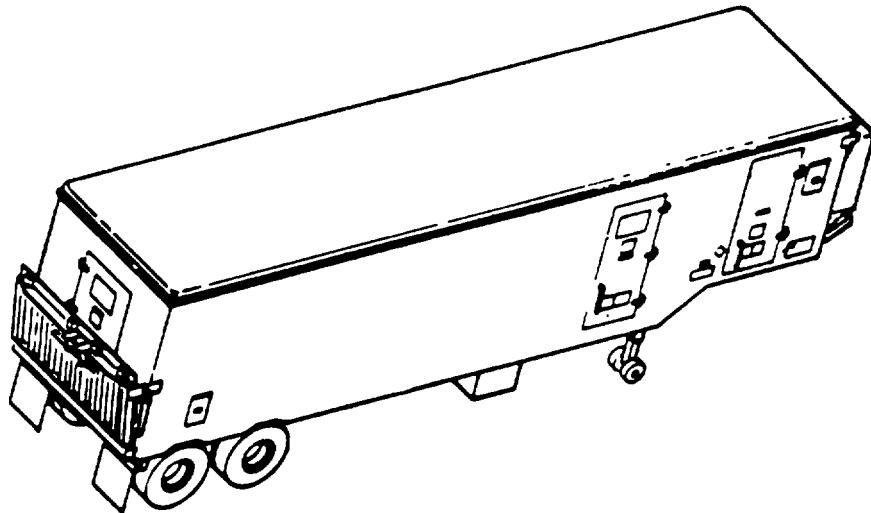


TECHNICAL MANUAL

OPERATOR'S MANUAL
FOR

ARMY OIL ANALYSIS PROGRAM
(AOAP)
MOBILE LABORATORY
SEMI-TRAILER MOUNTED
NSN 6640-01-254-1699

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and the content requirements normally associated with Army technical manuals. This technical manual does, however, contain all essential information required to operate and maintain the equipment.



Approved for public release; Distribution is unlimited.

HEADQUARTERS, DEPARTMENT OF THE ARMY
26 OCTOBER 1990

CHANGE
NO. 1
APRIL 1992

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 27

Operator's Manual
for
ARMY OIL ANALYSIS PROGRAM
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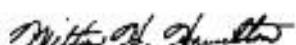
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Official:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff



MILTON H. HAMILTON
Administrative Assistant to the
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01057

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WARNINGS

HIGH VOLTAGE
is used in the operation of this equipment

DEATH ON CONTACT
may result if personnel fail to observe safety precautions

Death or serious injury may result from connecting main power cable to laboratory before grounding.

Do not attempt to connect live main power cable to laboratory electrical connector. Deactivate power source at generator set before connecting cable to connector.

WARNINGS

COMBUSTIBLE GASES
may be present in the shelter after prolonged periods

DEATH OR SERIOUS INJURY
may result if personnel fail to observe safe operating practices.

Do not attempt to enter laboratory during laboratory startup until automatic purge cycle (5 minutes) is completed. Dangerous combustible gases or vapors may be present which could ignite and cause death or serious injury to personnel.

WARNING

RADIOACTIVE MATERIAL

The ionizing unit utilized contains the radioactive isotope polonium which is an alpha emitter and can be a health hazard if ingested. When the unit is no longer effective as a static eliminator, the small quantity of radioactive materials remaining presents a potential hazard if mishandled. Do not discard as scrap. Dispose of as radioactive material in accordance with existing instructions.

WARNING

PRESSURIZED OXYGEN AND OIL

Do not lubricate valves or regulators on compressed gas bottles. Pressurized oxygen and oil can create an explosion that could cause death or injury to personnel.

WARNING

**Monobromotrifluoromethane liquid or gas can cause
DEATH
or serious injury if personnel fail to observe safety precautions.**

- Inhalation of monobromotrifluoromethane gas (Halon 1301) at concentrations of 5% to 6% for more than 4 or 5 minutes may result in serious cardiac or central nervous system effects.
- Liquid Halon 1301 (including the spray in the immediate vicinity of discharge) may freeze the skin (frostbite) on contact. Wear protective clothing and eye protection to avoid such contact. In the event of frostbite, warm the affected area quickly to body temperature. Immerse hands in warm water or place hands in armpits. Get medical attention promptly.

For First Aid Refer to FM 21-1 1.

