND SHUTOFF ARM SWITCH DO NOT CLICK WHEN DEPRESSED, AND THE DOOR SWITCH HAS RUST AROUND THE WHITE PLUNGER.
The switches are defective.
Replace switch.
22. EJECTOR BLADES NEED ADJUSTING.
See No. 18 above.
23. DOOR SEAL IS INEFFECTIVE.
Check if the door hinge is sprung.
Put a screwdriver handle at the lower right-hand hinge between the cabinet and the door and push gently on the top right-hand corner. Repeat this on the left-hand side. This will spring the door out at the bottom and push the top, where the poor seal is located, in closer to the cabinet.
24. WATER KEEPS RUNNING AND WON'T SHUT OFF.
Step 1. Faulty water valve switch.
Replace switch (para. 4-5c.).
Step 2, Check for defective solenoid valve.
Replace valve if defective.

Table 4-2. Ice Maker Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 3. Check for defective temperature control. Replace contro if defective (para. 4-5e.).
25. KNOCKING NOISE COMING FROM COMPRESSOR.
Step 1. Ice maker is not level, or faulty compressor. Level ice maker. Refer to refrigeration maintenance personnel.
Step 2. Check if fan motor is not operating. Check fan and correct applicable defect.
26. THE ICE CUBES ARE TOO BIG.
Water valve switch is out of adjustment. Adjust water valve switch to permit less water to enter the ice maker mold (para. 4-5c.).
27. THE ENTIRE SYSTEM IS FREEZING UP.
Ambient temperature is below the freezing point of water. Drain entire system as follows: shut off water supply, disconnect the waterline where it enters the solenoid valve in the unit compartment. Allow the machine to run for one hour so that all water is drained through the system. Leave waterline disconnected until reusing. Mop out any remaining water in the ice maker mold. Leave door propped open two inches so that humidity will not build up inside the cabinet and corrode the microswitches.
28. ICE HAS BUILT UP ON ICE MAKER, BUT IT IS STILL MAKING ICE CUBES.
Ice maker has not beed defrosted for a long time. Defrost ice maker.

Table 4-2. Ice Maker Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
29. ICE MAKER MECHANISM IS NOT DEFROSTING AUTOMATICALLY.
Step 1. Defective temperature control. Adjust or replace temperature control (para. 4-5e.).
Step 2. Check for timing cam malfunction. Adjust timing cam (See 18 above).
30. ICE AND FROST BUILDUP ON SECONDARY EVAPORATOR AROUND THE SIDE WALL.
Ice maker has not been defrosted. The secondary evaporator will not defrost automatically. Defrost ice maker.
31. ICE MAKER FAILS TO REFRIGERATE.
Check if freon is leaking from compressor. Inspect compressor for leak. Refer to refrigerator maintenance personnel.
32. HIGH PITCH OR RINGING NOISE IN UNIT COMPARTMENT.
Step 1. Check if fan blade is at the wrong pitch. Disconnect electrical power to ice maker. Bend each fan blade one-quarter to one-half inch to the rear, this will cause the blades to cut the air at a different angle eliminating the ringing noise.
Step 2. Check if copper refrigeration tube is touching the cabinet, causing noise as unit vibrates. Adjust copper refrigeration tube away from cabinet.

Table 4-2. Ice Maker Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

33. COMPRESSOR RUNS CONTINUOUSLY.

Step 1. Check if temperature control is set too low.

Adjust control (para. 4-5e.).

Step 2. Check if hot air is entering the front grille.

Remove heat source from in front of grille.

Step 3. An obstruction has been placed in front of the grille preventing cool air from entering the unit.

Remove obstruction.

34. HEATER ELEMENTS FAIL TO OPERATE DURING HARVESTING CYCLE.

Step 1. Heater element connections are loose.

Tighten connections.

Step 2. Heater elements are burned out.

Replace elements (para. 4-5b.).

35. STRANGE ODOR AROUND SECONDARY EVAPORATOR SYSTEM.

The secondary evaporator bucket has collected some moisture into which a bacteria culture has grown.

Wash bucket with soap and water solution. Wipe dry and replace bucket.

Table 4-2. Ice Maker Troubleshooting - Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
36. WATER DRIPS OR RUNS SLOWLY INTO ICEMAKER MOLD OR A RESTRICTION IN THE SOLENOID VALVE PREVENTS WATER FROM ENTERING THE ICE MAKER MOLD.
Solenoid valve is defective.
Replace valve.
37. ICE MAKER EJECTOR MOTOR RUNS, BUT THE EJECTOR BLADES DO NOT TURN.
Coupling is broken.
Replace coupling.
38. THE ICE MAKER EJECTOR MOTOR AND EJECTOR MOTOR BLADES TURN CONTINUOUSLY WHILE THE DOOR IS CLOSED.
Step 1. Check for defective temperature control.
Replace control (para. 4-5e.).
Step2. Check for defective holding switch.
Replace switch (para. 4-5c.).

NOTE

When bombs are first immersed in the bath, an equal amount of water will drain out overflow pipe.

Next, check the thermoregulator. Inspect the regulator closely, observing for presence of gas bubbles in mercury column. If bubbles or separation of mercury in column exist, heat bulb gently until bubbles are driven up into the expansion chamber. Cool slowly in a vertical position allowing mercury to receed slowly to form a solid column without bubbles or separation.

b. To calibrate the thermoregulator, immerse regulator in the bath at a temperature lower than that at which the bath is to be regulated. Place a calibrated ASTM No. 18F thermometer in the bath. Bring bath temperature up to 96 degrees F to 98 degrees F, rotate the micro-set magnetic coupler until the indicator light on the control box is out; rotate the magnetic coupler until indicator light is on; continue making minor adjustments until the bath temperature is maintained at the desired temperature (100 degrees F +0.2 degrees F or -0.2 degrees F).

c. After Operation Service.

(1) Lubrication. Through oil cap of stirrer meter, apply several drops of a good grade machine oil (PEl) every 4 months.

(2) To Drain Bath. Unscrew the overflow pipe until pipe is free. Pipe can then be lifted out of bath or pushed to the side until all water is drained out.

(3) Cleaning. Wipe all components with clean damp cloth.

d. Troubleshooting. Refer to table 4-3 for troubleshooting.

4-8. VOLT-OHM MULTIMETER.

a. Battery Replacement.

(1) Two batteries are used inside the case to supply power for resistance measurements. One is a 1.5 volt D cell and the other is a 9-volt battery. When it is no longer possible to adjust the pointer to zero for the RX1 and RX1OO ranges, replace the 1.5 volt cell. When it is no longer possible to adjust the pointer to zero on the RX1O,OOO range, replace the 9-volt battery.

(2) To install or replace a battery, remove the cover to the externally accessible battery compartment by loosening the single captivated screw. A small coin may be used to loosen the screw.

Table 4-3. Reid Vapor Pressure Apparatus Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
LOSS OF TEMPERATURE CONTROL OF BATH WATER,	
Step 1.	Check if stirrer motor is malfunctioning. Check electrical connections to stirrer motor. Check stirrer rod (may be bent) and propeller (may be missing). Assure proper water circulation. Correct applicable defect.
Step 2.	Check for heater element malfunction. Check electrical connections and assure that there is proper power supplied to elements. Using electrical circuit tester assure proper function of elements. Correct applicable defect.
Step 3.	Check thermoregulator for malfunction. Check thermoregulator. Reset and calibrate as required. Check location of thermoregulator. Restore to proper location as required. Check condition of thermoregulator. Replace if cracked or broken. Reset if bubbles are noted in mercury columns.

NOTE

When the batteries reach the end of their useful life, they should be replaced propmtly. Failure to do so may result in corrosion at the battery contacts due to battery leakage.

(3) Observe polarity when replacing the 1.5 volt D cell and connect as indicated. The D cell is held in place with spring clips which also act as battery contacts. Polarity for the D cell is marked adjacent to the battery contact clips. The 9-volt battery contacts and connector are polarized. To remove the 9 volt battery, first withdraw battery with mated connector from the compartment. Then remove the connector.

b. Fuse Replacement. The fuse is mounted in a holder in the externally accessible battery and fuse compartment. A spare fuse is located in a well between the + terminal of the D cell and the side of the case. Access to the compartment is obtained by loosening the single captivated screw on the compartment cover. To replace a burned out fuse, remove it from the holder and replae it only with a 1 ampere, 250 volt, quick/acting type 3AG fuse or equivalent. When removing the fuse from its holder, first remove the 9-volt battery.

4-9. VACUUM PUMP.

a. Flushing Pump. Flush the pump as follows:

(1) Remove the inlet (vacuum) regulator valve (fig. 4-2) and completely close down the outlet (Pressure) regulator valve. This will shut off the bypass bleed hole in the valve body so that all vented air must pass thrugh the outlet filter and hose connector.

(2) Wrap the oulet hose connector loosely with a rag or wiping tissue to retain any droplets of solvert that may emerge.

(3) Start the pump, and with an eyedropper inject two to three cc of solvent, P-D-680, or derosene into the vacuum regulator valve, while closing off the vacuum hose connector with a finger of thumb (fig. 4-3).

WARNING

Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 degrees F - 138 degrees F (38 degrees C - 59 degrees C).

(4) Continue running the pump until all injected solvent has passed through on into the outlet filter cup.

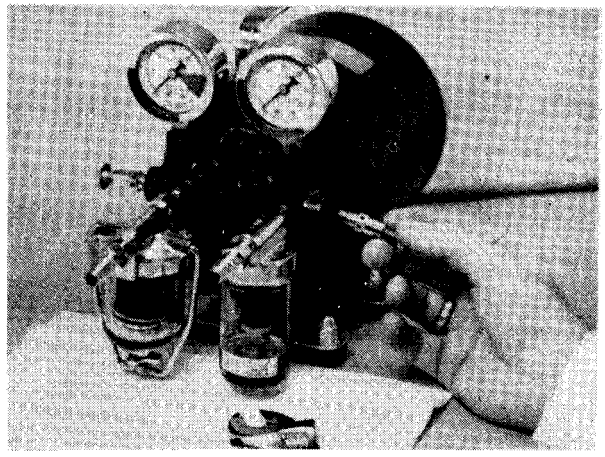

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Figure 4-2. Use a Wrench to Remove Inlet Regulator Valve on Vacuum Side of Pump.

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Figure 4-3. With an Eyedropper, Inject 2-3 cc of Solvent into Orifice Formerly Occupied by Inlet Regulator Valve, While Blocking Off Vacuum Hose Connector.

(5) Shut off the pump, remove the oulet filter assembly and clean its components including the Chemistone filter element (fig. 4-4) with solvent.

(6) Reassemble the pump and run it briefly to test. If after flushing the pump still does not operate properly, the pump vanes may need further cleaning.

b. Cleaning Pump Vanes. Clean as vanes as follows:

(1) Remove the inlet oil cup and outlet filter and oil pump assembly with a wrench.

(2) Detach the end plate by removing the six Phillips-head screws on the front on the pump.

NOTE

Do not attempt to remove the rotor.

(3) Remove the four vanes from their slots in the rotor (fig. 4-5), and wash them, the end plate and pump chamber with solvent.

(4) Wipe the front of rotor with a lint-free cloth moistened (not wet) with solvent.

(5) Air dry the components, then lubricate with SAE 10 pneumatic oil.

NOTE

Heavily abraded or unevenly worn edges or vanes should be replaced.

(6) Before instaling cleaned or new vanes, not that one of the long edges of the vane is notched by a shallow file mark. When inserting vane in the rotor slot, the notched edge must face rotor shaft.

Troubleshooting. A troubleshooting chart for the vacuum pump listed in table 4-4.

4-10. DISTILLATION TEST APPARATUS.

To repair or replace a defective component on this apparatus, proceed as follows:

a. Remove power cord from outlet.

b. Remove drawer that is under the apparatus by removing attaching screw, washers and nuts (fig. 4-6) and lifting front of drawer up and off drawer slides.

c. Free apparatus from counter top brackets by removing attaching bolts, washers and nuts securing brackets to counter (fig. 4-7).

Table 4-4. Vacuum Pump Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. PUMP FAILS TO START, OR HUMS WITHOUT OPERATING
Step 1. Check for defective power cord. Check and repair or replace defective part.
Step 2. Check for defective switch. Check switch, if defective replace.
Step 3. Check if unit is very cold and therefore hard to start. Bring pump to room temperature and start.
Step 4. Check if vanei s stuck in a rotor slot. Clean pump (para 4-9a.)

Table 4-5. Vacuum Pump Flow Rates

Air flow rates at different vacuum and pressure settings are given below. For vacuum operation, pump exit pressure is 1 atmosphere (14. 7 psia).

Vacuum	- mm Hg:	0(1)	127	254	381	508(2)	635(2)
	- in. Hg:	0	5	10	15	20	25
Flow	- LPM:	37	31	23	17	8.5	2.8
	- CFM:	1.3	1.1	0.8	0.6	0.3	0.1
Pressure	- kg/cm2:	0(1)	0.4	0.7	1.1	1.4(2)	1.8(2)
	- psig:	0	5	10	15	20	25
Flow	- LPM:	37	31	28	26	23	20
	- CFM:	1.3	1.1	l.O	0.9	0.8	0.7

(1) no restriction: regulator thumbscrew fully unscrewed.

(2) intermittent operation only.

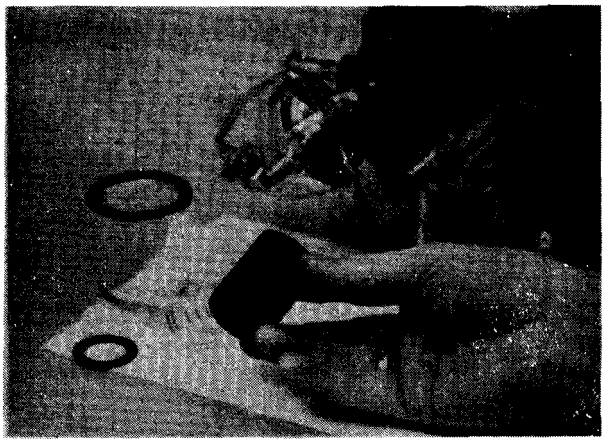

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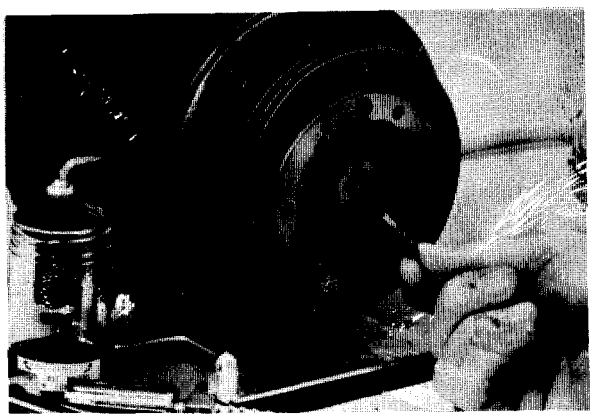
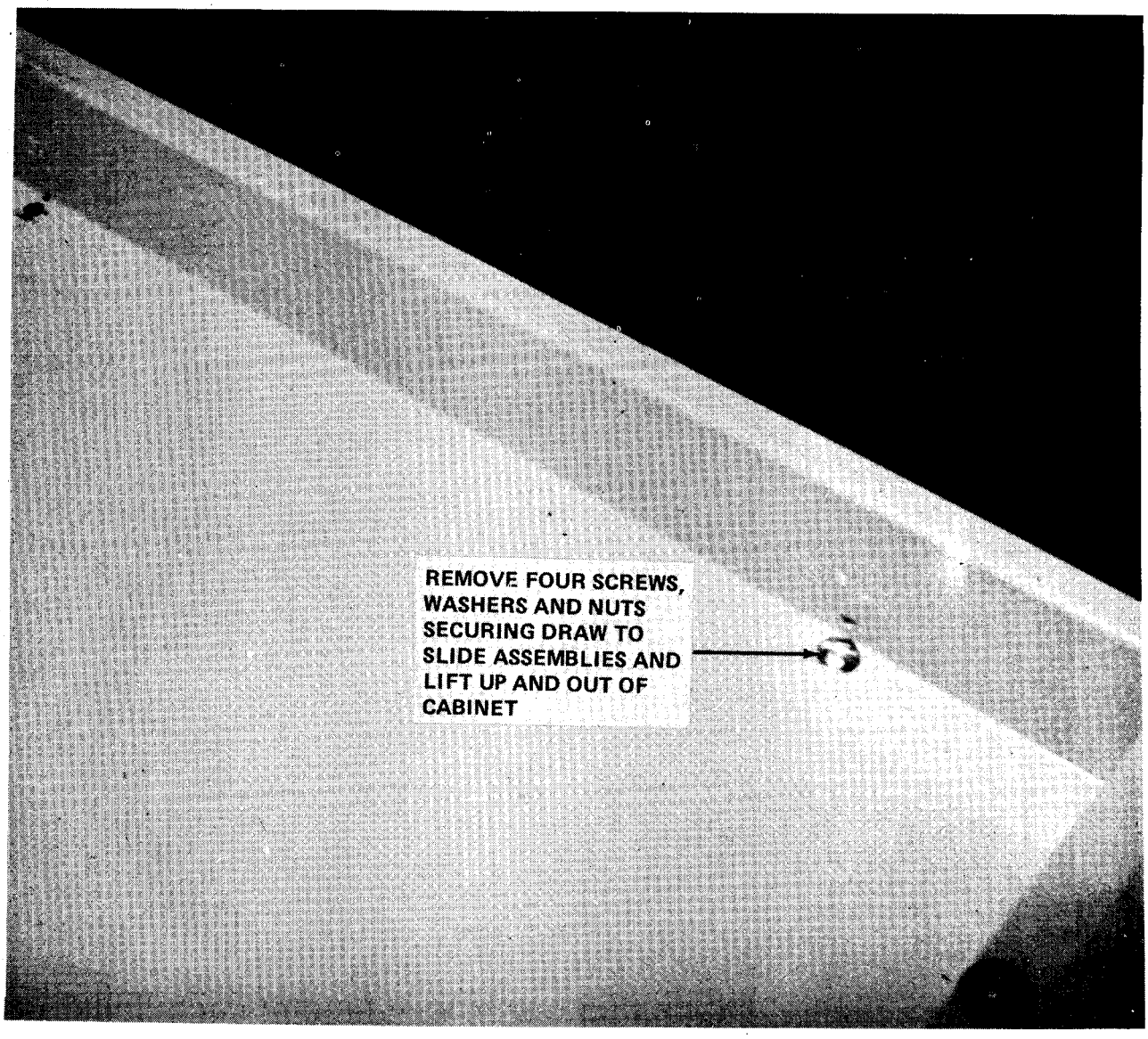
Figure 4-4. Cleaning Chemistone Filter Element With Solvent



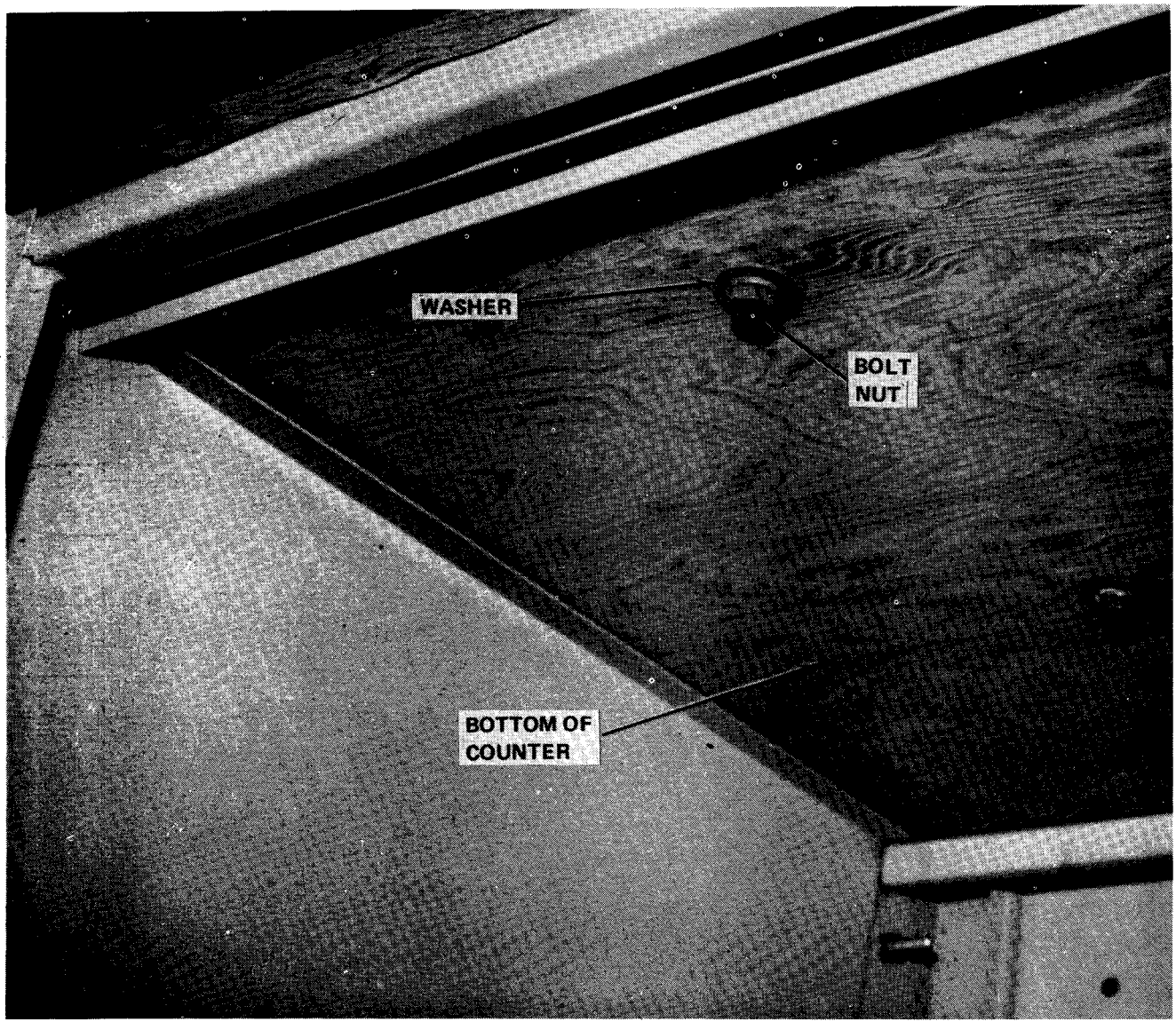
TS 6640-213-14/4-5

Figure 4-5. Removing End Plate Gives Access To Pump Vanes, When Replacing A Vane. Notched Edge of Vane Should Be Towards Rotor Shaft.



TS 6640-213-14/4-6

Figure 4-6. Drawer Removal Procedures



TS 6640-213-1414-7

Figure 4-7. Removing Attaching Hardware from Under Counter

d. Turn the apparatus on its side so that the internal components located at the bottom are accessible (fig. 4-8).

With the aid of the volt-ohm multimeter, supplied with the laboratory, perform continuity and short tests of the items suspected of not working.

f. To replace the switch (fig. 4-9), press the side holding springs on switch, from the inside of the apparatus and push out on the switch until free of stainless steel housing. Tag wires, then loosen screws and remove.

g. To remove auto-transformer proceed as follows:

(1) Loosen setscrew holding knob on the auto-transformer shaft (fig. 4-9).

(2) Remove nut and washer located under knob, lift off heat range dial and push auto-transformer shaft through stainless steel housing.