TECHNICAL MANUAL
NO. 10-6640-233-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 26 October 1990

**OPERATOR'S MANUAL
FOR
ARMY OIL ANALYSIS PROGRAM (AOAP) MOBILE LABORATORY
NSN 6640-01-2541699**

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), on DA Form 2028-2 located in back of this book to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MMTS, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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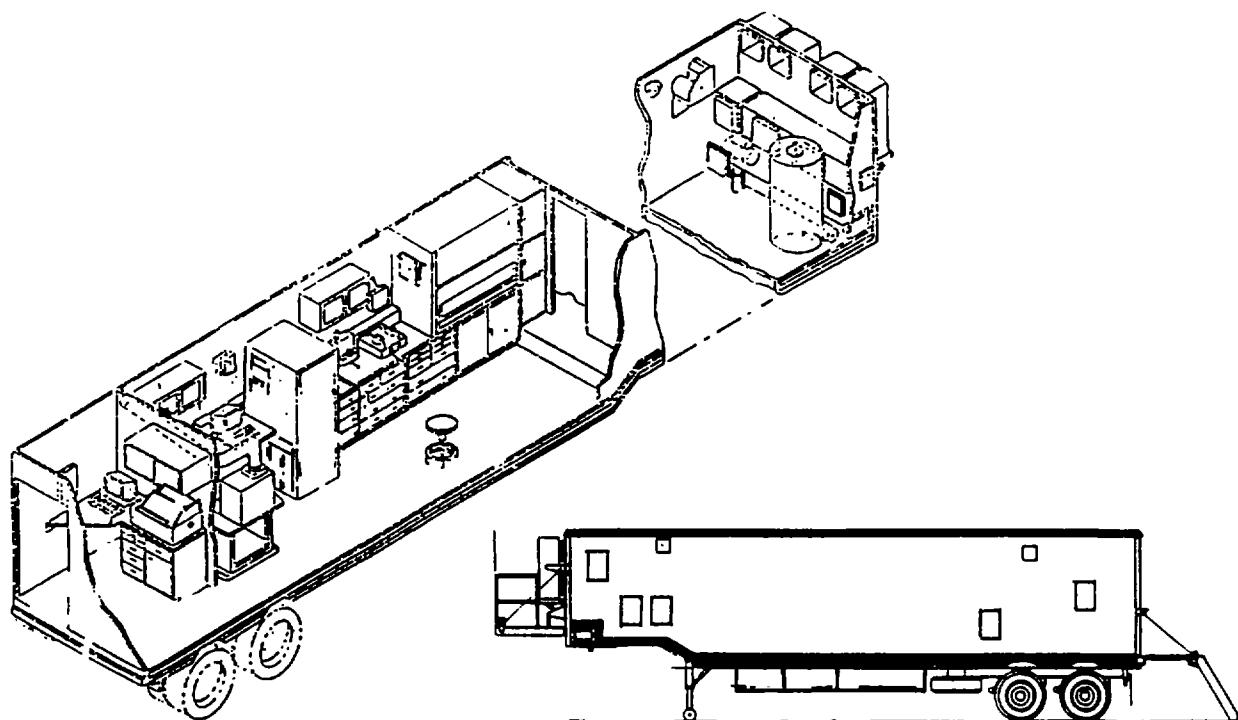
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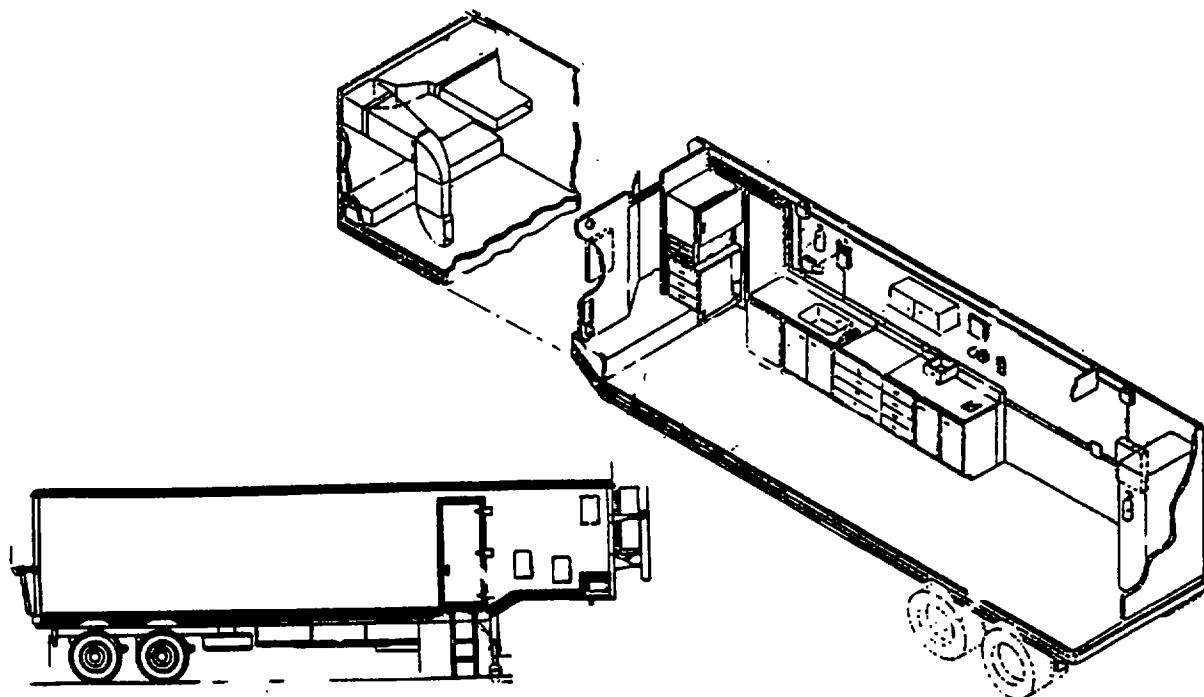
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ROADSIDE