(3) Tag wiring to auto-transformer (fig. 4-10).

(4) Disconnect wiring connector (fig. 4-11) from wiring harness going to heater element and auto-transformer.

h. Remove heater aboard (fig. 4-12) by carefully pulling up and out of apparatus. Turn board sideways and remove heavy wire leads coming from auto-transformer. When leads are free from heater board, board can be lifted free of apparatus.

i. Install all items in the reverse order of removal. After apparatus is assembled and tested, attach to counter top, and install cabinet drawer to slide assembly with four screws, washers, and nuts (fig. 4-6).

4-11. WATER PUMP.

The water pump requires no lubrication.

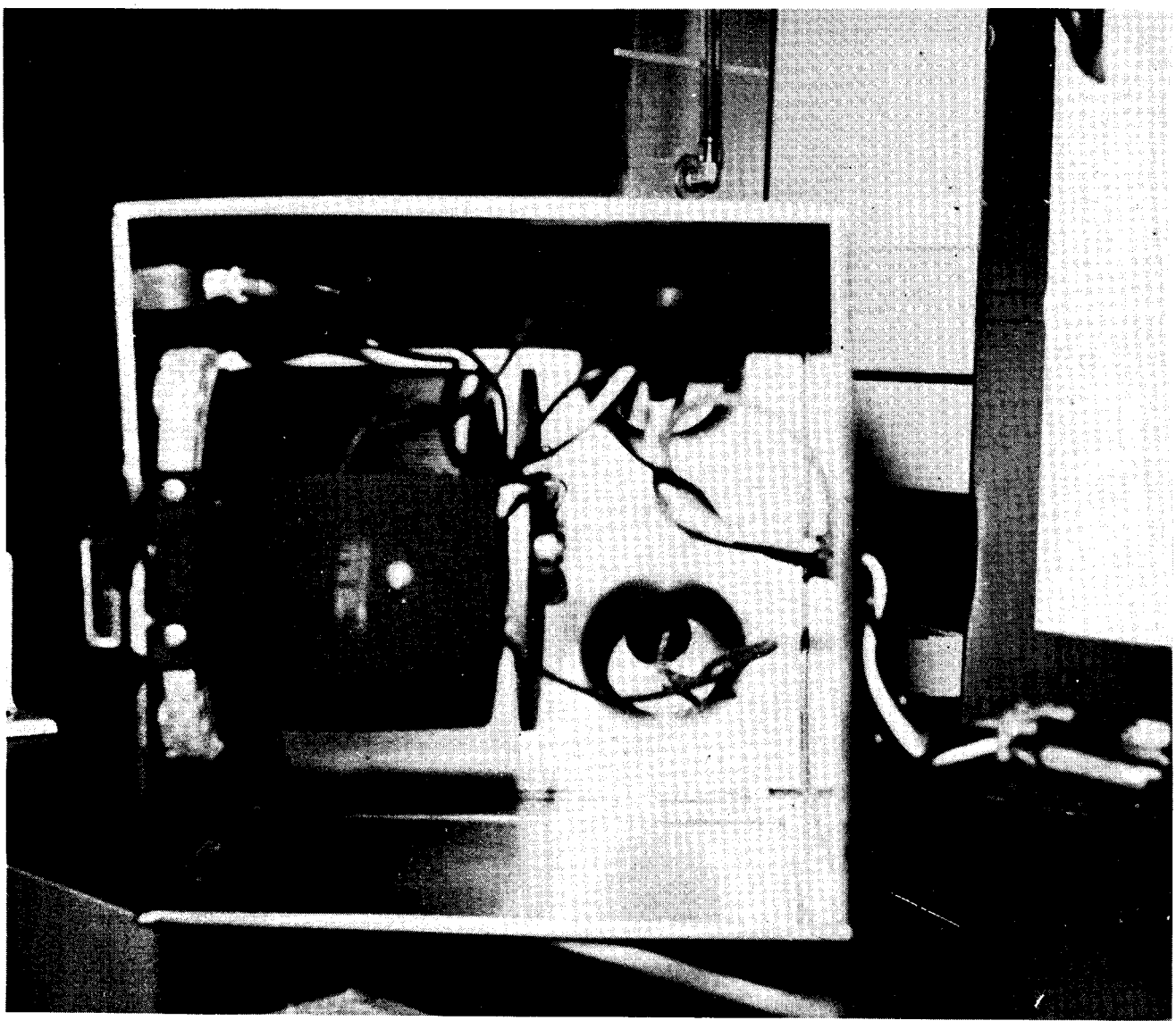
a. Before-Operation Service. Check electrical connection to pump motor.

b. During-Operation Service. Inspect pump and motor assembly, being alert for unusual noises or smells that could indicate malfunction. Check pump for leaks at shaft.

CAUTION

Overtightening of packing nut may cause motor damage. Tighten packing nut with motor operating just enough to stop leak.

c. After-Operation Service. Refill reservior with potable water. Inspect pump and motor for leaks. Make necessary repairs.



TS 6640-213-14/4-8

Figure 4-8. Bottom View of Components in Apparatus

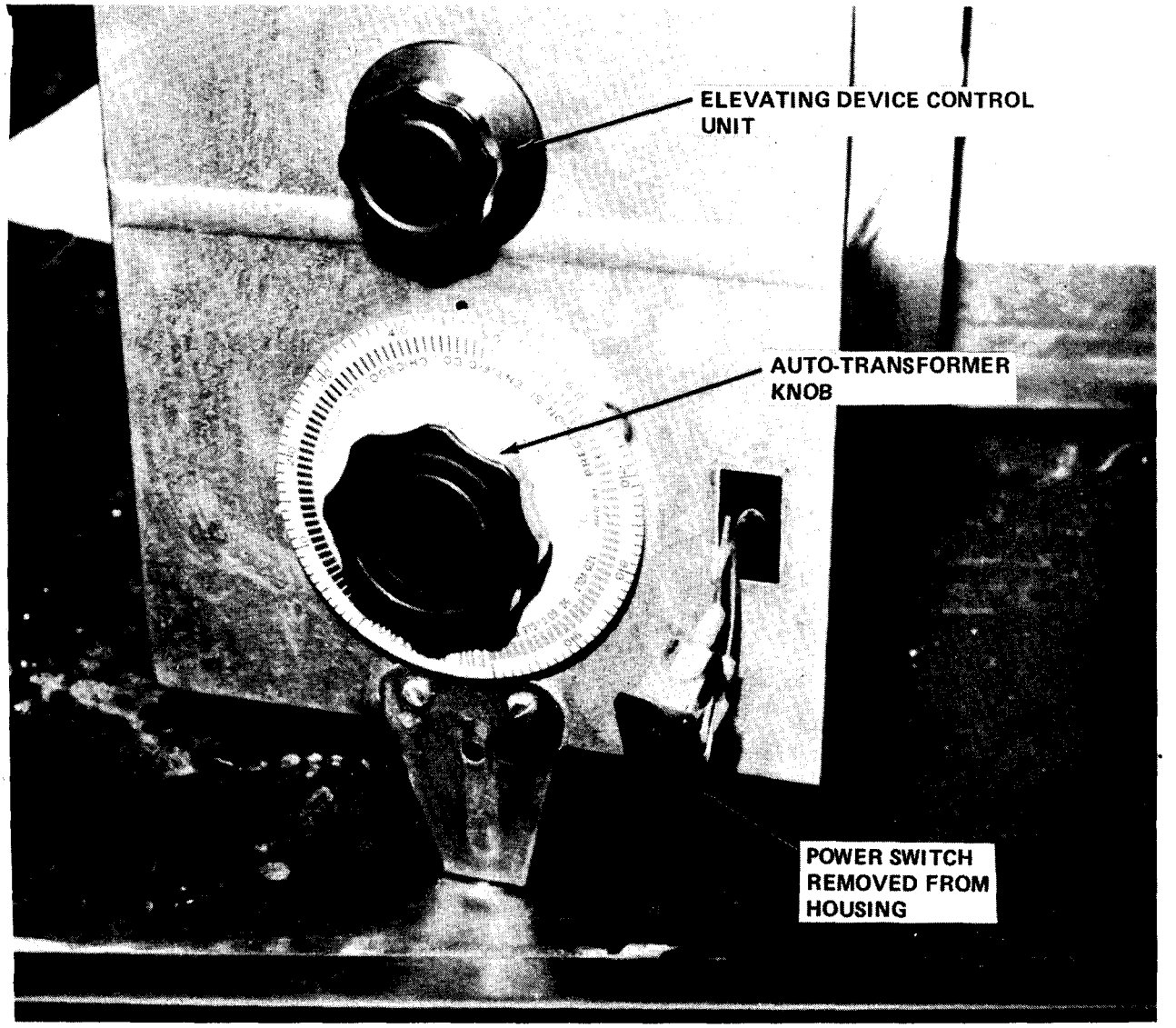
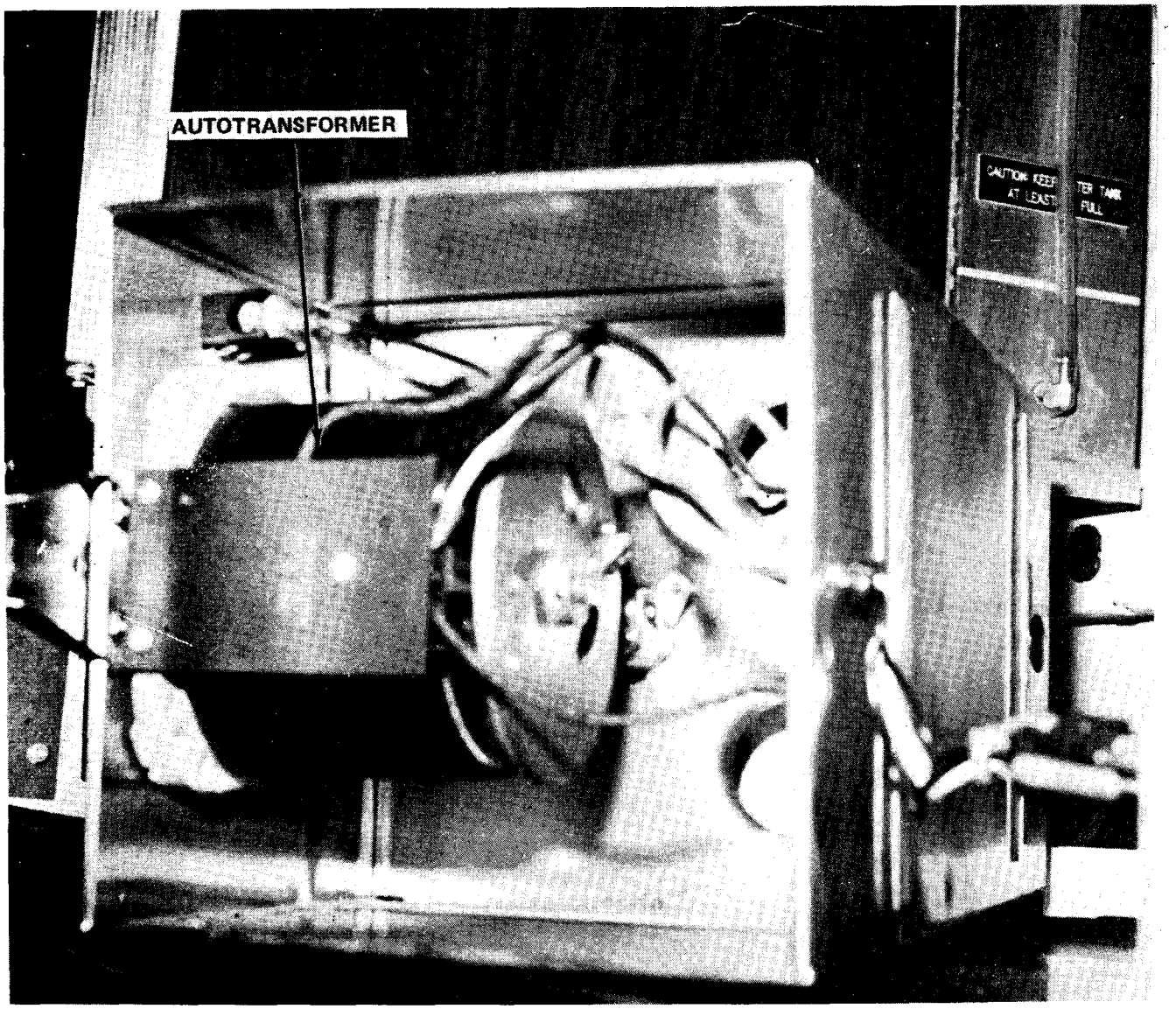


Figure 4-9. Removing Setscrew and Knob from Auto-Transformer



TS 6640-213-14/4-10

Figure 4-10. Tag All Wiring to Auto-Transformer.

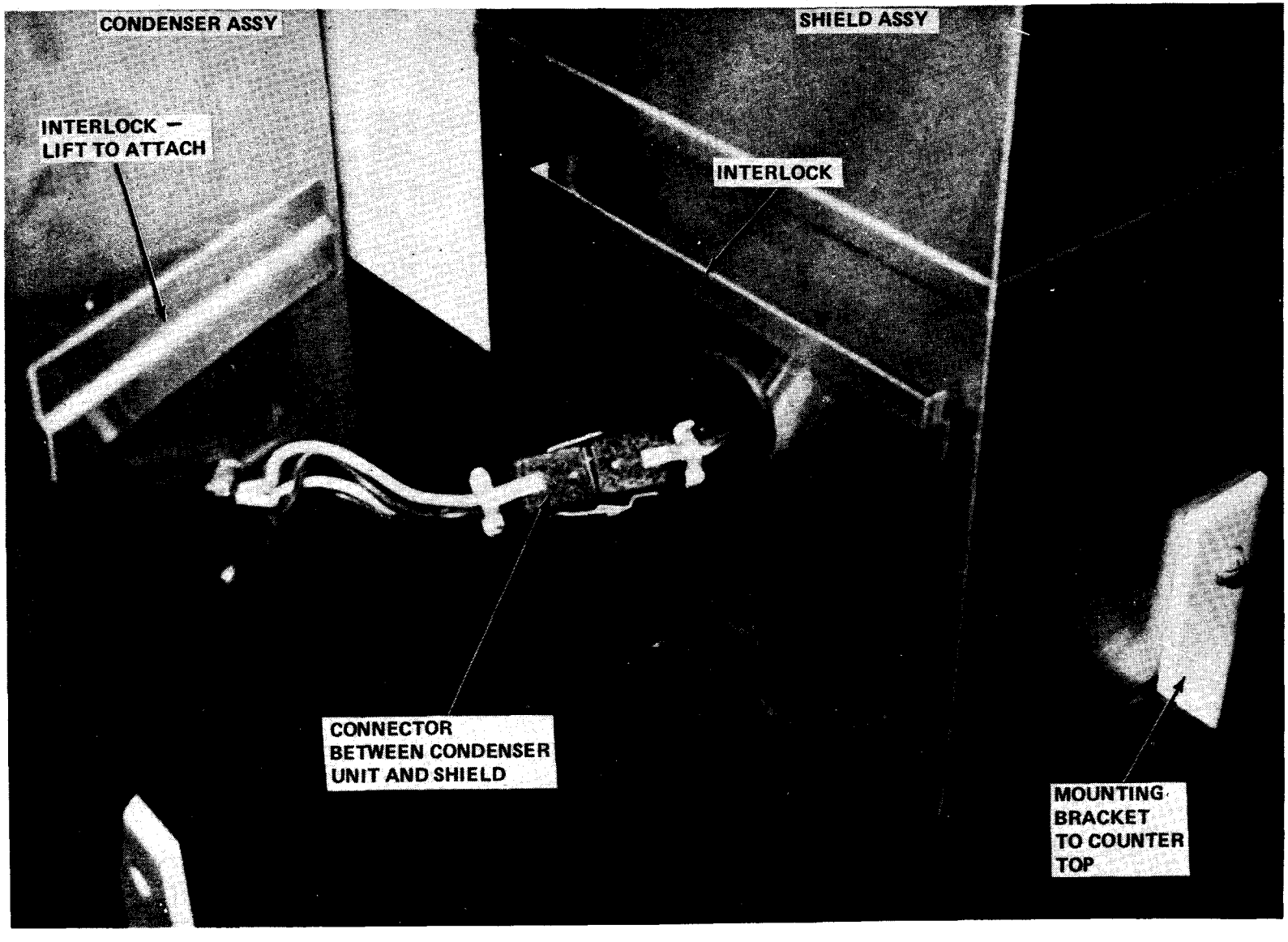
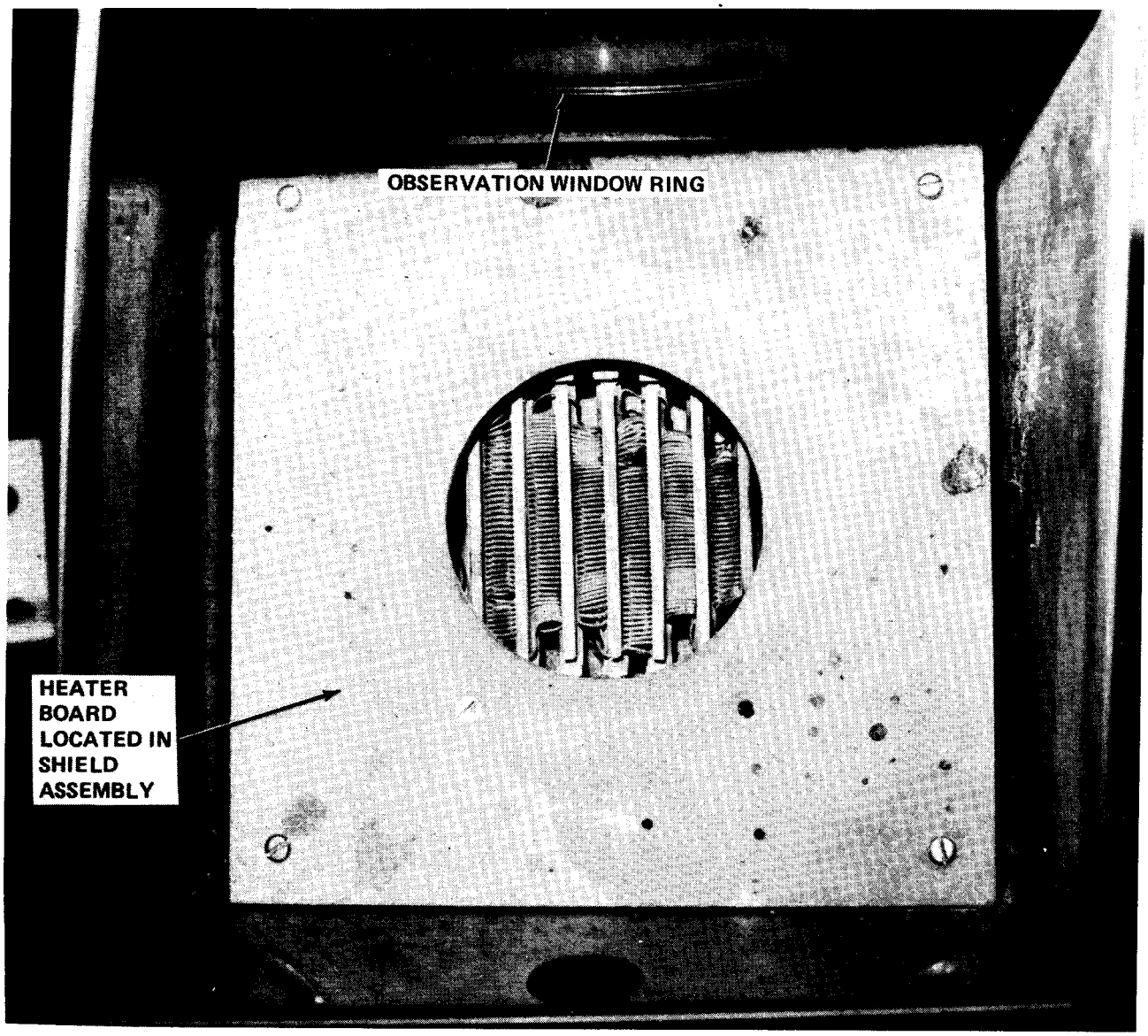
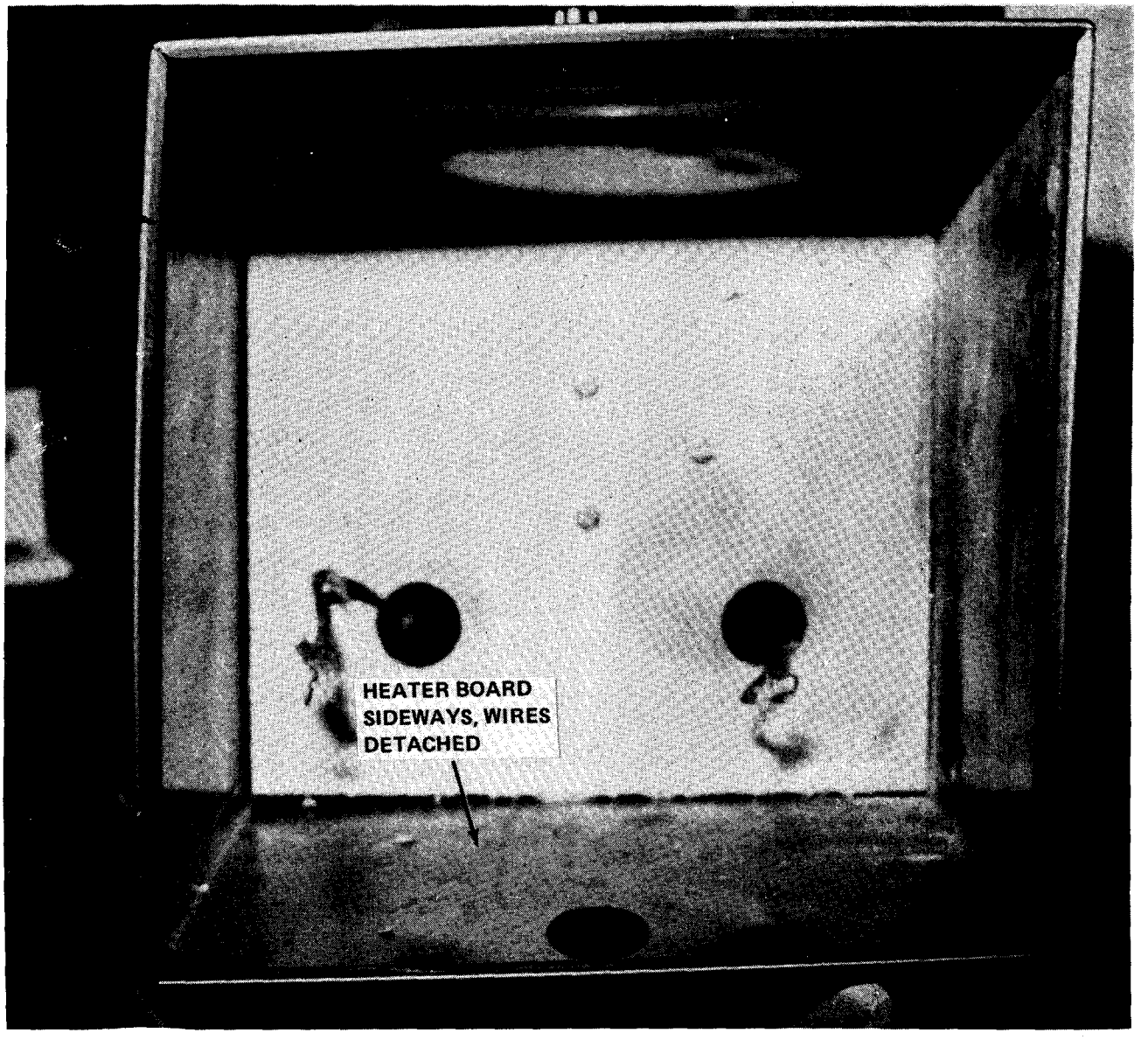


Figure 4-11. Location of Apparatus Connector



TS 6640-213-14/4-12

Figure 4-12. Heater Board Being Lifted from Apparatus



TS 6640-213-14/4-13

Figure 4-13. Heater Board Removed from Apparatus

4-12. PURGING BLOWER (EXHAUST FAN).

a. Check that exhaust louvers open and close.

b. Check that baffle plate, fan guard and attaching hardware are secure.

c. Check that fan is activated when switch (S3) is energized.

d. Check that fan operates and louvers open to exhaust position when zero adjust shaft is turned clockwise to energize the gas alarm system.

e. Troubleshooting. A troubleshooting chart for the fan is listed in table 3-2.

APPENDIX A

REFERENCES

A-1. TECHNICAL MANUALS (TM).

5-4120-274-15	Operator, Organizational, Direct Support, General Support, and Depot Maintenance Manual: Air Conditioning Units, Electric Motor Driven, 9,000 Btu/hr, Vertical Compact, 230 Volt, Single Phase, 50/60 Cycle (Thermo-Air Model CV-9-1-30-60) NSN 4120-00-935-1612; 9,000 Btu/hr, Vertical Compact, 208 Volt, 3 Phase, 400 Cycle (Thermo-Air Model CV-9-3-08-400) NSN 4120-00-935-1610; 9,000 Btu/hr, Vertical Compact, 208 Volt, 3 Phase, 50/60 Cycle (Thermo-Air Model CV 9-3-08-60) NSN 4120-00-935-1611
5-6630-216-12	Testing Kit Fuel Contamination, Portable, NSN 6630-01-008-5524
10-0065	Significance of ASTM Test for Petroleum Products
1978 Annual ASTM Standards	Petroleum Products (1) D-56-D-1660
1978 Annual ASTM Standards	Petroleum Products (11) D-1661-D-2896
11-5410-213-14P	DS, GS, and Depot Maintenance Repair Parts and Special Tools Lists: Shelters, Electrical Equipment, S-280 A/G and S-280 B/G

A-2 . TECHNICAL BULLETINS (TB).

9-6625-961-35	Calibration Procedures for Multimeter, Simpson Model 260-5
9-6620-201-50	Calibration Procedures for Hydrometer Kit (7907391)
9-6670-254-50	Calibration Procedures for Weights (Mass) (General)
9-6620-210-50	Calibration Procedures for Dial Indicating Pressure Gages (0 to 10,000 psi)
9-6685-314-50	Calibration Procedures for Self-Indicating Thermometers (Celsius and Fahrenheit)
750-236	Calibration Requirements for the Maintenance of Army Materiel
750-240	Maintenance and Repair Procedures for S-141/G, S-144/G, S-250/G,

S-280/G, and S-318/G Type Shelters

A-3 . OTHER.

ASTMD -3240-75	Standard Method of Test for Undissolved Water in Aviation Turbine Fuels.
FM 10-69	Aircraft Fueling
FM 10-72	Petroleum Testing Facilities, Laboratories , and Kits
MIL-L-52733 (ME)	Laboratory, Airmobile, Aviation Fue 1
MIL-5-55286 (EL)	Shelter, Electrical Equipment S-6280/G

A-4 . FIELD MANUALS (FM) .

FM 10-70	Inspecting and Testing Petroleum Products

APPENDIX B

COMPONENTS OF END ITEM

B-1. SCOPE.

This appendix lists integral components of end item and basic issue items for the petroleum laboratory to help inventory items required for safe and efficient operation.

B-2. GENERAL .

Components of End Item List is divided into the following sections:

a. Section II, Integral Components of the End Item. These items, when assembled, comprise the Petroleum Laboratory and must accompany it whenever it is transferred or turned in. Illustrations will help you identify these items.

b . Section III, Basic Issue Items. A list of items which accompany the petroleum laboratory and are required by the operator/ crew for installation, operation, or maintenance.

B-3. EXPLANATION OF COLUMNS.

a. Illustration. This column is divided as follows:

(1) Figure Number. Indicates the figure number of the illustration on which the item is shown (if applicable).

(2) Item Number. The number used to identify item called out in the illustration.

b. National Stock Number (NSN). Indicated the National Stock Number assigned to the item and which will be used for requisition.

c. Part Number (P/N). Indicates the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items.

d. Description. Indicates the Federal item name and, if required, a minimum description to identify the item.

e. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on to an adjacent area.

f. Useable on Code. Usable on Codes are not applicable.

g. Quantity requried (Qty Reqd.). This column lists the quantity of each item required for a complete major item.

h. Quantity. This column is left blank for use during inventory. Under the Rcv'd column, list the quantity actually received on major item. The Date columns are for use when you inventory the major item at a later date such as for shipment to another site.

Section II. INTEGRAL COMPONENTS OF END ITEM

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8) Quantity			
(a) Figure No.	(b) Item No.	National Stock Number	Part No. & FSCM	Description	Location	Usable on Code	Qty Reqd	Rcv'd	Date	Date	Date
B-8	2	6810-00-753-4780	(22527) A-19	Acetone, Spectranalyzed, ACS, CH_3COCH_3, 1 Qt. Bottle	Drawer 8	NONE	6				
Not Shown	Not Shown	NNSN	(05083) 23-4027	Adapter, Test Socket	Not Shown	NONE	1				
3-1	6	6665-00-410-4951	(05083) CD800W	Alarm, Gas, Automatic, w/Alarm Filament	Right Front Wall	NONE	1				
B-7	10	6240-00-143-7428	(05083) 354-097	Lamp, Alarm	Drawer 7	NONE	1				
B-7	11	6240-00-902-4660	(05083) 354-128	Lamp, Failure	Drawer 7	NONE	1				
B-7	8	6240-00-057-2887	(05083) 354-020	Lamp, Pilot	Drawer 7	NONE	1				
B-7	9	6240-00-682-3411	(05083) 354-120	Lamp, Test	Drawer 7	NONE	1				
B-7	12	6110-00-464-0671	(05083) 360-131	Regulator, Voltage	Drawer 7	NONE	1				
B-7	3	6665-00-410-4951	(05083) 23-0412	Filament, Alarm	Drawer 7	NONE	1				
B-7	5	5945-00-434-2525	(05083) 361-085	Relay, Alarm	Drawer 7	NONE	1				
B-7	13	5945-00-434-2424	(05083) 361-139	Relay, Failure	Drawer 7	NONE	1				
B-7	6	5930-00-132-8370	(05083) 355-016	Switch, Reset	Drawer 7	NONE	1				
B-13	10	8415-00-082-6108	(80740) 1-480 Large	Apron, Rubber	Drawer 39(2)	NONE	2				
B-24	1	6670-00-494-8152	(53088) 2400-2463	Balance, Analytical, w/Case	Cabinet No. 23	NONE	1				
			(53088) 72-60-09-8 (*)	Bulb, Light, 6 Volt, 5 Watt		NONE	6				
			(53088) 69-05-150-2 (*)	Bulb, Signal, Series 2400		NONE	1				
			(53088) 69-00-070-3 (*)	Door, Glass, Right		NONE	1				
			(53088) 69-00-060-6 (*)	Door, Glass, Left		NONE	1				
			(53088) 69-05-070-1 (*)	Plate, Glass, Weighing Chamber		NONE	1				
			(53088) 69-01-100-1 (*)	Knob, Control, Micrometer		NONE	1				
			(53088) 69-01-190-0 (*)	Knob, Control, Zero		NONE	1				

Section II. INTEGRAL COMPONENTS OF END ITEM - Continued

(1) Illustration (a) Figure No.	(1) Illustration (b) Item No.	(2) National Stock Number	(3) Part No. & FSCM	(4) Description	(5) Location	(6) Usable on Code	(7) Qty Reqd	(8) Quantity Rcv'd	(8) Quantity Date	(8) Quantity Date	(8) Quantity Date
		6670-00-436-9857	(22527) 2-052-5D	Balance, Double Beam, *w/o* Weights		NONE	1				
1-3	29	6685-00-255-9507	(2257) 2-405	Barometer, Aneroid, (u/o ASTM D-86)	Left Wall	NONE	1				
1-3	24	6640-00-522-1886	(80740) 66-937-12	Bath, Corrosion Test (u/o ASTM D-130-75)	Left Counter Top	NONE	1				
			(48619) 232064 (*)	Gasket, O-Ring, Test Bomb		NONE	25				
			(22527) 13-420-45 (*)	Test Tube, Flat		NONE	1				
			(48619) 239079 (*)	Thermostat		NONE	1				
2-8		6630-00-359-9629	(48619) 74893	Bath, Reid Vapor Pressure, 3 Bomb Capacity, (u/o ASTM D323-72)	Right Side Counter	NONE	1				
			(48619) 240119 (*)	Switch, Line		NONE	1				
			(48619) 522235 (*)	Thermoregulator		NONE	1				
			(48619) 248162 (*)	Relay, Mercury, 120V		NONE	1				
			(48619) 234026 (*)	Pilot Light, 120V		NONE	1				
		6135-00-542-6216	(81349) W-B-101, Class F, Size D	Battery, Dry Cell (For Flashlight)		NONE	2				
B-19	3	6640-00-403-3500	(96906) MS35992-7	Beaker, Laboratory, 400 ML	Drawer No. 18	NONE	6				
B-18	1	6640-00-403-5000	(96906) MS35992-9	Beaker, Laboratory, 1000 ML	Cabinet No. 17	NONE	3				
B-10	3	3030-00-478-8368	(80740) 6541	Belt, Drive, Stirrer Ay (Pensky-Martens) (u/o ASTM D-93-73)	Cabinet No. 10	NONE	1				
B-9	4	6630-00-522-1893	(22527) 13-420-20	Bomb, Corrosion Tesl (u/o ASTM D-130-75)	Drawer No. 9	NONE	2				
B-1	9	7610-00-939-7387	NPN	ASTM Standards - Petroleum Products (TM 10-1166)	Drawer No. 1	NONE	1				
B-1	8	NNSN	(80740) Cata-log No. 14	Catalog, Greiner Laboratory Equipment	Drawer No. 1	NONE	1				
B-1	10	NNSN	NPN	Significance of ASTM Tests (TM 10-1165)	Drawer No. 1	NONE	1				
B-23	8	6640-00-131-4566	(80740) 27-084	Borer Set, Cork	Drawer No. 22	NONE	1				

Section II. INTEGRAL COMPONENTS OF END ITEM - Continued

(1) Illustration		(2)	(3)	(4)	(5)	(6)		(8) Quantity			
(a) Figure No.	Item No.	National Stock Number	Part No. & FSCM	Description	Location	Usable on Code	Qty Reqd	Rcv'd	Date	Date	Date
B-12(1)	2	8125-00-400-7958	(80740) 49-905-51-1	Bottle, Polyethylene, 1 Gal.	Cabinet No. 12	NONE	6				
B-13(1)	3	8125-00-174-0852	(22527) 2-923-104	Jug, Polyethylene, 1 Gal., Complete with 38-43D Cap.	Cabinet No. 13	NONE	2				
2-13	3	4610-00-522-1882	(80740) 30-867-10	Bracket, Water Demineralizer	Left Wall	NONE	2				
B-13(2)	2	7920-00-240-7178	(80740) 7-740	Brush, Beaker, 13 In Lg.	Cabinet No. 13	NONE	1				
B-13(2)	3	7920-00-494-3688	(80740) 7-770-2	Brush, Flask, 14 In. Lg.	Cabinet No. 13	NONE	2				
B-4	1	7920-00-205-0565	(80740) 7-760	Brush, Camel's Hair	Analytical Balance Case	NONE	1				
B-13(2)	5	7920-00-282-7784	(80740) 7-890	Brush, Test Tube, 8 In. Lg.	Cabinet No. 13	NONE	3				
Not Shown	Not Shown	NNSN	(97403) 13219E1524	Cable Ay, Power, 4 Conductor, 50 Ft. Lg,	Not Shown	NONE	1				
1-4	27	6640-00-986-5033	(96906) MS35217-3	Cabinet, Desiccating (u/o ASTM D-2276-73	Right Wall	NONE	1				
B-6	1	5350-00-184-6255	(22527) C-190	Powder, Carborundum, 150 Grit, 1 Lb. Can (u/o ASTM D-130-75)	Drawer No. 6	NONE	1				
B-13(1)	5	6640-00-222-8261	(80740) 30-867-04	Cartridge, Water Demineralizer (Organic)	Cabinet No. 13	NONE	3				
B-13(1)	6	6640-00-729-4486	(80740) 30-867-02	Cargridge, Water Demineralizer (Calcium Carbonate)	Cabinet No. 13	NONE	3				
B-23	6	6640-00-024-2279	(96906) MS36003-1	Clamp, Rubber Tubing	Drawer No. 22	NONE	3				
B-23	7	5940-00-892-8281	(22527) 2-513-10	Clamp, Alligator	Drawer No. 22	NONE	10				
B-12(2)	5	5350-00-174-0999	(80740) 53-541-02	Paper, Carbide, 240 Grit (u/o ASTM D-130-75)	Cabinet No. 12	NONE	10				
B-9	3	6640-00-074-3339	(80740) 66-940-12	Standards, Copper Strip Corrosion, (u/o ASTM D-130-75)	Drawer No. 9	NONE	1				
B-15	1	6640-00-179-2558	(80740) 27-000	Corke, Assorted	Cabinet No. 10	NONE	100				
B-9	5	6640-00-323-8689	(96906) MS35252-1	Corrosion Test Strip, Copper (u/o ASTM D-130-75)	Drawer No. 9	NONE	25				
B-13(2)	1	6410-00-201-4000	(80740) 27-180	Cotton, Absorbent	Cabinet No. 13	NONE	1				

Section II. INTEGRAL COMPONENTS OF END ITEM - Continued

(1) Illustration (a) Figure No.	(1) Illustration (b) Item No.	(2) National Stock Number	(3) Part No. & FSCM	(4) Description	(5) Location	(6) Usable on Code	(7) Qty Reqd	(8) Quantity Rcv'd	(8) Quantity Date	(8) Quantity Date	(8) Quantity Date
B-17	2	6640-00-912-8656	(80740) 28-476-5	Cylinder, Glass, Graduated, 5 M1	Drawer No. 16	NONE	3				
B-17	1	6640-00-883-8516	(22527) 8-552E	Cylinder, Glass, Graduated, 100 M1 (u/o ASTM D-86)	Drawer No. 16	NONE	6				
B21	4	6640-00-420-6000	(96906) MS35947-6	Cylinder Glass Graduated, 100 M1 (u/o ASTM D-1094-72)	Drawer No. 20	NONE	1				
B-20	2	6640-00-420-3000	(96906) MS35943-10	Cylinder, Glass, Graduated, 1000 M1	Cabinet No. 19	NONE	2				
B3	2	6640-00-244-4341	(80740) 28-395	Cylinder, Hydrometer (u/o ASTM D-287)	Drawer No. 3	NONE	3				
B23	3	6850-00-664-6654	(80740) 24-780	Drierite, Anhydrous Calcium Sulfate, 1 Lb. Jar	Drawer No. 22	NONE	1				
B-10	4	6640-00-244-9478	(32218) GTP-323MM, Series II	Kit, Test, Fuel Contamination (Aqua-Glo)	Cabinet No. 10	NONE	1				
B-13(1)	1	7930-00-558-1111	(80740) 19-082	Detergent, General Purpose	Cabinet No. 13	NONE	1				
B-19	2	6640-00-422-5000	(80740) 29-110-90	Dish, Biological 60 x 90 mm	Drawer No. 18	NONE	1				
B-18	3	6640-00-299-8689	(08071) PD10-47-00	Dish, Petri, Plastic, 100 Ea. (u/o ASTM D-2276-73)	Cabinet No. 17	NONE	1				
B-11	5	6640-00-967-0501	(08071) AAWP-047-00	Disc, Filtering (u/o ASTM D-2276-73)	Drawer No. 11	NONE	3				
B-18	2	6640-00-688-7882	(08071) XX66-025-00	Dispenser, Filtering Solvent (u/o ASTM D-2276-73)	Cabinet No. 17	NONE	2				
2-10	1	6630-00-251-2118	(48619) 76002	Distillation Test Apparatus, Left-hand (u/o ASTM D-86)	Left Side Counter	NONE	1				
			(48619) 225095 (*)	Auto-Transformer, VT8N, 120V, 60 Hz		NONE	1				
			(48619) 225087 (*)	Brush, Auto-Transformer		NONE	1				
			(48619) 523549 (*)	Heater, Lo-Cap, 120V , 1000 W.		NONE	1				
1-4	8	4210-00-270-4512	NPN	Extinguisher, Fire, CO_2, 5 Lb., Bracket	Left Front Wall	NONE	1				
B-6	3	6640-00-522-1885	(24123) AB580B	Oil Filter, Inlet (u/o ASTM D-2276-73)	Drawer No. 6	NONE	1				
B-6	4	6640-00-522-1883	(24123) V425M	Oil Filter, Outlet (u/o ASTM D-2276-73)	Drawer No. 6	NONE	1				

Section II. INTEGRAL COMPONENTS OF END ITEM - Continued

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8) Quantity			
(a) Figure No.	(b) Item No.	National Stock Number	Part No. & FSCM	Description	Location	Usable on Code	Qty Reqd	Rcv'd	Date	Date	Date
1-3	22	6545-00-526-1903	NPN	First Aid Kit, Cylindrical (c/o 12 Items)	Left Front Wall	NONE	1				
		6545-00-513-6101	NPN (*)	Refill for First Aid Kit, NSN 6545-00-526-1903		NONE	1				
B-5	6	6230-00-269-3034	NPN	Flashlight (u/o ASTM D-2276-73)	Drawer No. 5	NONE	1				
B-3	1	6640-00-438-8500	(96906) MS36058-3	Flask, Distilling, 125 M1 (u/o ASTM D-86)	Drawer No. 3	NONE	6				
B-20	3	6640-00-424-9000	(96906) MS36066-5	Flask, Distilling, 1000 M1. (u/o ASTM D-2276-73)	Cabinet No. 19	NONE	1				
B-20	1	NNSN	(96906) MS36066-6	Flask, Distilling, 4000 M1.	Cabinet No. 19	NONE	2				
B-11	2	6640-00-426-0315	(08071) XX62-000-06	Forceps, Flatbeaded (u/o ASTM D-2276-73)	Drawer No. 11	NONE	2				
B-23	14	6640-00-369-5093	(80740) 36-580	Forceps, Gooseneck, Monel	Drawer	NONE	1				
B-17	3	6640-00-426-8060	(96906) MS36084-7	Funnel, Laboratory	Drawer No. 16	NONE	2				
B-13(1)	4	7240-00-141-5665	NPN	Funnel, Plastic, 8 oz.	Cabinet No. 13	NONE	1				
B-7	4	5920-00-850-6092	NPN	Fuse, 10 Amp., SLO-BLO	Drawer No. 7	NONE	1				
1-4	7	5975-00-878-3791	NPN	Ground Rod Ay, Fed. Spec. W-R-550A	Above Door	NONE	1				
2-8	1	6685-00-194-1699	(80740) 69-105-0-5	Gauge, Reid Vapor Pressure (u/o ASTM D-323-72)	Right Rear Wall	NONE	2				
B-21	3	6685-00-194-1683	(80740) 69-105-0-15	Gauge, Reid Vapor Pressure (u/o ASTM D-323-72)	Drawer No. 20	NONE	1				
B-23	5	5330-00-169-0557	(80740) 69-055	Gasket, RVP, Gauge Coupling	Drawer No. 22	NONE	25				
B-23	4	5330-00-143-8334	(80740 69-056	Gasket, RVP, Liquid Chamber	Drawer No. 22	NONE	25				
B-22(2)	4	8415-00-261-7015	(80740) 1-640	Gloves, Asbestos, Pair	Cabinet No. 12	NONE	1				
B-12(2)	6	8415-00-682-6786	(80740) 74-769-04	Gloves, Plastic	Cabinet No. 12	NONE	100				
B-6	6	9150-00-965-2408	(80740) 78-586	Grease, High Vacuum	Drawer No. 6	NONE	1				
B-16	2	6685-00-179-2533	(80740) 81-608-11	Guard, Thermoregulator	Drawer No. 15	NONE	1				

Section II. INTEGRAL COMPONENTS OF END ITEM - Continued

(1) Illustration (a) Figure No.	(1) Illustration (b) Item No.	(2) National Stock Number	(3) Part No. & FSCM	(4) Description	(5) Location	(6) Usable on Code	(7) Qty Reqd	(8) Quantity Rcv'd	(8) Quantity Date	(8) Quantity Date	(8) Quantity Date
B-5	2	5120-00-061-8541	NPN	Hammer, Hand, 8 oz.	Drawer No. 5	NONE	1				
B-10	1	6640-00-980-5002	(48619) 61600	Heater, Electric	Cabinet No. 10	NONE	2				
B-15	7	4540-00-134-4236	(80740) 42-685-1500	Heater, Immersion, Automatic Cut-Off	Cabinet No. 14	NONE	1				
B-18	4	6640-00-299-8691	(08071) XX10-047-00	Holder, Filter Disc (u/o ASTM D-2276-73)	Cabinet No. 17	NONE	1				
B-16	15	6630-00-265-7758	(80740) 48-536	Hydrometer, API, 29 to 41 Deg. F. (u/o ASTM D-287)	Drawer No. 15	NONE	2				
B-16	14	6630-00-265-7759	(80740) 48-538	Hydrometer, API, 39 to 51 Deg. F. (u/o ASTM D-287)	Drawer No. 15	NONE	3				
B-16	16	6630-00-265-7764	(80740) 48-541	Hydrometer, API, 49 to 61 Deg. F. (u/o ASTM D-287)	Drawer No. 15		4				
B-16	3	6630-00-265-7765	(80740) 48-542	Hydrometer, API, 59 to 71 Deg. F. (u/o ASTM D-287)	Drawer No. 15	NONE	4				
B-16	4	6630-00-815-2267	(80740) 48-544	Hydrometer, API, 69 to 81 Deg. F. (u/o ASTM D-287)	Drawer No. 15	NONE	4				
1-3	21	4110-00-134-4219	(32331) TCM-28	Ice maker, Tank Type	Left Side Counter	NONE	1				
B-11	6	6640-00-522-1892	(80740) 3-997-03	Holder, Ionizing Unit (u/o ASTM D-2276-73)	Drawer No. 11	NONE	1				
B-11	3	6640-00-522-1890	(80740) 3-997-02	Ionizing Unit, Static-Master (u/o ASTM D-2276-73)	Drawer No. 11	NONE	1				
B-4	Not Shown	6810-00-145-0250	(64484) SC15530	Trimethyl Pentane (u/o ASTM D-130 and FTMS F-5340) Pint	Cabinet No. 4	NONE	2				
B-18	Not Shown	6640-00-359-9870	(80740) 49-750	Jar, Cylindrical, Glass (u/o ASTM D-86)	Cabinet No. 17	NONE	2				
B-7	1	4820-00-557-0182	(53477) 3562-8000	Kit, Pressure Regulator Repair	Drawer No. 7	NONE	1				
B-6	7	6640-00-179-2559	(08071) XX60-000-20	Kit, Vacuum Pump Repair	Drawer No. 6	NONE	1				
B-7	7	6240-00-583-3668	NPN	Lamp, Fluorescent	Drawer No. 7	NONE	2				
1-3	1	6685-00-842-4565	(39739) 301EA25 MWM	Manometer, 25 In., Wall Mounted, w/ SC4606 Duplex Scale (Hq) (PSI)	Left Rear	NONE	1				
B-6	2	6810-00-281-7453	(64484) SC13462	Mercury, ACS, 1 Lb. Bottle	Drawer No. 6	NONE	2				

Section II. INTEGRAL COMPONENTS OF END ITEM - Continued

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8) Quantity			
(a) Figure No.	Item No.	National Stock	Part No. & FSCM	Description	Location	Usable on Code	Qty Reqd	Rcv'd	Date	Date	Date
B-19	1	6625-00-998-6084	(55026) 260-5	Multimeter, 0 to 5000V	Drawer No. 18	NONE	1				
B-6	5	9150-00-273-8663	(80740) 72-752-01	Oil, Pneumatic Pump, 1 Qt.	Drawer No. 6	NONE	1				
1-4	24	6640-00-359-9880	(48619) 31477	Oven, Laboratory (u/o ASTM D-2276-73)	Right Side Counter	NONE	1				
			(48619) 240150 (*)	Switch, Line		NONE	1				
			(48619) 234035 (*)	Pilot Light		NONE	1				
			(48619) 239091 (*)	Thermostat		NONE	1				
B-9	8	6640-00-235-3820	(32218) GTP-25	Pad, Fuel Contamination Test Kit (25 Per Box)	Drawer No. 9	NONE	3				
B-21	2	6640-00-543-6045	(80740) 34-460	Paper, Filter, 15 cm Dia. Circles	Drawer No. 20	NONE	1				
B-11	4	6640-00-179-2634	(08071) UH-TAN-Plain 050-25MM	Paper, Filter (u/o ASTM D-2276-73)	Drawer No. 11	NONE	1				
B-23	12	7510-00-174-3205	(80740) 66-170 Black	Pencil, Wax, Black	Drawer No. 22	NONE	2				
B-8	1	6810-00-753-4990	(64484) SC13997	Ether, Petroleum Reagent, ACS, 1 Qt. Btl.	Drawer No. 8	NONE	6				
B-5	11	5120-00-247-5177	NPN	Pliers, Long Nose, 6 In. Lg.	Drawer No. 5	NONE	1				
B-5	8	5120-00-278-0352	NPN	Pliers, Angle Nose, 10 In. Lg.	Drawer No. 5	NONE	1				
B-5	1	5120-00-223-7396	NPN	Pliers, Straight Nose, 6 In. Lg.	Drawer No. 5	NONE	1				
B-9	7	6810-00-137-5000	(64484) SC14266	Potassium Phosphate, Mondbasic, ACS (u/o ASTM D-1094-72)	Drawer No. 9	NONE	1				
B-9	9	6810-00-270-3255	(64484) SC14268	Potassium, Phosphate Dibasic (u/o ASTM D-1094-72)	Drawer No. 9	NONE	1				
B-12(2)	3	6830-00-584-3041	(70784) TX9	Propane, Disposable 14 oz. Cylinder	Cabinet No. 12	NONE	1				
B-4	1	6810-00-227-0410	(64484) SC12934	Isopropyl Alcohol, Reagent, ACS, 1 Gal.	Cabinet No. 4	NONE	2				
2-3	8	4320-00-194-3732	(80293) B1	Pump, Centrifugal, EMD, 7.5 GPM	Under Sink	NONE	1				
		6650-00-508-3360	(06175) 33-45 58-01 (*)	Refractometer, ABBE Type (u/o FTMS-F-5340)		NONE	1				

Section II. INTEGRAL COMPONENTS OF END ITEM - Continued

(1) Illustration (a) Figure No.	(1) Illustration (b) Item No.	(2) National Stock Number	(3) Part No. & FSCM	(4) Description	(5) Location	(6) Usable on Code	Qty Reqd	(8) Quantity Rcv'd	Date	Date	Date
2-4	2	4820-00-957-5639	NPN	Regulator, Air Pressure	Left Rear Wall	NONE	1				
B-2	1	7240-00-248-9620	(80740) 12-456-09	Can, Safety, 5 Gal.	Cabinet No. 2	NONE	1				
B-5	4	5120-00-542-3438	NPN	Screwdriver, Cross Tip, 8 In., Blade	Drawer No. 5	NONE	1				
B-5	12	5120-00-236-2140	NPN	Screwdriver, Flat Tip, 2 In. Blade	Drawer No. 5	NONE	1				
B-5	10	5120-00-278-1283	NPN	Screwdriver, Flat Tip, 6 In. Blade	Drawer No. 5	NONE	1				
B-5	7	5120-00-260-4837	NPN	Screwdriver, Flat Tip, 8 In. Blade	Drawer No. 5	NONE	1				
B-23	11	5110-00-263-0248	(80740) 27-170	Sharpener, Cork Borer	Drawer No. 22	NONE	1				
B-4	Not Shown	6810-00-890-2052	(80740) 19-089-01	Chromerge (u/o ASTM D-1094-72)	Cabinet No. 4	NONE	1				
Not Shown	Not Shown	3439-00-542-0531	(70785) JT25	Kit, Soldering Torch	Not Shown	NONE	1				
B-13(2)	7	7920-00-240-2559	(80740) 19-132	Sponge, Cellulose	Cabinet No. 13	NONE	1				
B- 12(2)	7	5350-00-240-2920	NPN	Steel Wool Pads	Cabinet No. 12	NONE	1				
B-10	5	6640-00-531-5022	(48619) 75765	Stirrer, Electric (u/o ASTM D-93-73)	Right Side Counter		1				
B-9	6	6645-00-126-0286	(80740) 78-732	Stopwatch	Drawer No. 9	NONE	1				
2-10	3 and 4	4820-00-134-4279	NPN	Stopcock	Left Side Counter	NONE	2				
B-11	1	6640-00-235-3821	(08071) XX10-047-08	Stopper, Neoprene	Drawer No. 11	NONE	6				
B-15	1	6640-00-116-2823	(80740) 26-970	Cock, Std Taper, 100 Ea.	Drawer No. 10		1				
B-7	2	6810-00-282-9710	NPN	Sulfur, Technical, 1 Lb. Btl.	Drawer No. 7	NONE	1				
B-4	2	6810-00-146-7520	(64484) SC15125	Sulfuric Acid, ACS	Cabinet No. 4	NONE	1				
Not Shown	Not Shown	6670-00-494-8153	(80740) 78-902	Support, Vibration Dampening, Analytical Balance	Right Side Counter	NONE	1				
B-21	1	6640-00-061-8967	(80740) 79-500-25	Tube, Test, 55 M1.	Drawer No. 20	NONE	12				

Section II. INTEGRAL COMPONENTS OF END ITEM - Continued

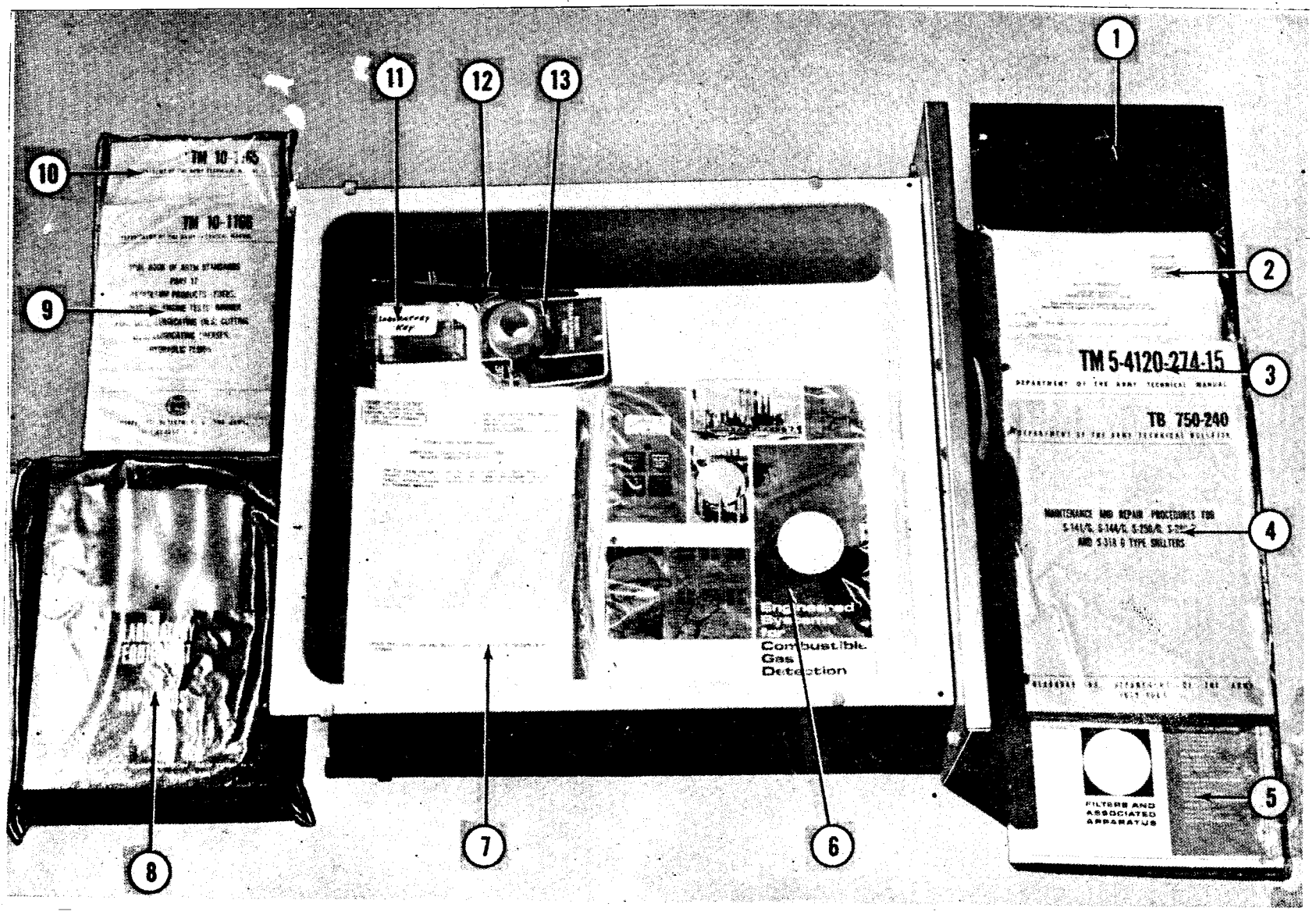
(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8) Quantity			
(a) Figure No.	Item No.	National Stock Number	Part No. & FSCM	Description	Location	Usable on Code	Qty Reqd	Rcv'd	Date	Date	Date
B-10	5	6630-00-530-0987	(80740) 67-901	Tester, Flash Point, Pensky-Martens (u/o ASTM D-93-73)	Cabinet No. 10	NONE	1				
B-22	1	6630-00-151-5310	(19099) SC6630-90-CL-NO1	Testing Kit, Petroleum (u/o ASTM D-270, D-287, D-1085 and D-1250-56)	Cabinet No. 21	NONE	1				
B-16	2	6685-00-179-2534	(80740) 81-608-01	Thermoregulator, 50 to 250 Deg. F.	Drawer No. 15	NONE	1				
B-16	9	6685-00-242-2224	(80740) 80-100-12	Thermometer, Fahrenheit, -5 to +215 Deg., ASTM No. 12 F (u/o ASTM D-130-75)	Drawer No. 15	NONE	2				
B-16	1	6685-00-245-7696	(80740) 80-100-58	Thermometer, Fahrenheit, -30 to +120 Deg., ASTM No. 58 F (u/o ASTM D-323-72)	Drawer No. 15	NONE	2				
B-16	12	6685-00-242-2183	(80740) 80-100-09	Thermometer, Fahrenheit, +20 to +230 Deg., ASTM No. 9 F (u/o ASTM D-93-73)	Drawer No. 15	NONE	1				
B-16	8	6685-00-242-2187	(80740) 80-100-07	Thermometer, Fahrenheit, +30 to +580 Deg., ASTM No. 7 F (u/o ASTM D-86)	Drawer No. 15	NONE	6				
B-16	7	6685-00-242-2203	(80740) 80-100-18	Thermometer, Fahrenheit, +94 to +108 Deg., ASTM No. 18 F (u/o ASTM D-323-72)	Drawer No. 15	NONE	2				
B-16	13	6685-00-242-2184	(80740) 80-100-10	Thermometer, Fahrenheit, +200 to +700 Deg., ASTM No. 10 F (u/o ASTM D-93-73)	Drawer No. 15	NONE	1				
B-16	10	6685-00-191-3214	(80740) 80-100-64	Thermometer, Fahrenheit, +77 to +131 Deg., ASTM No. 64F	Drawer No. 15	NONE	1				
B-16	11	6685-00-191-3213	(80740) 80-100-68	Thermometer, Fahrenheit, +293 to 401 Deg., ASTM No. 68 F	Drawer No. 15	NONE	2				
1-6	2	6695-00-496-9624	(80740) 68-875	Thief, Oil, Glass (u/o ASTM D-270)	Rear Wall	NONE	1				
B-9	1	6645-00-880-8045	(80740) 22-500	Timer, 12 Hour	Drawer No. 9	NONE	1				
B-23	Not Shown	6640-00-444-8000	(96906) MS35023-2	Tongs, Laboratory, Crucible, 10 In. Lg.	Drawer No. 22	NONE	1				
B-23	10	6640-00-360-0021	(80740) 81-990	Tongs, Beaker, 9 In. Lg.	Drawer No. 22	NONE	1				
B-15	6	4720-00-221-8658	(80740) 74-995-3-16	Tubing, Plastic, 3/16 In. I.D., 10 Ft. Lg.	Cabinet No. 10	NONE	1				

Section II. INTEGRAL COMPONENTS OF END ITEM - Continued

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)	(8) Quantity			
(a) Figure No.	(b) Item No.	National Stock Number	Part No. & FSCM	Description	Location	Usable on Code	Qty Reqd	Rcv'd	Date	Date	Date
B-15	5	4720-00-221-8659	(80740) 74-995-1-4	Tubing, Plastic, 1/4 In. I.D., 10 Ft. Lg.	Cabinet No. 10.	NONE	1				
B-15	6	4720-00-236-6273	(80740) 74-995-5-16	Tubing, Plastic, 5/16 In. I.D., 10 Ft. Lg.	Cabinet No. 10	NONE	1				
B-15	4	4720-00-640-0329	(08071) XX71-000-04	Tubing, Rubber, 3/8 In. I.D., 4 Ft. Lg. (u/o ASTM D-2276-73)	Cabinet No. 10	NONE	1				
B-15	2	4720-00-277-5388	(80740) 75-090-3-16	Tubing, Rubber, 3/16 In. I.D., 10 Ft. Lg.	Cabinet No. 10	NONE	1				
B-15	3	4720-00-236-6268	(80740) 75-095-5-8	Tubing, Rubber, Vacuum, 5/8 I.D., 5 Ft. Lg.	Cabinet No. 10	NONE	1				
B-12(1)	1	6640-00-845-0749	(08071) XX60-000-00	Pump, Vacuum-Pressure, 115V, 60 Hz	Cabinet No. 12	NONE	1				
B-9	2	6670-00-351-2356	(22527) 2-214A	Weight Set, Balance, Class S	Drawer No. 9	NONE	1				
Not Shown	Not Shown	6670-00-803-9680	(22527) 2-301B	Weight Set, Balance, 1 to 1000 G (13 Ea. per set)		NONE	1				
B-13(2)	4	6145-00-299-5186	(22527) 15-545-2A	Wire, Electrical, Copper 16 AWG, 1 Lb. Roll	Cabinet No. 3	NONE	4				
B-13(2)		5120-00-244-4389	NPN	Wrench, Bung	Cabinet No. 12	NONE	1				
B-5	3	5120-00-240-5328	NPN	Wrench, Adjustable, 8 In. Lg.	Drawer No. 5	NONE	1				
B-5	5	5120-00-264-3796	NPN	Wrench, Adjustable, 12 In. Lg.	Drawer No. 5	NONE	1				

Section III. BASIC ISSUE ITEMS

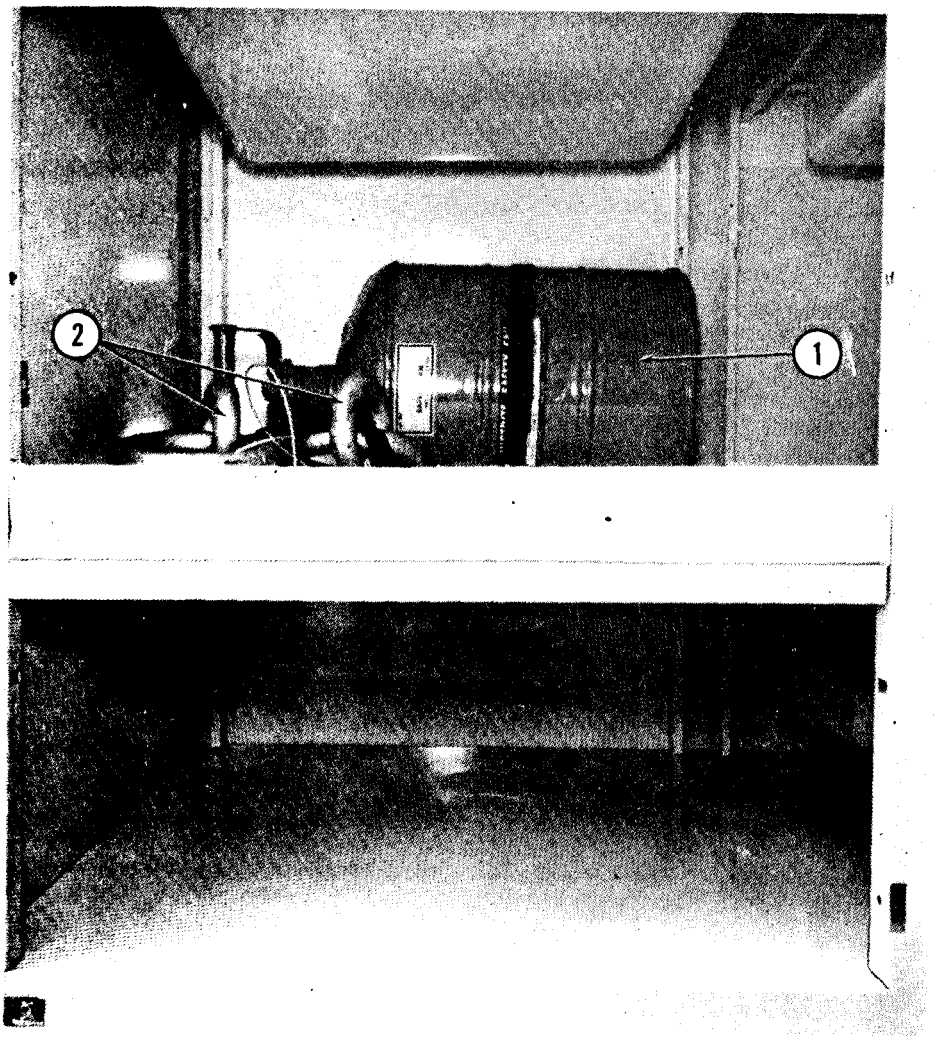
(1) Illustration (a) Figure No.	(1) Illustration Item No.	(2) National Stock Number	(3) Part No. & FSCM	(4) Descripticin	(5) Location	(6) Usable on Code	(7) Qty Reqd	(8) Quantity Rcv'd	(8) Quantity Date	(8) Quantity Date	(8) Quantity Date
1-4	8	4210-00-270-4512	NPN	Extinguisher, Fire CO^2, 5 Lb., Bracket	Left Front Wall	NONE	1				
		NNSN	NPN	TM 5-6640-213-14, Laboratory, Air Mobile, Aviation Fuel	Drawer No. 1	NONE	1				
B-1	1	NNSN	NPN	TB 750-240, Maintenance and Repair Procedure for S-280/G Type Shelters	Drawer No. 1	NONE	1				
B-1	3	NNSN	NPN	TM 5-4120-274-15, Operator Organizational, Direct Support, General Support and Depot Maintenance Manual, 9000 BTU Air Conditioner, NSN 4120-00-926-1137	Drawer No. 1	NONE	1				
		NNSN	NPN	TM 11-5410-213-14P, Operator, Organizational, Direct Support, General Support and Maintenance Manual for Shelter, Electrical Equipment, NSN 5410-00-117-2868	Drawer No. 1	NONE	1				
				NOTE The Basic Issue Items for the S-280B/G Shelter are listed on Page 5 of TM 11-5410-213-14P							



1. Hoppmann Manual
2. Military Specifications
3. TM 5-4120-274-15
4. TB 750-240
5. Millipore Catalog MF-68
6. J-W Gas alarm Catalog 5005
7. FED-STD-791B
8. Greiner Catalog
9. ASTM Part 17
10. ASTM Significance of ASTM Tests
11. Laboratory keys
12. Pencils
13. Transparent tape

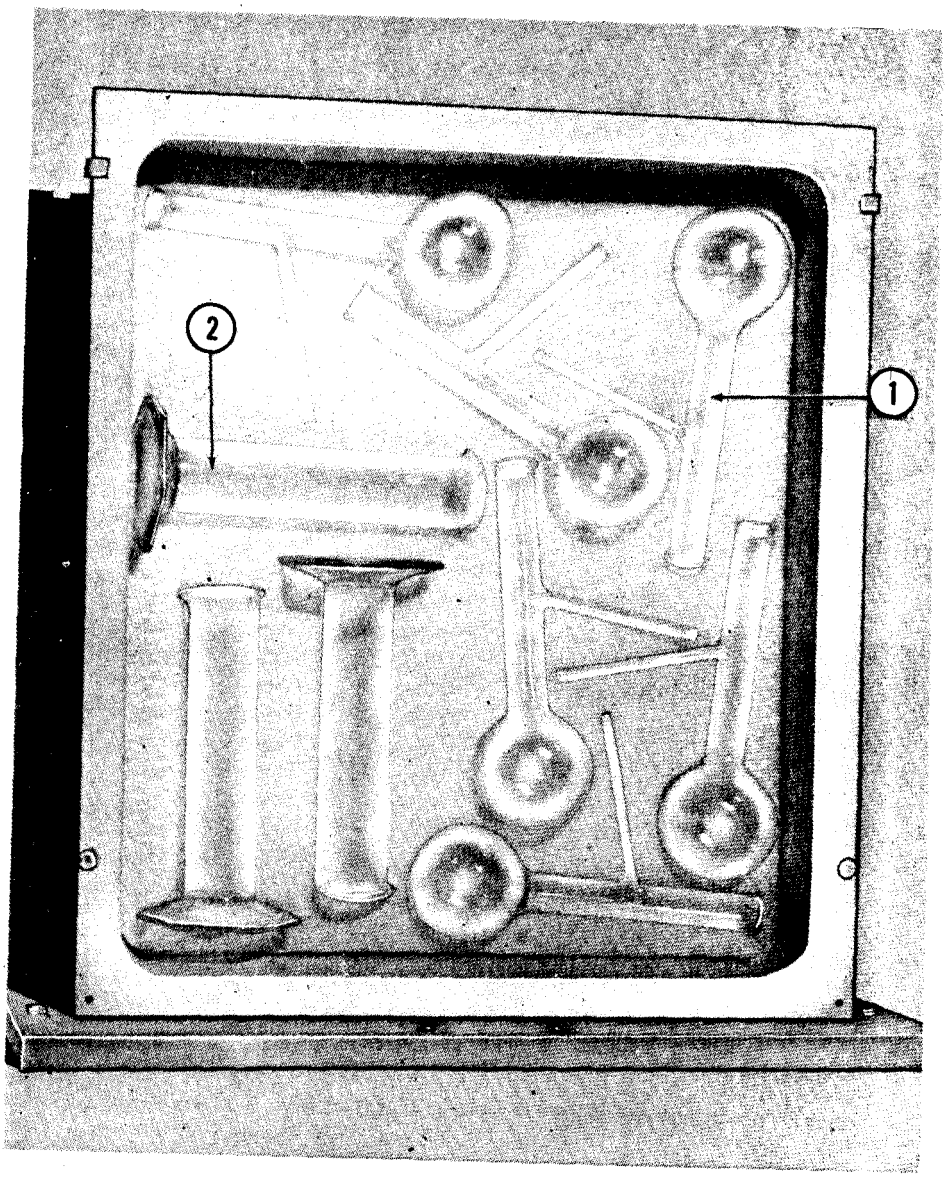
TS 6640-213-14/B-1

Figure B-1. Drawer No. 1 (18, fig. 1-3)



1. Safety can
2. Truck brackets

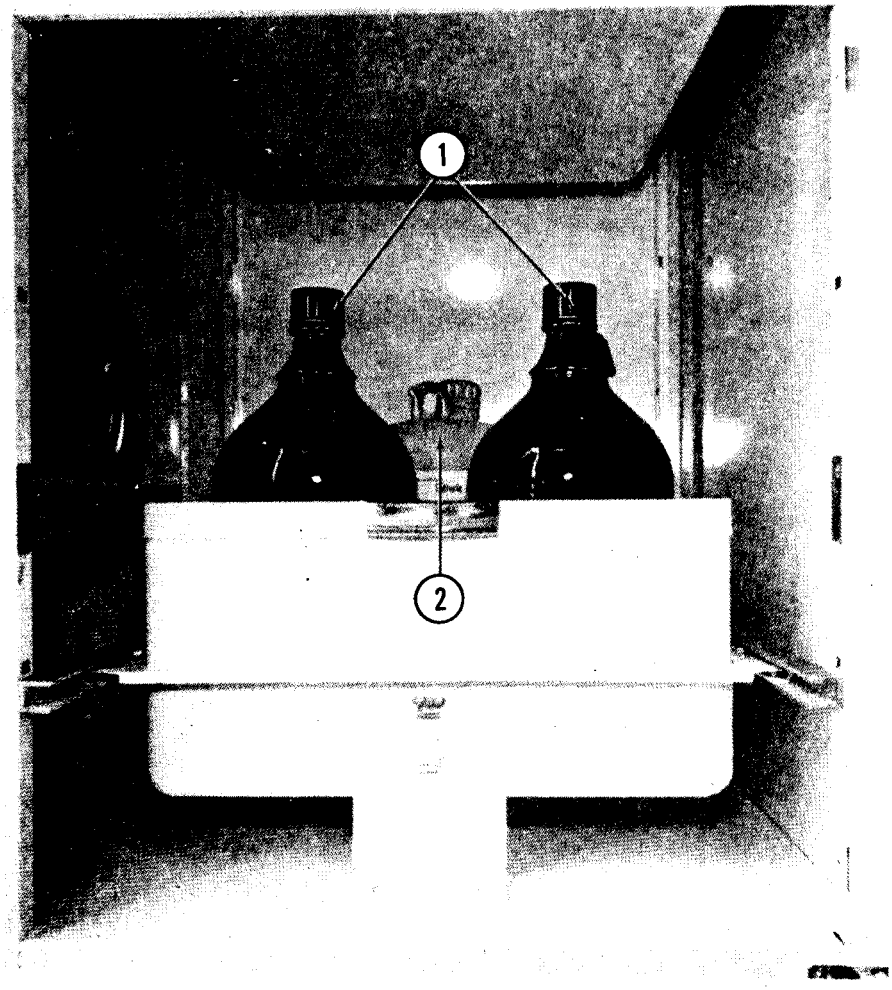
Figure B-2. Cabinet No. 2 (20, fig. 1-3)



TS 6640-213-14/B-3

1. 125 ml distilling flask
2. Hydrometer cylinder

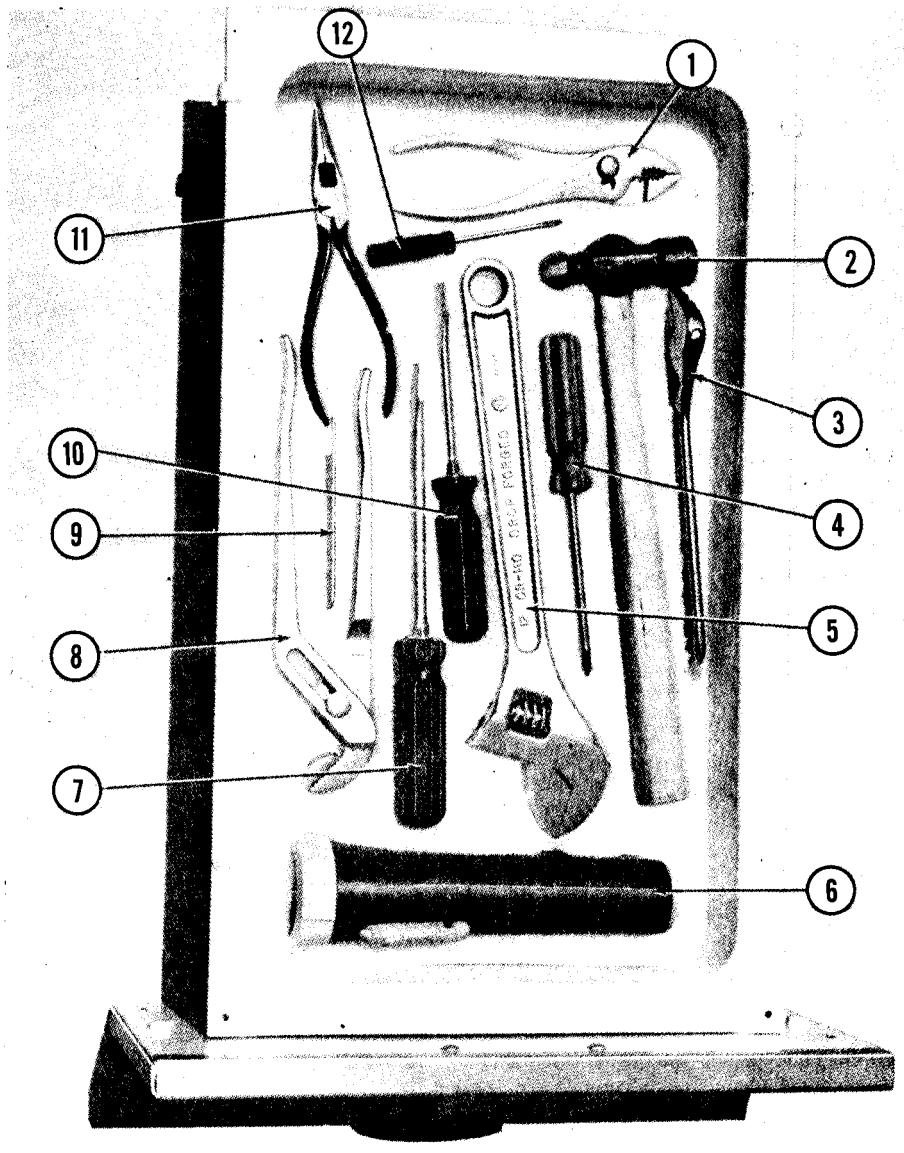
Figure B-3. Drawer No. 3 (16, fig. 1-3)



TS 6640-213-14/B-4

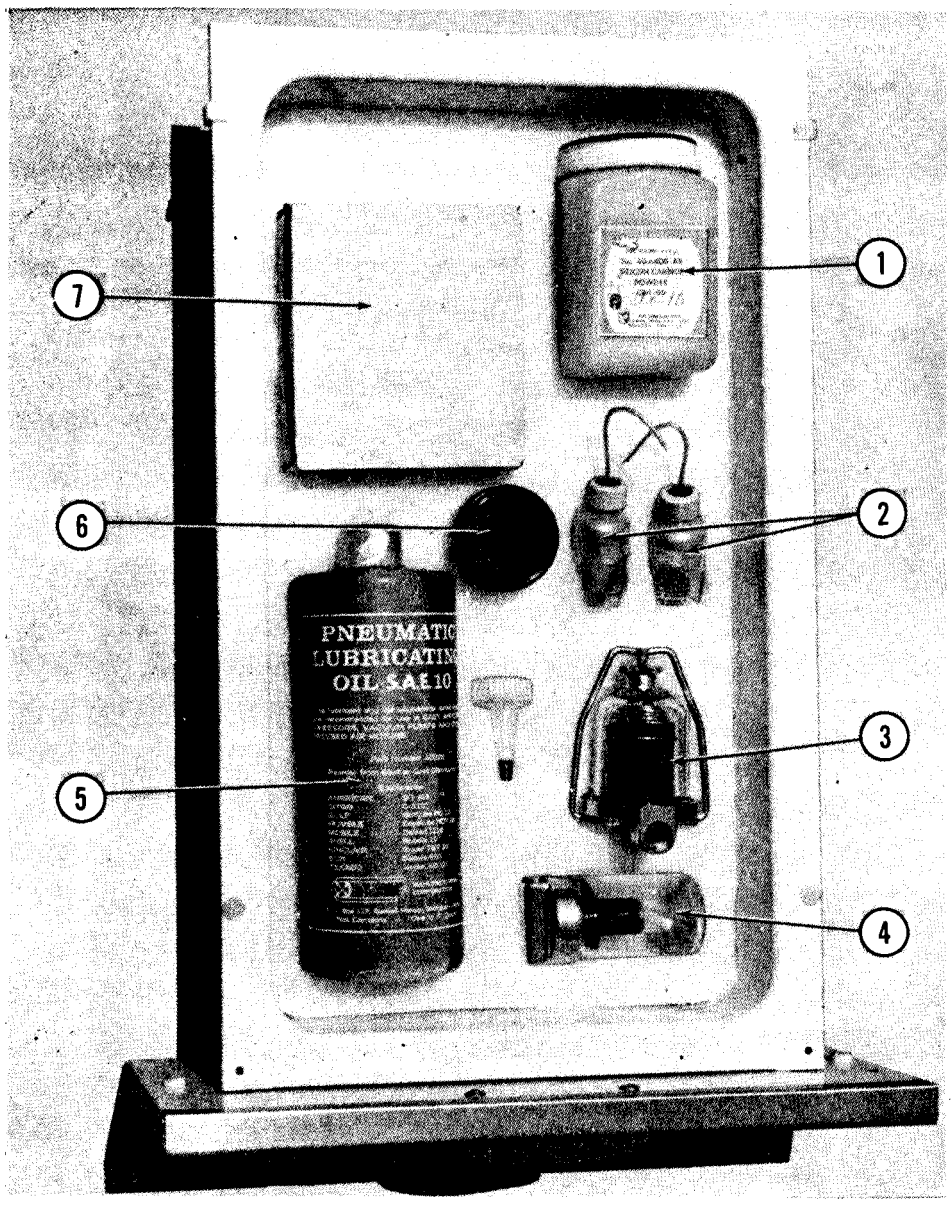
1. Isopropyl alcohol
2. Sulphuric acid

Figure B-4. Cabinet No. 4 (17, fig. 1-3)



Pliers, 6 in.		7.	Screwdriver, 10 in.
Hammer		8.	Slipjoint pliers, 10 in.
Adjustable wrench, 8 in.		9.	Wrench (for water pump)
Philips screwdriver, 8 in.		10.	Screwdriver, 8 in.
Adjustable wrench, 12 in.		11.	Long Nose pliers, 6 in.
Flashlight		12.	Screwdriver, 2 in.

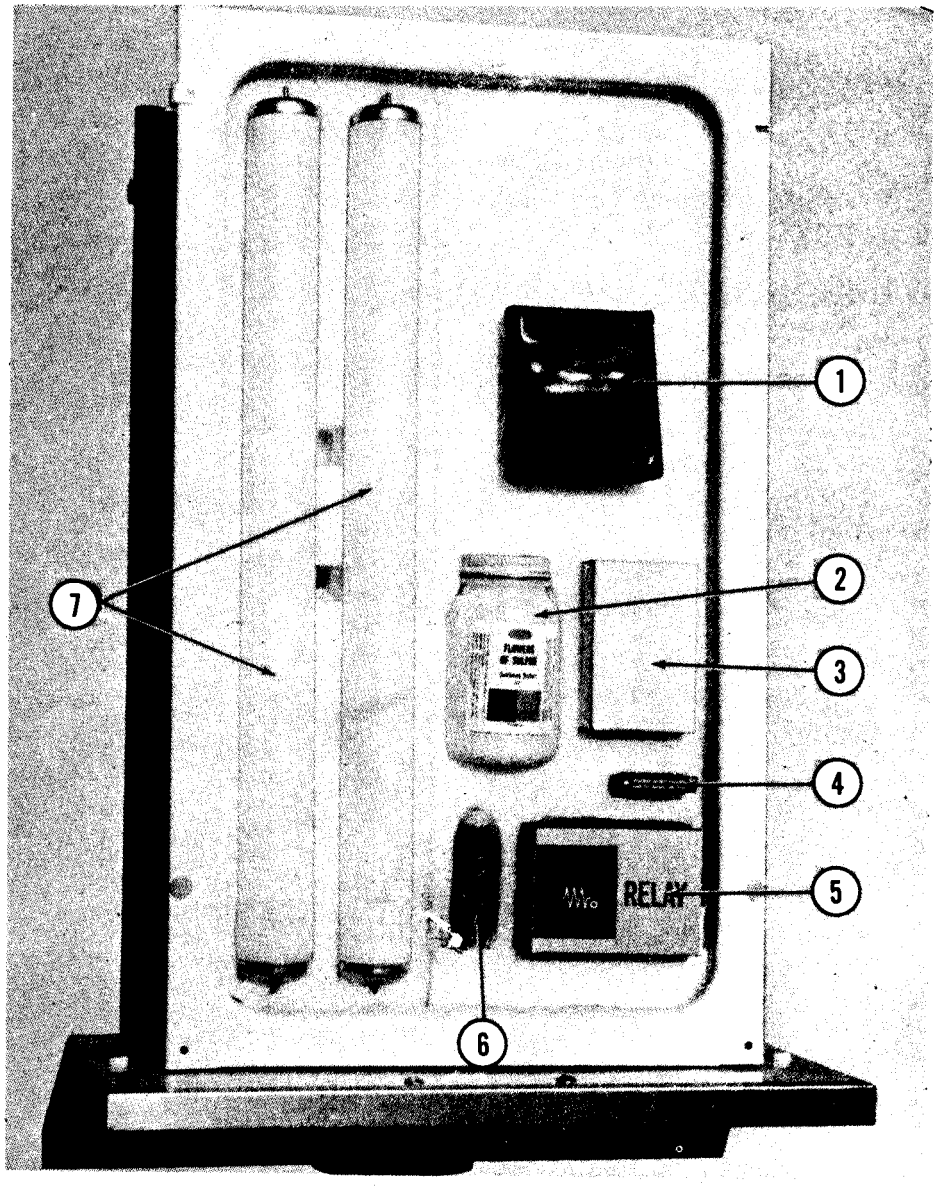
Figure B-5. Drawer No. 5 (12, fig. 1-3)



TS 6640-213-14/B-6

1. Silicon Carbide Powder
2. Mercury
3. Air pump intake filter
4. Vacuum filter
5. Pneumatic lube oil
6. Grease, ground glass joint
7. Air-vac. pump repair kit

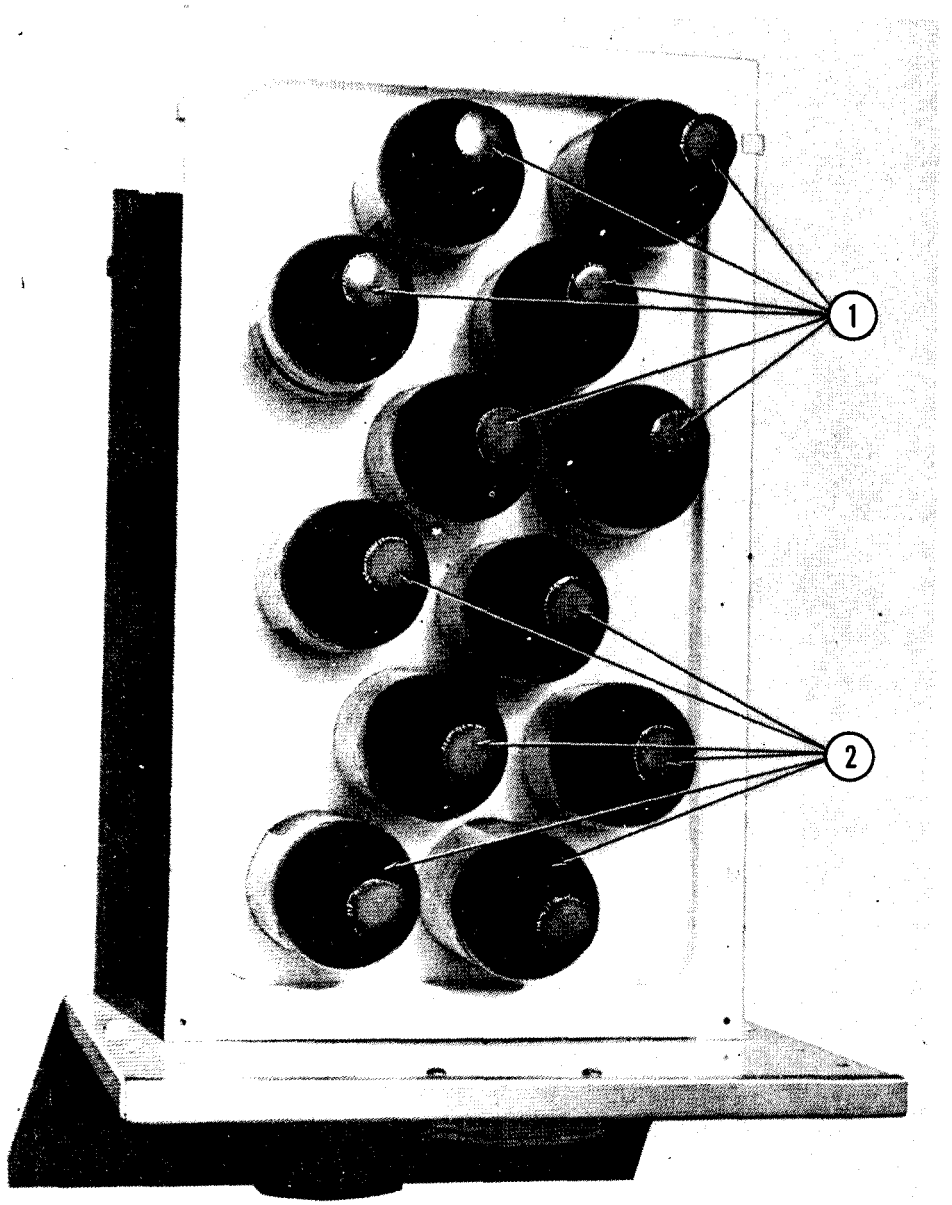
Figure B-6. Drawer No. 6 (13, fig. 1-3)



TS 6640-213-14/B-7

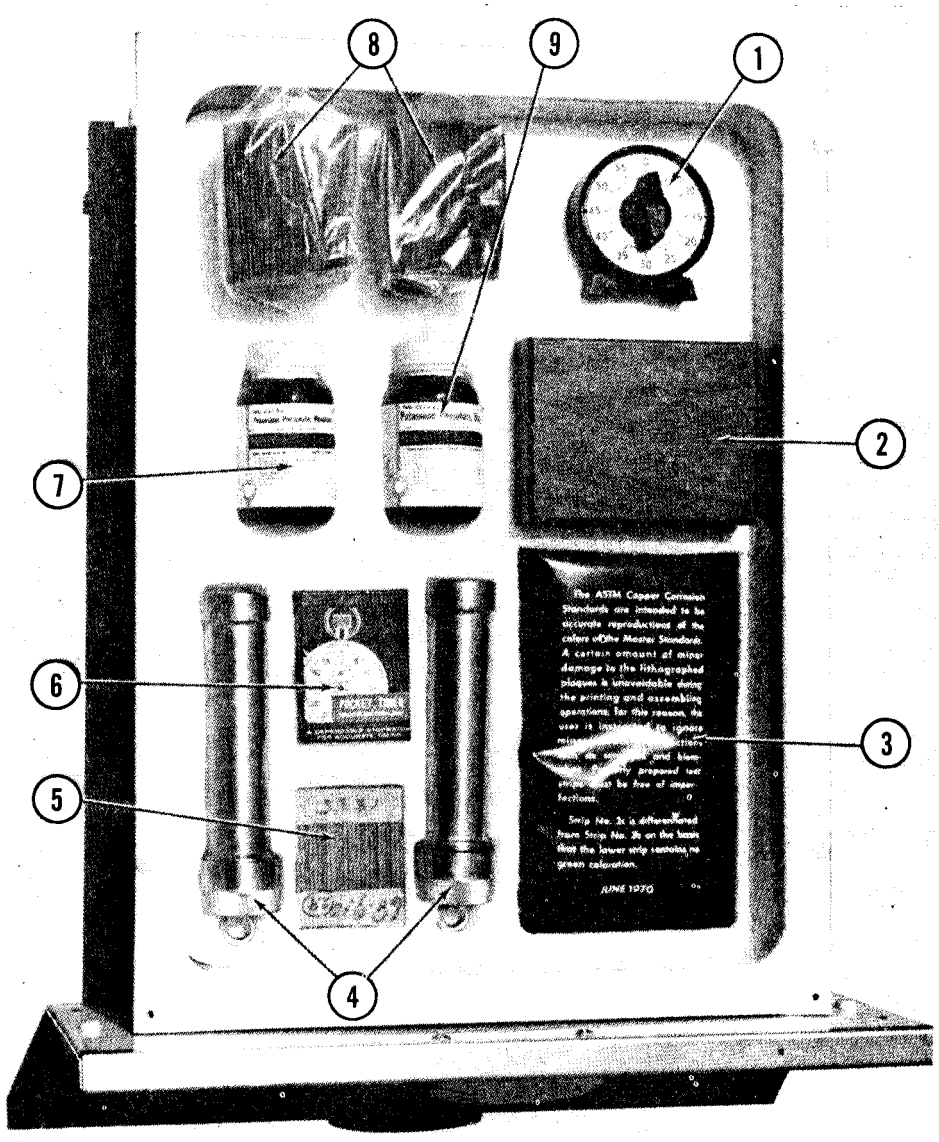
1. Pressure regulator repair kit
2. Sulphur powder
3. Filament alarm
4. Fuse
5. Alarm relay
6. Reset switch
7. Lamps
8. Pilot lamp
9. Test lamp
10. Alarm lamp
11. Failure lamp
12. Voltage regulator
13. Failure relay

Figure B-7. Drawer No. 7 (14, fig. 1-3)



1. Ether
2. Acetone

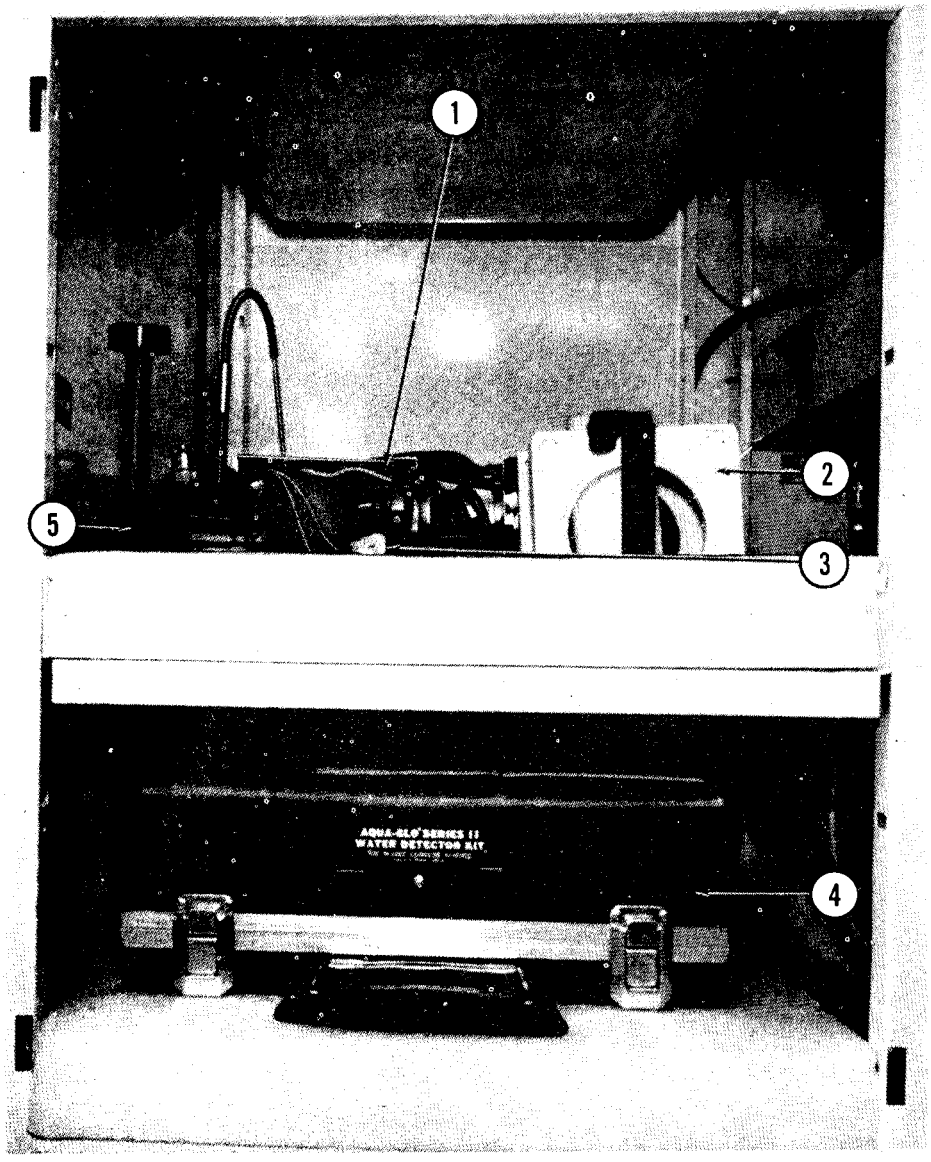
Figure B-8. Drawer No. 8 (15, fig. 1-3)



TS 6640-213-14/B-9

1. Timer
2. Weight set
3. ASTM copper corrosion standards
4. Copper strip bomb
5. Copper test strips
6. Stopwatch
7. Potassium phosphate monobasic
8. Aqua-Glo pads
9. Potassium phosphate dibas

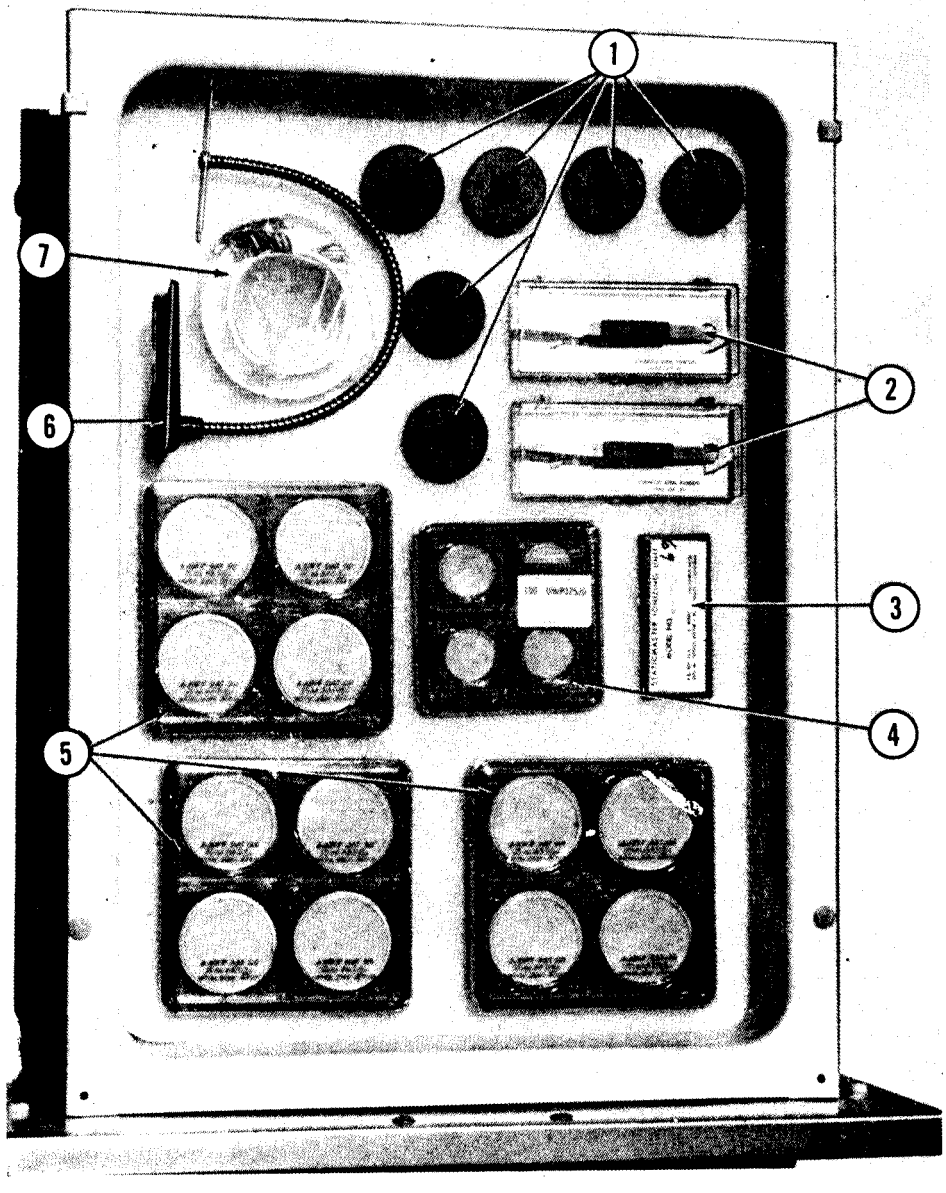
Figure B-9. Drawer No. 9 (8, fig. 1-3)



TS 6640-213-14/B-10

1. Electric heaters
2. Heater shield
3. Belts and Allen wrench
4. Water detector kit
5. Flash tester cup and stirrer

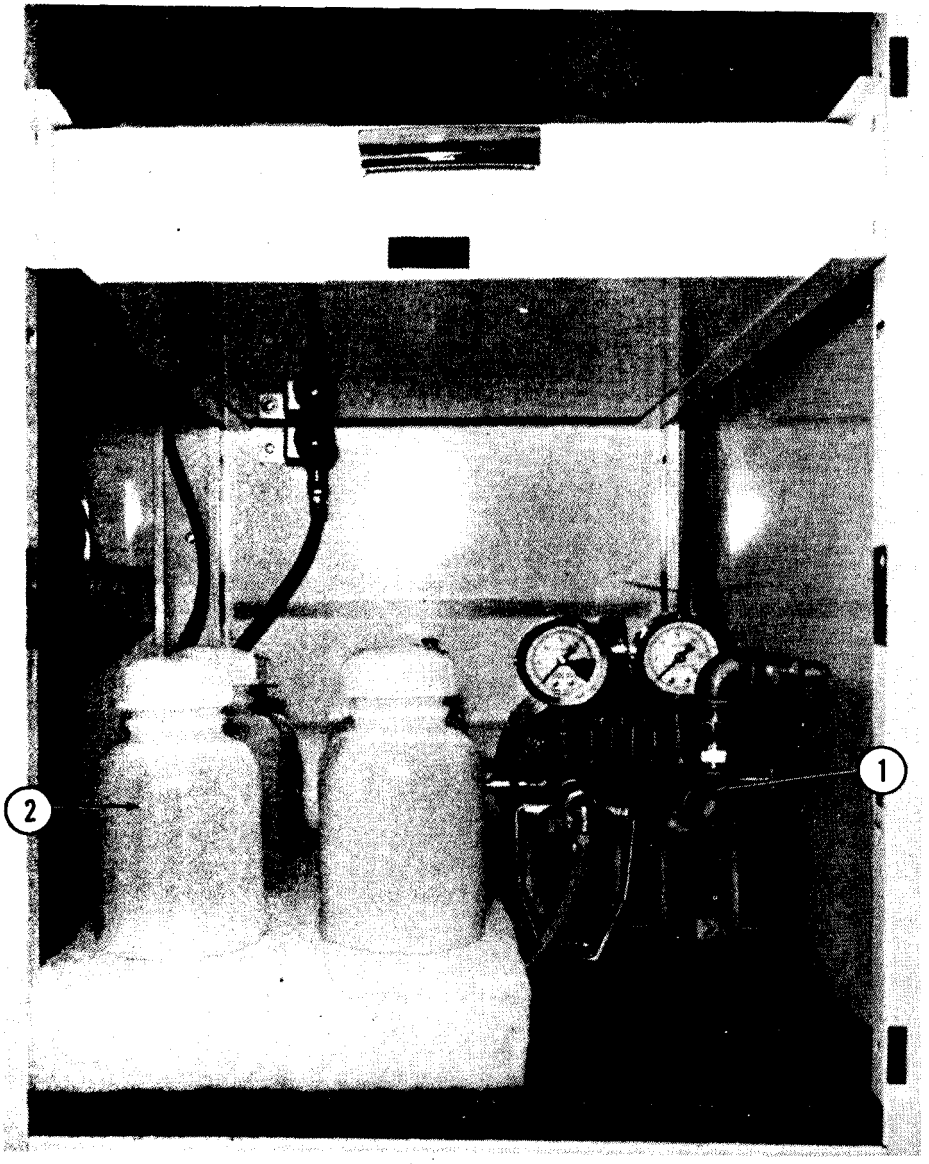
Figure B-10. Cabinet No. 10 (11, fig. 1-3)



TS 6640-213-14/B-11

1. Millipore drilled stoppers
2. Filter forceps
3. Ionizing unit
4. Filter pads
5. Filter discs
6. Ionizing unit holder
7. Pyrex bumper guard, 1,000 m

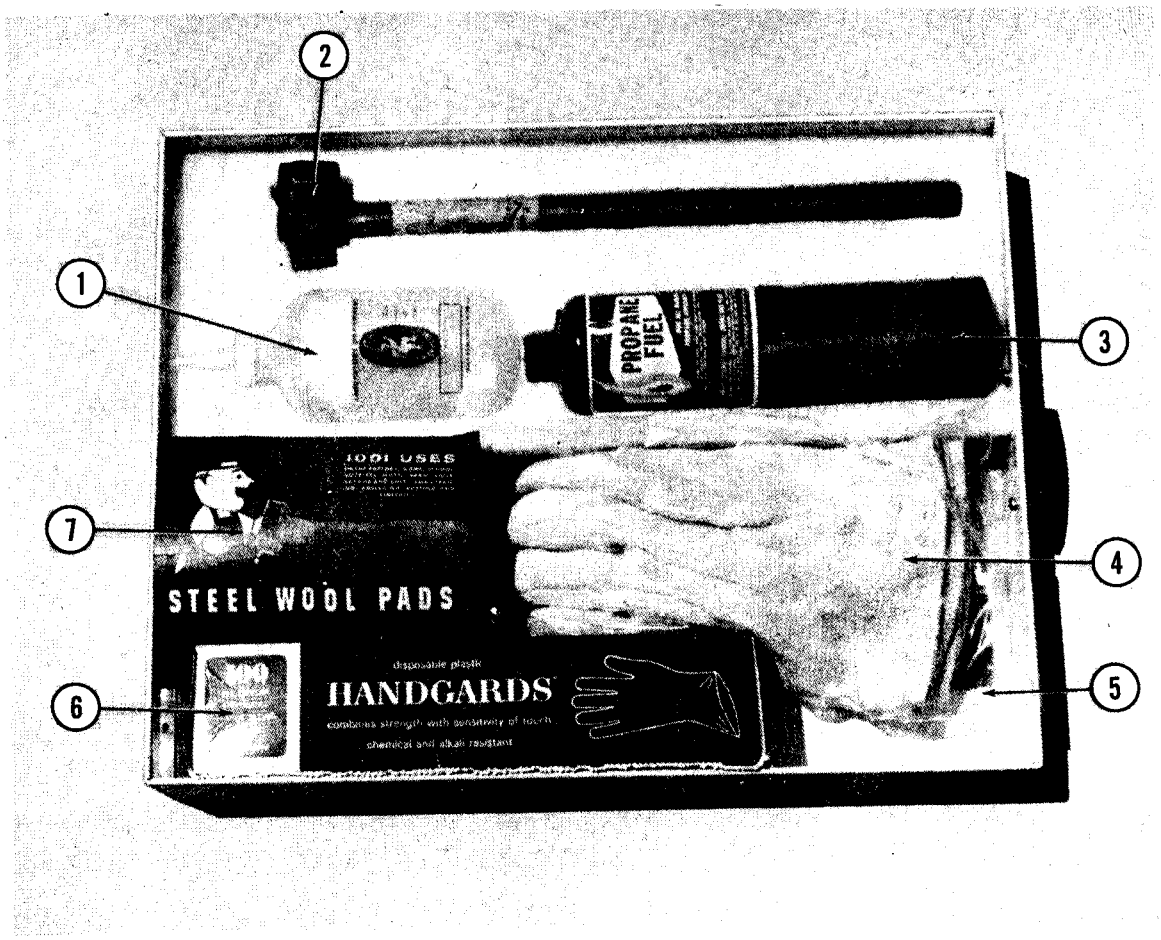
Figure B-11. Drawer No. 11 (6, fig. 1-3)



TS 6640-213-14/B-12 (1)

1. Air-vac pump
2. Sample bottles

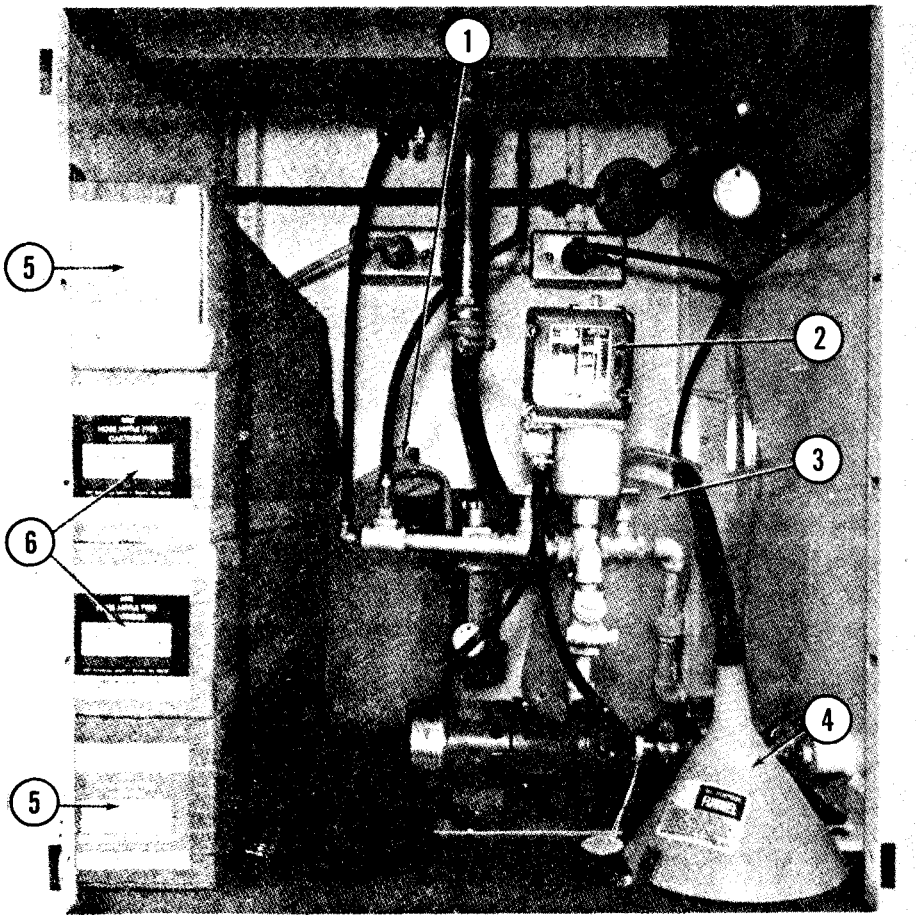
Figure B-12. Cabinet No. 12 (7, fig. 1-3)
(Sheet 1 of 2)



TS 6640-213-14/B-12 (2)

1. Detergent dispenser
2. Bung wrench
3. Propane tank
4. Asbestos gloves
5. Carbide paper
6. Plastic gloves
7. Steel wool pads

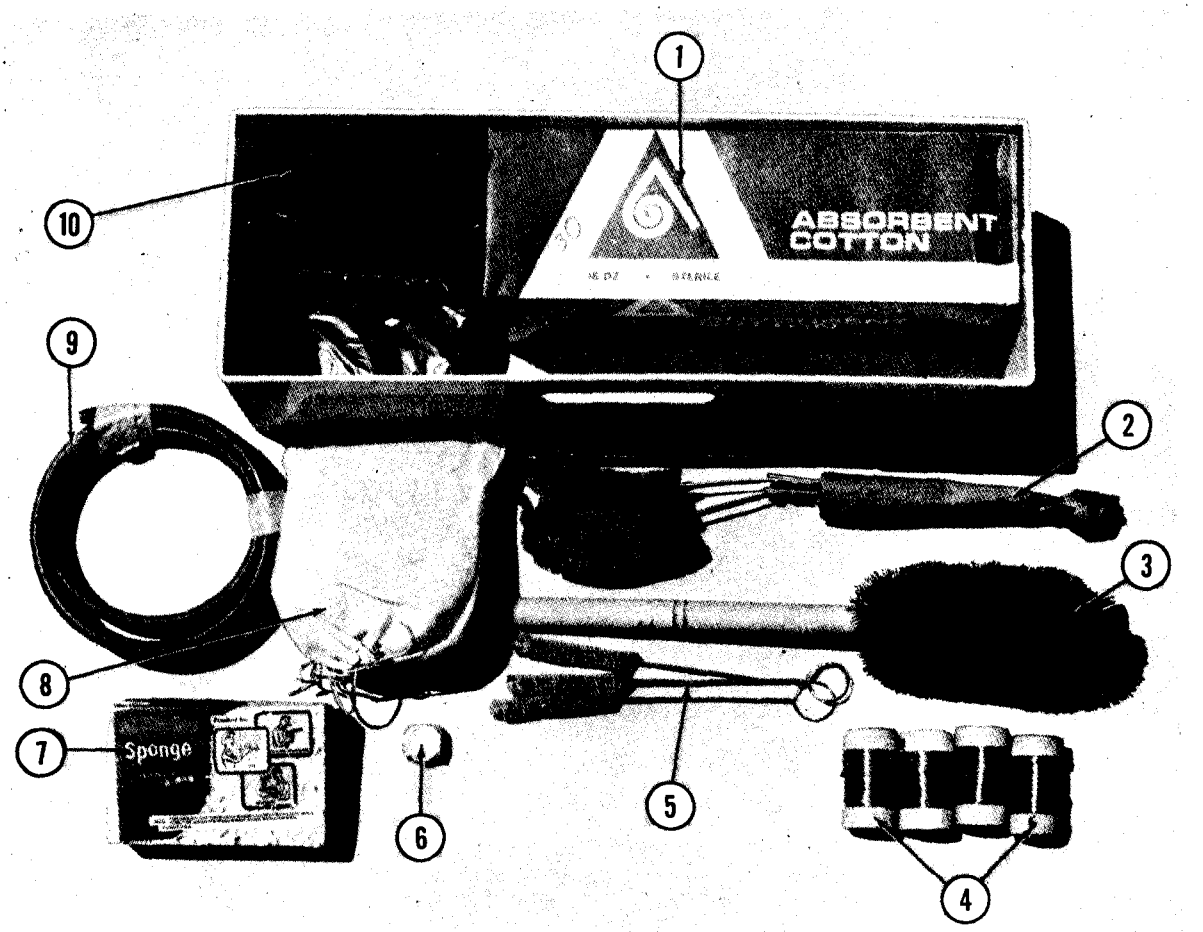
Figure B-12. Auxiliary Drawer of Cabinet No. 12 (7, fig. 1-3) (Sheet 2 of 2)



TS 6640-213-14/B-13 (1)

1. Detergent
2. Pressure switch
3. Polyethylene bottle
4. Funnel
5. Demineralizer cartridges, organic
6. Demineralizer cartridges, mixed resin

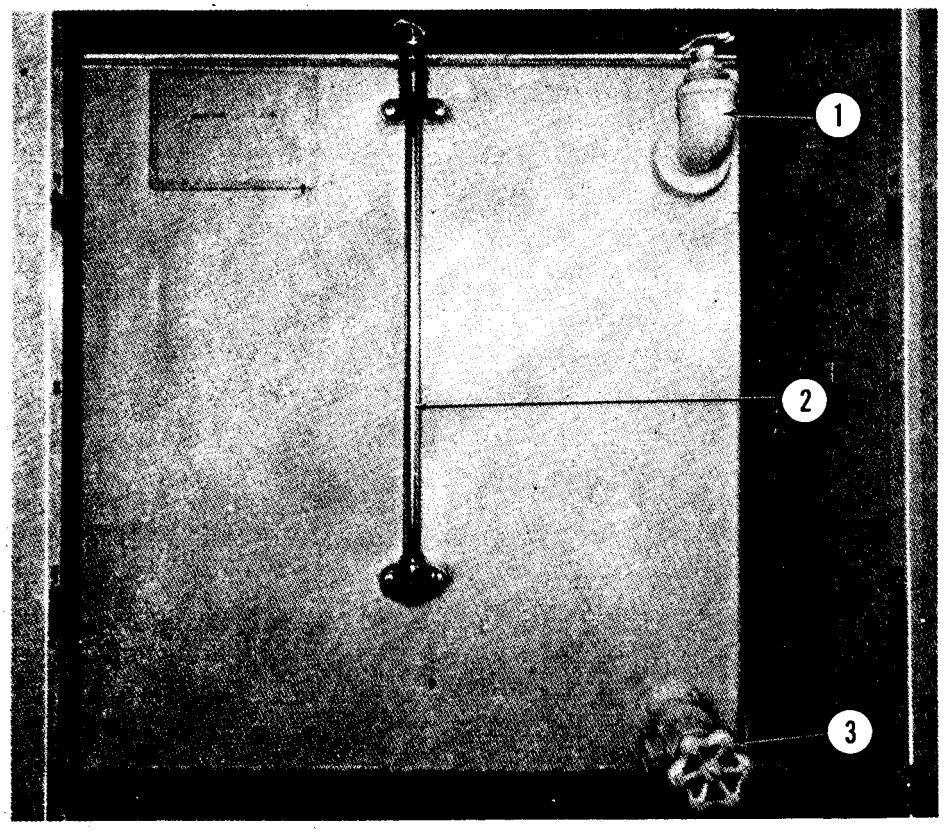
Figure B-13. Cabinet No. 13 (5, fig. 1-3) (Sheet 1 of 2)



TS 6640-213-14/B-13 (2)

1. Cotton
2. Flask brush
3. Beaker brush
4. Copper wire
5. Test tube brush
6. Faucet nozzle
7. Sponge
8. Cloth bags
9. Tubing, 3/8 in.
10. Lab apron

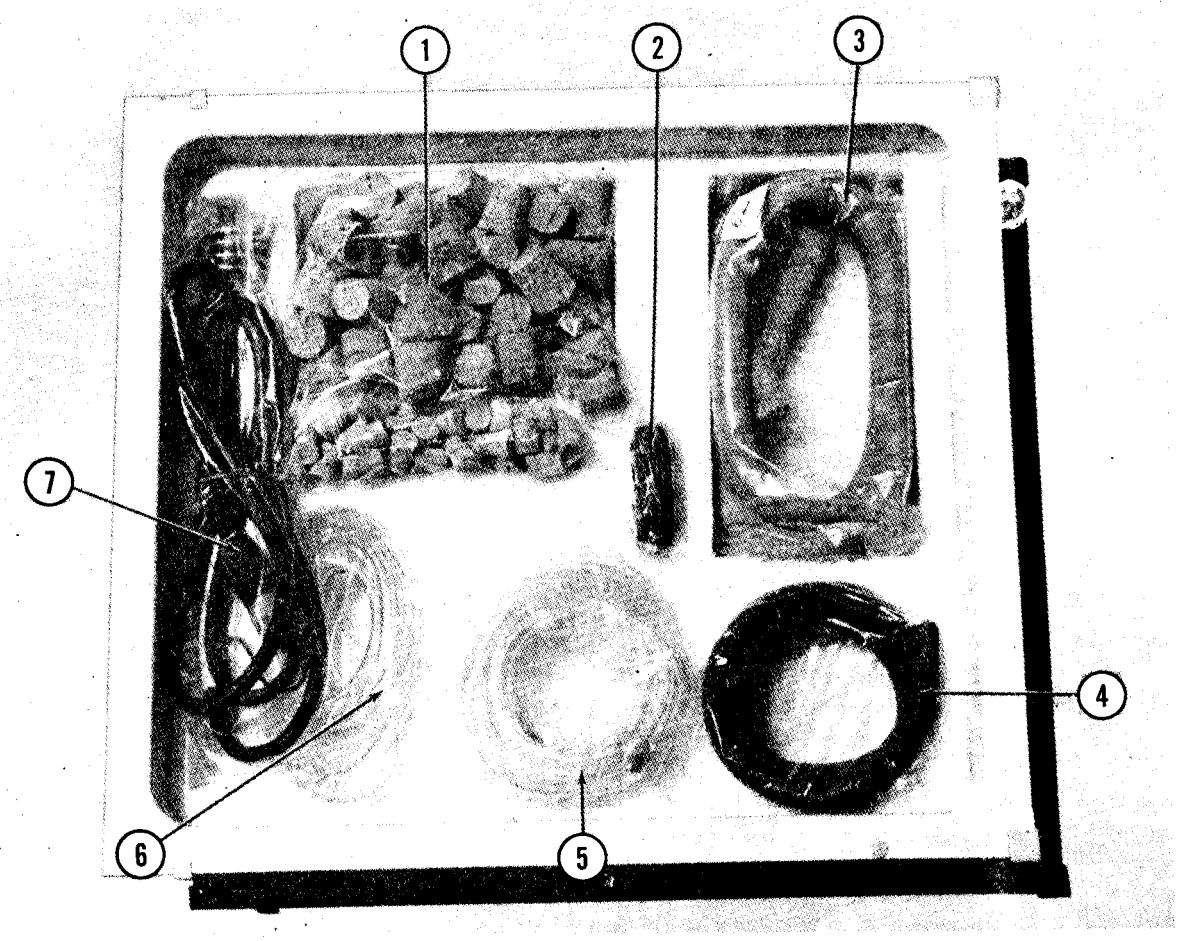
Figure B-13. Auxiliary Drawer of Cabinet No. 13 (5, fig. 1-3) (Sheet 2 of 2)



TS 6640-213-14/B-14

1. Air bleed valve and hand-fell parts
2. Sight gage
3. Draincock

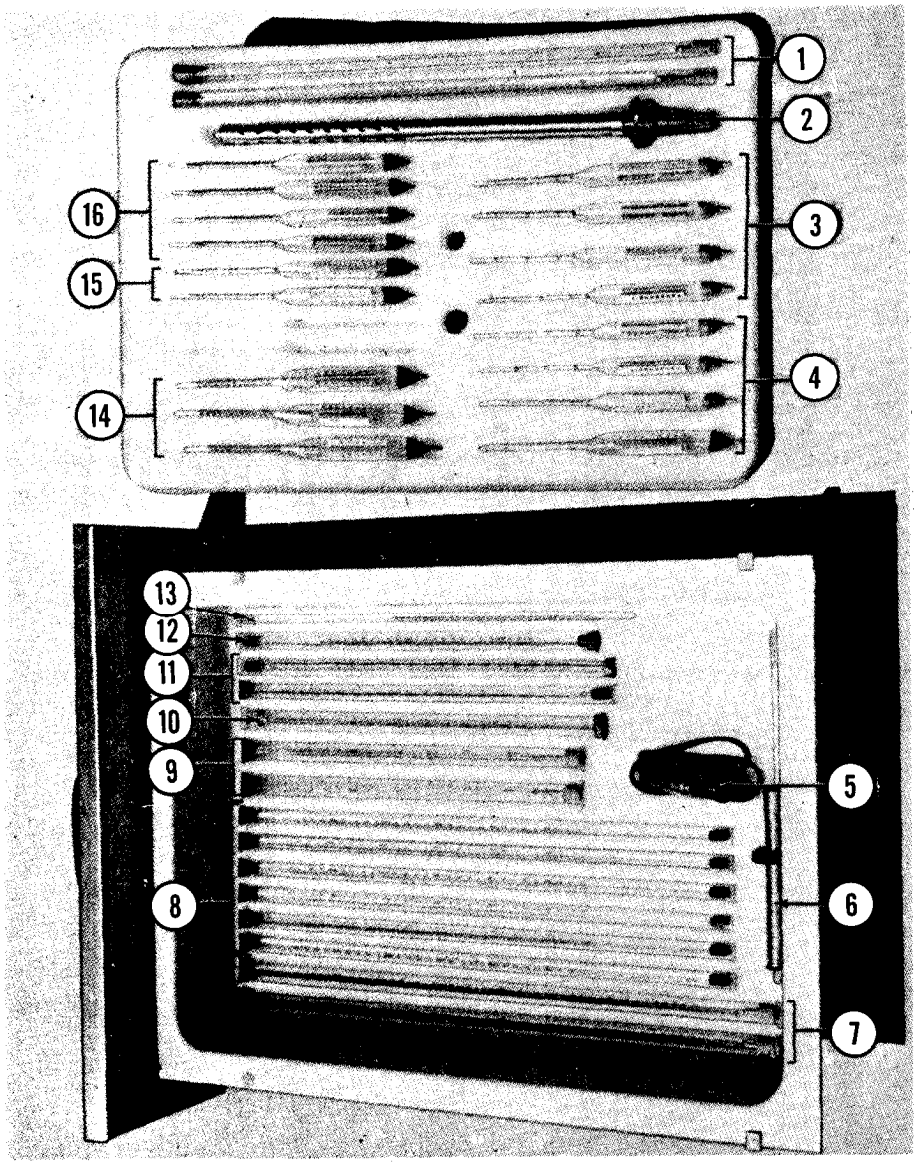
Figure B-14. Water Tank in Cabinet No. 16 (4, fig. 1-3)



TS 6640-213-14/B-15

1. Corks
2. 3/6-inch rubber tubing
3. 5/8-inch rubber tubing
4. 3/8-inch rubber tubing
5. 1/4-inch tygon tubing
6. 3/16-inch and 5/16-inch tygon tubing
7. Immersion heater

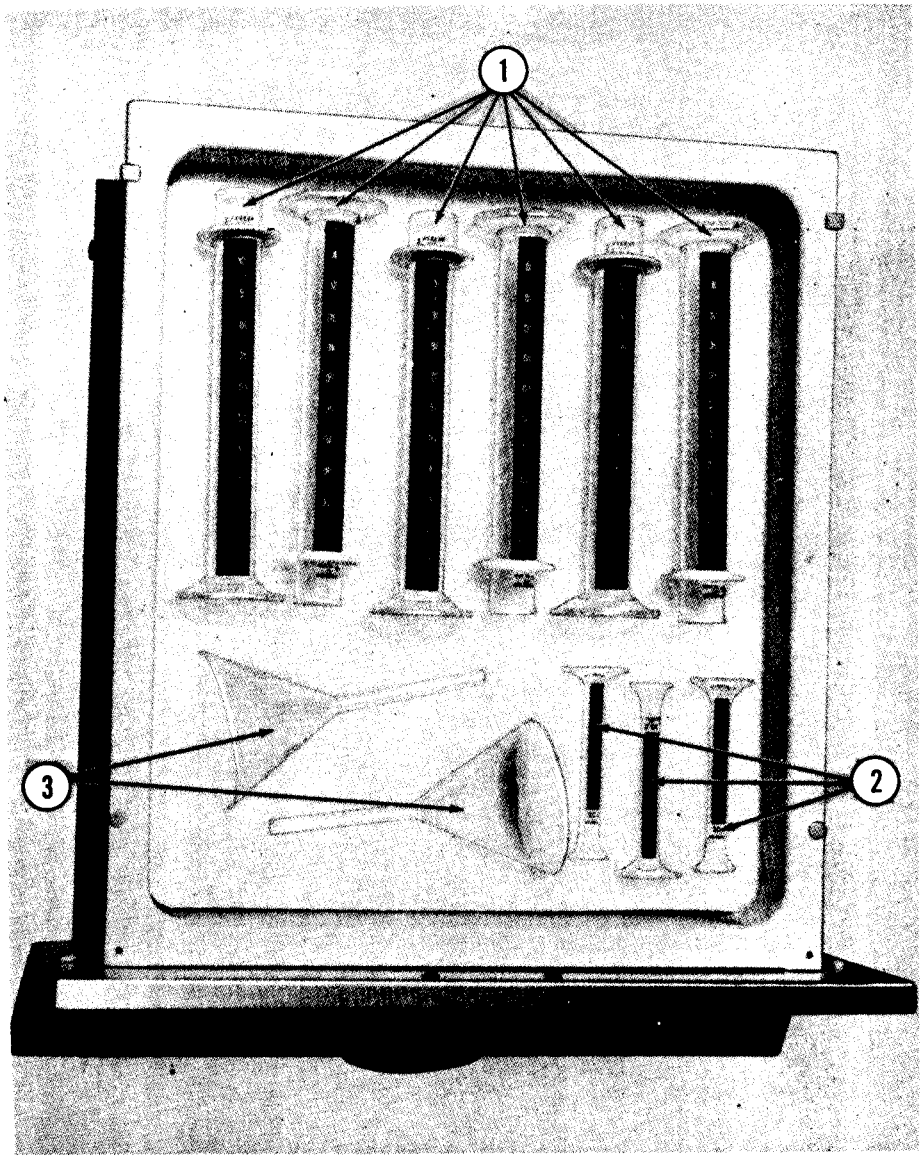
Figure B-15. Auxiliary Drawer of Cabinet No. 10 (4, fig. 1-3)



TS 6640-213-14/B-16

1. Thermometer 58 F
2. Thermoregulator and guard
3. Hydrometer 59 degrees - 71 degrees F
4. Hydrometer 69 degrees - 81 degrees F
5. Thermoregulator plug and wire
6. Thermostat RVP
7. Thermometer 18F
8. Thermometer 7F
9. Thermometer 12F
10. Thermometer 64F
11. Thermometer 68F
12. Thermometer 9F
13. Thermometer 10F
14. Hydrometer 39 degrees - 51 degrees F
15. Hydrometer 29 degrees - 41 degrees F
16. Hydrometer 49 degrees - 61 degrees F

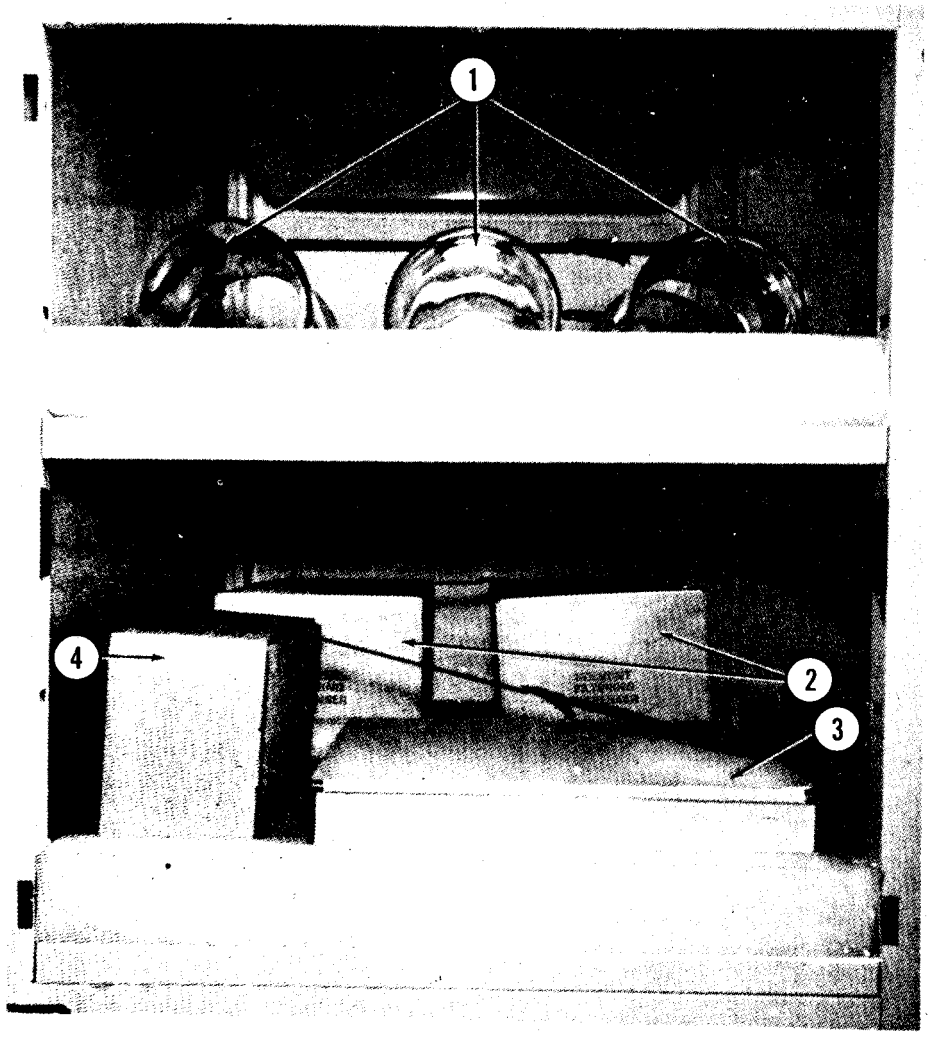
Figure B-16. Drawer No. 15 (20, fig. 1-4)



TS 6640-213-14/B-17

1. 100-ml cylinders
2. 5-ml cylinder
3. Funnels

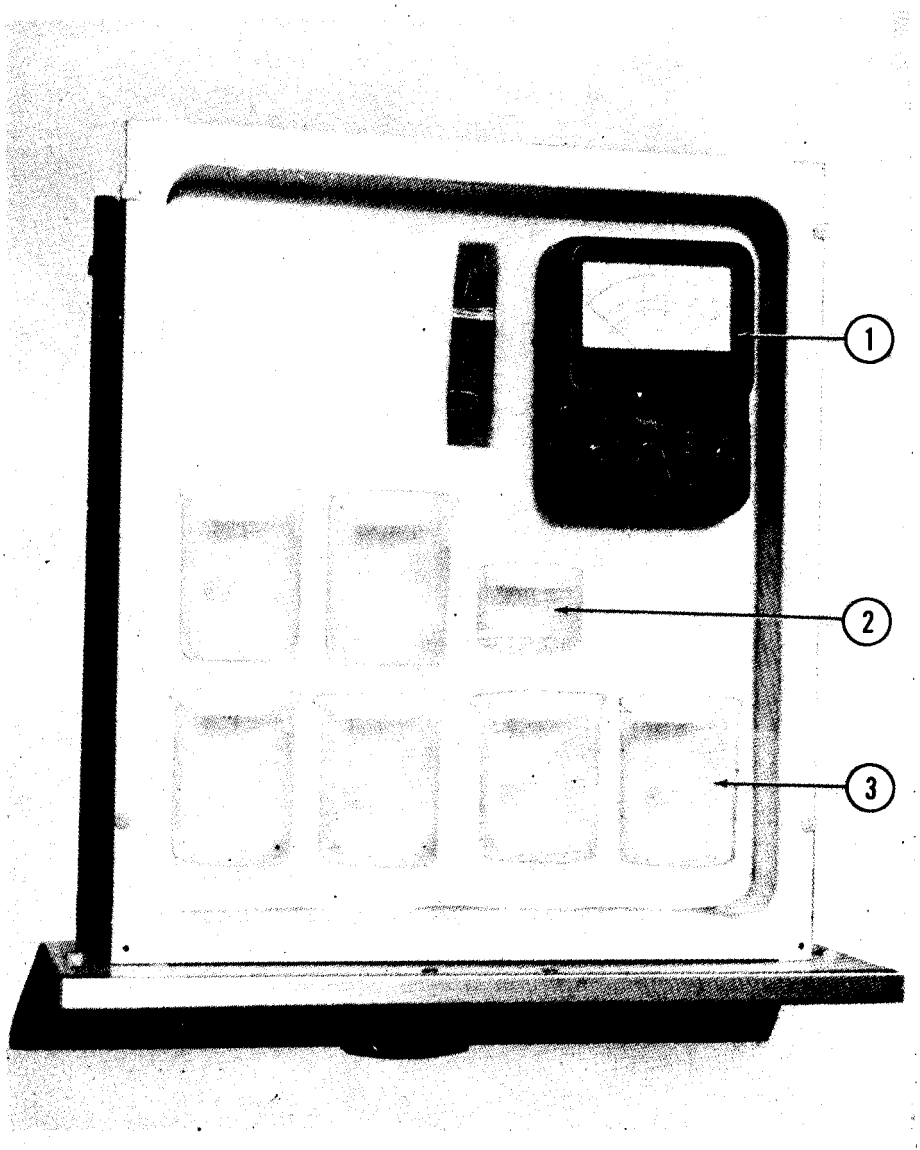
Figure B-17. Drawer No. 16 (16, fig. 1-4)



TS 6640-213-14/B-18

1. 1000-ml beakers
2. Filtering dispensers
3. Petri dishes
4. Filter holders

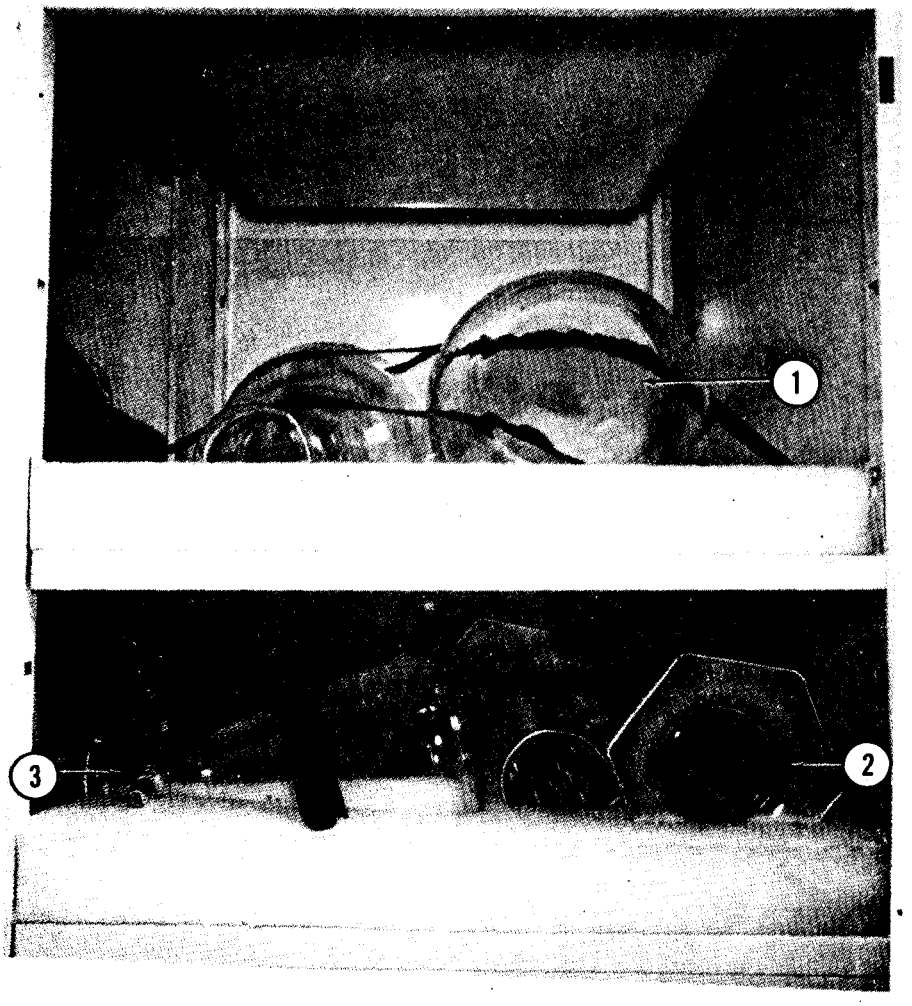
Figure B-18. Cabinet No. 17 (17, fig. 1-4)



TS 6640-213-14/B-19

Multimeter 0 to 5000 v
Biological dish
400-ml beaker

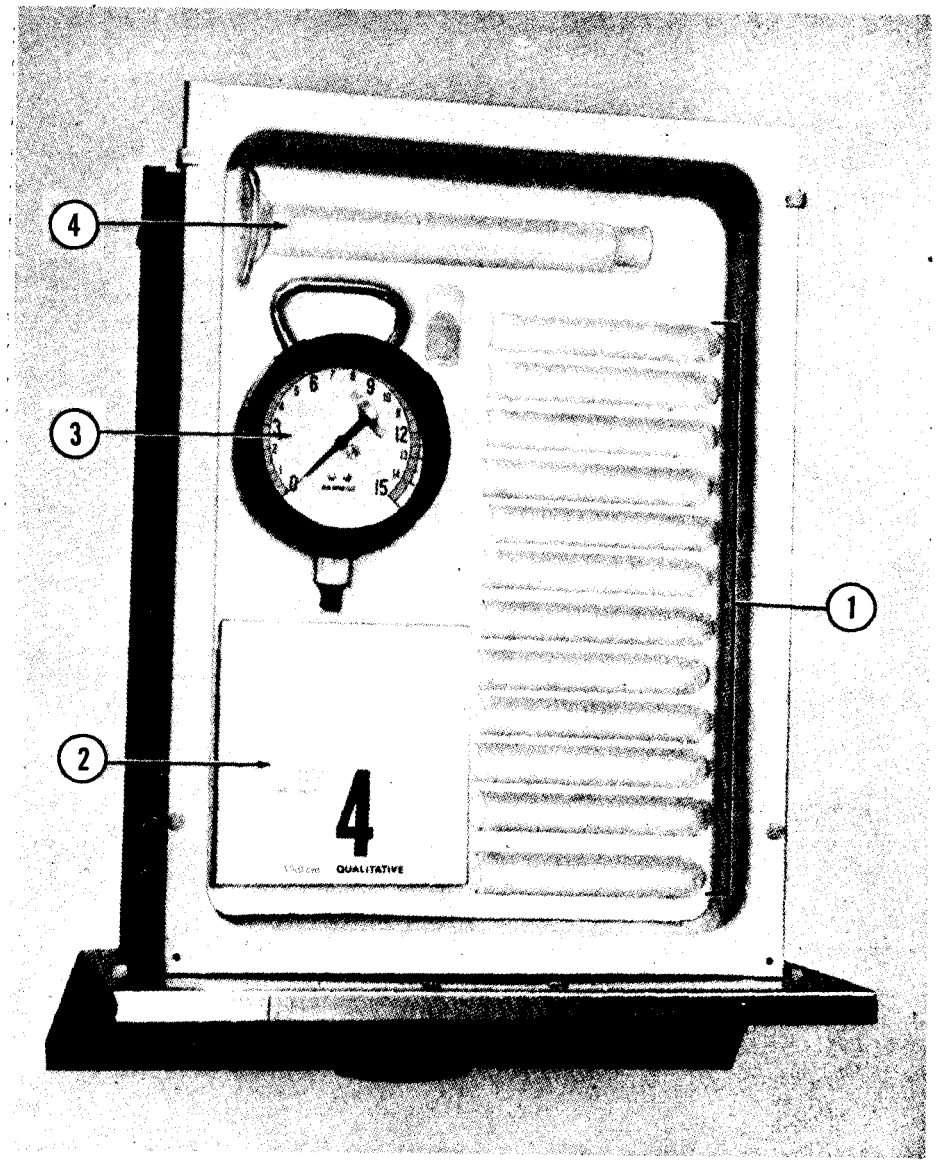
Figure B-19 . Drawer No. 18 (“14, fig. 1-4)



TS 6640-213-14/B-20

1. 4000-ml flask with side tube
2. Graduated cylinder, 1000 ml
3. 1000-ml flask with side tube

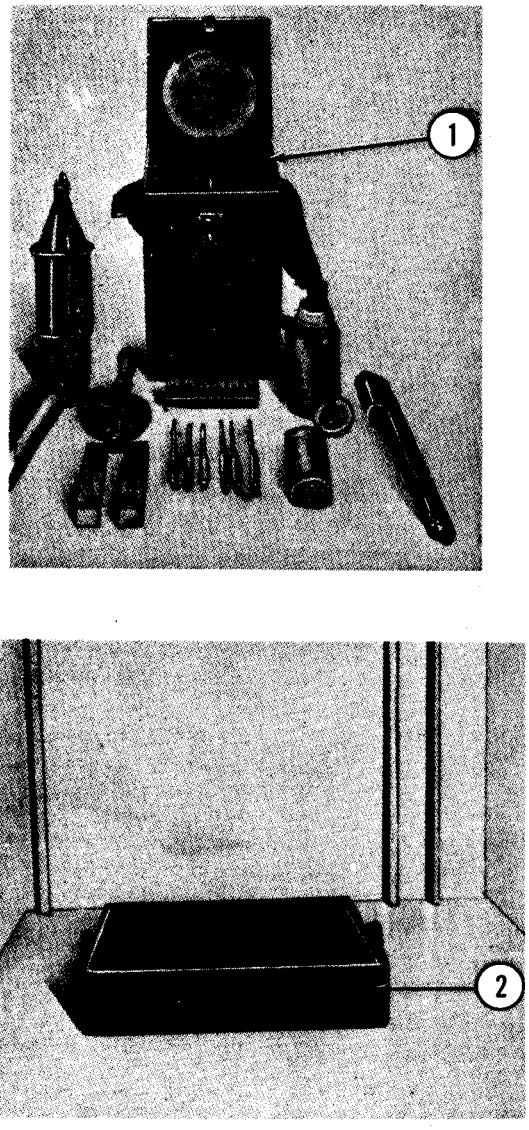
Figure B-20. Cabinet No. 19 (15, fig. 1-4)



TS 6640-213-14/B-21

1. Test tubes
2. Filter paper
3. RVP gage 0 to 15
4. 100-ml graduate cylinder

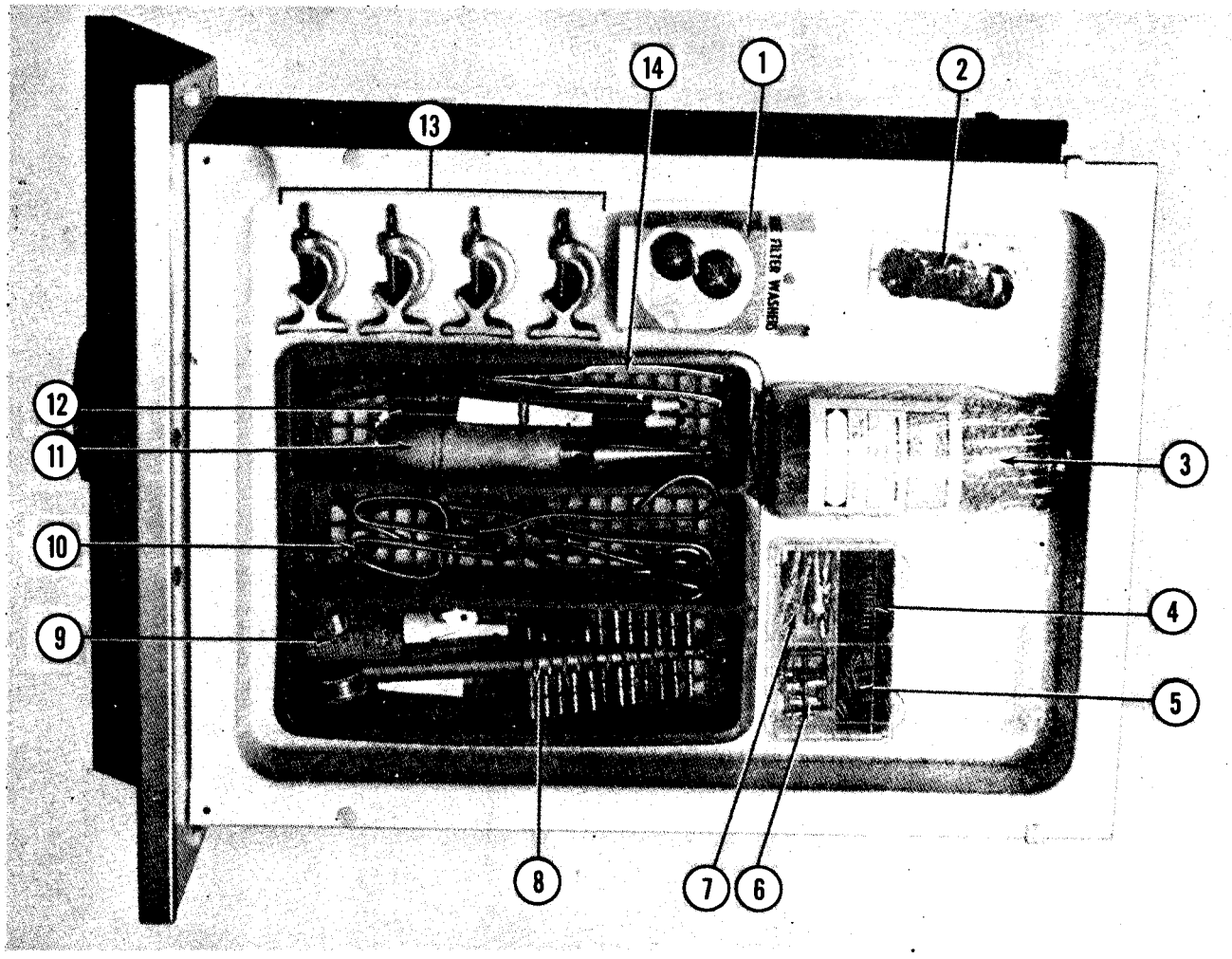
Figure B-21. Drawer No. 20 (10, fig. 1-4)



TS 6640-213-14/B-22

1. Petroleum testing kit, with components (top shelf)
2. Shipping and mounting base (bottom shelf)

Figure B-22. Cabinet No. 21 (11, fig. 1-4)



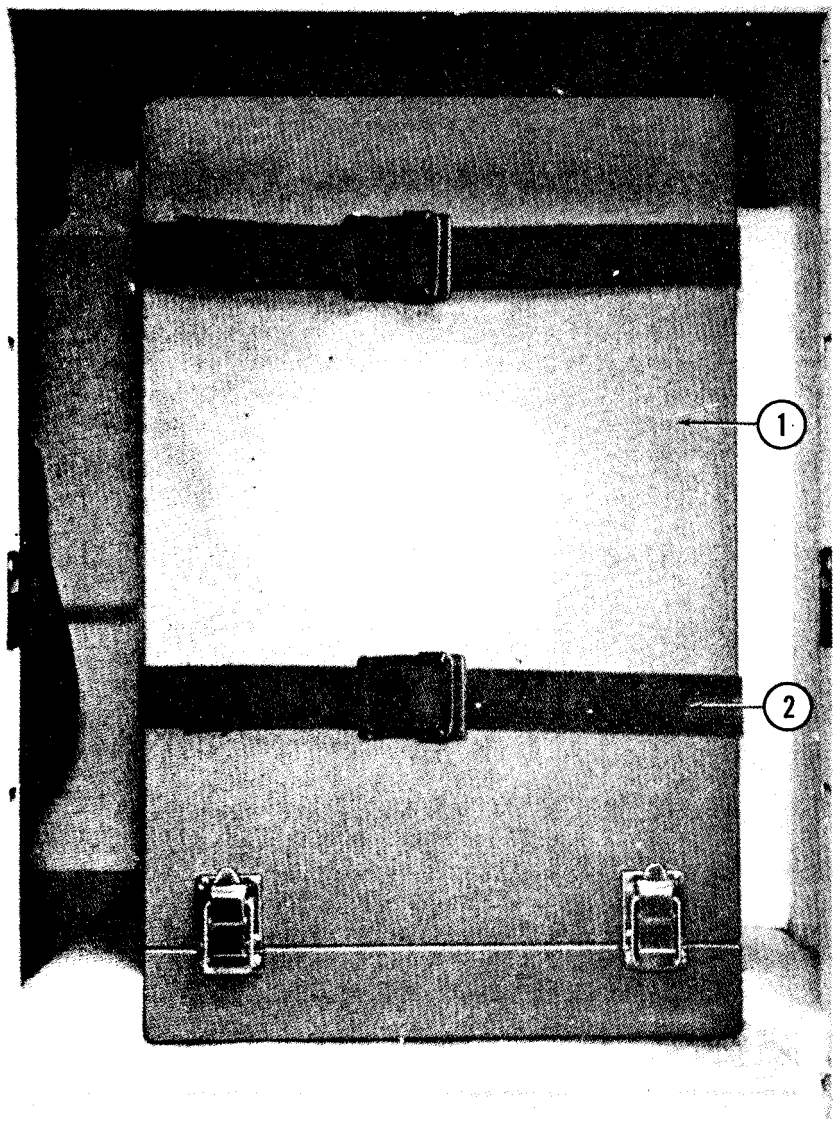
TS 6640-213-14/B-23

1. Filter washer
2. Garden hose washers
3. Desiccant
4. Large RVP bomb gaskets
5. Small RVP bomb gaskets
6. Tubing clamps
7. Alligator clamps
8. Cork borer set
9. Oil
10. Beaker tongs
11. Cork borer sharpener
12. Grease Pencils
13. Heater clamps
14. Forceps

Figure B-23. Drawer No. 22 (6, fig. 1-4)

NOTE

Laboratory tongs are hidden under beaker tongs and tweezers are hidden under oil.



TS 6640-213-14/B-24

1. Analytical balance in case
2. Shipping strap

Figure B-24. Cabinet No. 23 (9, fig. 1-4)

APPENDIX C

ABBREVIATIONS

ac	alternating current
ACS	American Chemical Society
amp	ampere(s)
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
advp	avoirdupois
AWG	American Wire Gage
AY	Assembly (U/I)
BD	bundle (U/I)
bp	boiling point
BT	bottle (U/I)
Btu/h	British thermal units per hour
BX	box(es) (U/I)
c	centigrade
cc	cubic centimeters
cfm	cubic feet per minute
cm	centimeter(s)
CN	can (U/I)
CO-bs	National Bureau of Standards
CT	carton(s) (U/I)
cu	cubic
dc	direct current
deg	degree(s)
dia	diameter(s)
DZ	dozen (U/I)
EA	each (U/I)
elec	electric
F	Fahrenheit
Fed	Federal
FSN	Federal Stock Number
FT	Feet, foot (U/I)
FTMS	Federal Test Method Standard
g	grams(s)
GL	gallon (U/I)
gph	gallons per hour
h	height, high
Hg	mercury
hp	horsepower
Hz	Hertz
id	inside diameter
JR	jar (U/I)
kw	kilowatt
lb	pound(s) (U/I)
lel	lower explosion limit
lg	long, length
ma	milliampere
mg	milligram(s)
Mi1	Military
min	minimum, minute(s)
ml	milliner
mm	millimeter(s)
no.	number(s)
ns n	national stock number
od	outside diameter(s)
ppm	parts per million
psi	pounds per square inch
psig	pounds per square inch gage
PT	pint(s) (U/I)
QT	quart(s) (U/I)
rpm	revolutions per minute
Rvp	Reid vapor pressure
SE	set (U/I)
Spec	Specification(s)
Sq	square
Std	Standard(s)
M	micron
U/I	unit of issue
v	volt(s)
w	watt(s)

APPENDIX D

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

D-1 . GENERAL.

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component and the work measurement time required to perform the functions by the designated maintenance level. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance function.

c. Section III lists the tools and test equipment required for each maintenance function as referenced from Section II.

D-2. EXPLANATION OF COLUMNS IN SECTION II.

a. Column (1), Group Number. Column 1 lists group numbers to identify related components, assemblies, subassemblies, and modules with their next higher assembly. The applicable groups are listed in the MAC in disassembly sequence beginning with the first group removed.

b. Column (2), Component/Assembly. This column contains the noun names of components, assemblies, subassemblies and modules for which maintenance is authorized.

Column (3), Maintenance Functions. This column lists the functions to be performed on the item listed in Column (2). The maintenance functions are defined as follows:

(1) Inspect. To determine serviceability and detect incipient failure by measuring the mechanical or electrical characteristics with established standards through examination.

(2) Test. To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

(3) Service. Operations required periodically to keep an item in proper operating condition, i,e, . to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants) hydraulic fluids, or compressed air supplies.

(4) Adjust. To maintain within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

(5) Align. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparison to two instruments, one of which is a certified standard of known accuracy of the instrument being compared.

(6) Install. The act of emplacing, seating, or fixing into position an item, part or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

(7) Replace. The act of substituting a serviceable like type part, subassembly or module (component or assembly) for an unserviceable counterpart.

(8) Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in part, subassembly, module (component or assembly), end item, or system.

(9) Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed maintenance standards (i.e. , DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to a like' new condition.

(10) Rebuild. Consisits of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance supplied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

d. Column (4), Maintenance Category. This column is made up of subcolumns for each category of maintenance. Work time figures are listed in these subcolumns for the lowest level of maintenance authorized to perform the function listed in Column (3). These figures indicate the average active time required to perform the maintenance function at the indicated category of maintenance under typical field operating conditions.

Column (5), Tools and Equipment. This column is provided for referencing by code, the common tool sets (not individual tools) special tools, test and support equipment required to perform the designated function.

f. Column (6) , Remarks. This column shall contain a letter code in alphabetic order which shall be keyed to the remarks contained in Section IV.

D-3. EXPLANATION OF COLUMNS IN SECTION III.

a. Column (1), Reference Code. This column consists of an arabic number listed in sequence from Column (5) of Section II. The number references the common tool sets, special sets and test equipment requirements.

b. Column (2), Maintenance Level. This column shows the lowest category of maintenance authorized to use the special tools or test equipment.

c. Column (3), Nomenclature. This column lists the name or identification of the common tool sets, special tools or test equipment.

d. Column (4), National/Nato Stock No. (NSN). This column is provided for the NSN of common tool sets, special tools and test equipment listed in the Nomenclature column.

e. Column (5), Tool Number. This column lists the manufacturer's code and part number of tools and test equipment.

Section II. MAINTENANCE ALLOCATION CHART

(1) Group Number	(2) Component/Assembly	(3) Maintenance function	(4) Maintenance Level C	O	F	H	D	(5) Tools and equip. ment	(6) Remarks
01	Military Shelter								A
02	Alarm, Gas, Automatic	Inspect	0.2					01	
		Test	0.2					01	
		Replace		1.0				02	
		Repair		4.0				01,02,	
		Calibrate						03	
				4.0					B
03	Balance, Analytical	Inspect	0.2						
		Replace	0.5					02	
		Repair		1.0				02	
		Calibrate	1.0						C
04	Balance, Double Beam	Inspect	0.2						
		Replace	0.2					02	
		Repair	0.2					02	D
05	Barometer, Aneroid	Inspect	0.2						
		Replace	0.5					02	
		Repair					2.0		
06	Bath, Corrosion	Inspect	0.2						
		Replace	0.2					02,03	
		Repair		1.0				01	
07	Bath, Reid Vapor Pressure	Inspect	0.3						
		Replace		1.5				02	
		Repair			8.0			01,02,	
		Calibrate	1.0					03	F
08	Cabinet, Descicating	Inspect	0.2						
		Replace	1.0					02	
		Repair	0.5					02	G
09	Demineralizer, Water	Inspect	0.2						
		Replace	0.5					02	
		Repair	0.2					02	H
10	Kit, Water, Detector	Inspect	0.3						
		Replace	0.2						
		Calibrate	0.5					02	I
11	Distillation Test Apparatus	Inspect	0.3						
		Replace		0.5				02	
		Repair			4.0			02	
12	Heater, Electric, Extraction	Inspect	0.2						
		Replace	0.2					02	
		Repair		6.0				01,02	

Section II. MAINTENANCE ALLOCATION CHART (Cont)

(1) Group Number	(2) Component/Assembly	(3) Maintenance function	(4) Maintenance Level C	O	F	H	D	(5) Tools and equipment	(6) Remarks
13	Refrigerator-Icemaker	Inspect	0.5						
		Replace		3.0				02	
		Repair			12.0			01,02 03	
14	Manometer	Inspect	02						
		Replace		0.5					
		Calibrate	1.0					02	J
15	Multimeter	Inspect	0.2						
		Replace	0.2						
		Repair		3.0				02	
		Calibrate					2.0		K
16	Oven, Utility	Inspect	0.5						
		Replace		0.5					
		Repair			2.0			01,02 03	
17	Pump, Centrifugal, Water	Inspect	0.2						
		Replace	1.5					02 01,02, 03,04	
18	Refractometer	Inspect	0.2						
		Replace	0.5						
		Repair	0.5					02	L
19	Tester, Flash Point	Inspect	0.2						
		Replace	0.5						
		Repair		1.5				02	
20	Pump, Vacuum	Inspect	0.2						
		Replace	1.0					02	
		Repair			6.0			01,02, 03	
21	Weight Set, Balance	Inspect	0.2						
		Replace	0.2						
		Calibrate					1.0		M
22	Blower, Purging	Inspect	0.3						
		Replace		3.0				02	
		Repair			8.0			02	

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) Reference code	(2) Maintenance level	(3) Nomenclature	(4) National/NATO stock number	(5) Tool number
01	C	Multimeter, 0 to 5000V	6625-00-998-6084	(55026) 260-5
02	C	Assorted Tools (Located in Drawer No. 5) consisting of:		
		1 ea. Pliers, Lg. Nose, 6 In. Lg.	5120-00-247-5177	
		1 ea. Hammer, Hand, 8 oz.	5720-00-061-8541	
		1 ea. Wrench, Adj., 8 In. Lg.	5120-00-240-5328	
		1 ea. Screwdriver, Crosstip, 8 In.	5120-00-542-3438	
		1 ea. Wrench, Adj., 12 In. Lg.	5120-00-264-3796	
		1 ea. Flashlight	6230-00-269-3034	
		1 ea. Screwdriver, Flat Tip, 8 In.	5120-00-260-4837	
		1 ea. Screwdriver, Flat Tip, 6 In.	5120-00-278-1283	
		1 ea. Pliers, Straight Nose, 6 In.	5120-00-223-7396	
		1 ea. Screwdriver, Flat Tip, 2 In.	5120-00-236-2140	
03	C	Kit, Soldering Gun, 115V, 60 Cycle, Complete with Solder and Carrying Case	3439-00-930-1638	NPN
04	C	Soldering Torch Kit, Propane	3439-00-542-0531	(70785) JT25

Section IV. REMARKS

Reference Code	Remarks
A	Refer to TM 11-5410-213-14P and TB 750-240 for Maintenance Instructions
B	The Alarm System will be calibrated in accordance with the Instructions in Chapter II, Section II.
C	Repair is restricted to the replacement of only those parts listed in the Integral Components of End Item List (ICOEIL). All other Maintenance will be accomplished by returning the balance to the Manufacturer. Refer to TB 750-25 and TB 9-5200-201-50 for calibration.
D	Repair is restricted to the replacement of the pans. All other Maintenance will be accomplished by returning the balance to the Manufacturer.
E	Repair is restricted to the replacement of the Glass Bezel. All other Maintenance will be performed at Depot Level.
F	Refer to Chapter 3 for calibration of the Thermoregulators and the Gages.
G	Repair is restricted to replacement of the Rubber Door Gasket.
H	Repair is restricted to the replacement of the Filter Cartridges.
I	Refer to TM 5-6630-216-12 for calibration of the Meter Pack.
J	Refer to Chapter 3 for calibration of the Manometer.
K	Refer to TB 6625-961-50 for calibration of the Multimeter.
L	Repair is restricted to the replacement of those parts listed in the ICOEIL. All other maintenance will be accomplished by returning the Refractometer to the Manufacturer.
M	Refer to TB 9-5200-201-50 fro calibration of the Weight Set.

INDEX

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81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN.

SAMPLE

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REVERSE OF DA FORM 2028-2

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 5-6640-213-14	24 Jun 1980	Laboratory, Air Mobile Aviation Fuel NSN 6640-00-902-9711

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.365	metric tons	short tons	1.102
pound-inches	mewton-meters	.11375			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 046208-000