CURBSIDE

Figure 1-1. Army Oil Analysis Program (AOAP) Mobile Laboratory

CHAPTER 1

INTRODUCTION

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Section I. GENERAL INFORMATION

1-1. Scope. This manual provides operating procedures and operator maintenance for the Army Oil Analysis Program (AOAP) Mobile Laboratory, Model Number PD6640-0043 (NSN 6640-01-254-1699). The purpose and intended use of the AOAP Mobile Laboratory is to provide mobile oil analysis capability for aeronautical and selected nonaeronautical equipment in a theater of operations. Present capabilities of on-line aviation maintenance preclude the ability to monitor internal wear of lubrication and hydraulic systems. When assigned to, or deployed with, an aviation maintenance support unit, the AOAP Mobile Laboratory is able to analyze a minimum of 2500 used oil samples per month for wear metal content.

1-2. Maintenance Forms and Records. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS) (Maintenance Management Update).

1-3. Hand Receipt (-HR) Manuals. Not applicable.

1-4. Reporting of Equipment Improvement Recommendations (EIR). If your AOAP Mobile Laboratory needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to us at: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-QS, 4300 Goodfellow Boulevard, St. Louis, Missouri 63120-1798. We will send you a reply.

1-5. Warranty Information. The AOAP Mobile Laboratory is warranted for one year. The warranty starts on the date found in block 23, DA Form 2408-9 in the logbook. Report all defects in material and workmanship to your supervisor who will take appropriate action.

1-6. Safety, Care, and Handling. Safe and efficient AOAP Mobile Laboratory operations depend on the observance of well established safety practices and a thorough knowledge of testing procedures. The testing procedures often involve using equipment and materials that are potentially hazardous. Injury to personnel and damage to equipment caused by fire, chemicals, dangerous pressures and vacuums, and misuse of equipment can be avoided by alert and responsible laboratory technicians. Strict observance to established safety, care, and handling practices and procedures will allow the laboratory personnel to perform their duties in a safe and hazard free environment.

1-7. General Precautions. The following are general safety precautions that need to be observed by all operators of the AOAP Mobile Laboratory.

- Always be mindful to tests in progress. Never allow horseplay or loud talking that would divert the attention of laboratory technicians. If it is necessary to leave the laboratory or to leave a test in progress, make certain no safety hazard will result because of your absence.
- Do not attempt to perform tests simultaneously unless each test can be given the required attention.
- Whenever in doubt concerning any operation, consult your supervisor.
- Do not attempt unauthorized shortcuts to save time, as they generally are not in accordance with safe laboratory procedures.
- Be prepared for any emergencies which may arise, and be familiar with the proper action to take in event of emergencies.
- When ending daily operations, make a thorough and orderly check of laboratory, equipment, and facilities to ensure that no hazards may develop during the time the laboratory is unattended.

1-8. Preventing Fires. The following fire prevention rules must be observed in all laboratory procedures:

- Do not smoke in the laboratory.
- Never leave open flames or heating elements unattended.
- Never pour hot liquids into drain. Set aside hot liquids to cool thoroughly in covered containers before discarding.
- Make sure that chemicals which may react together to produce dangerous fumes, fires, or explosion are stored in their proper places.
- Make sure that volatile liquids and flammable products are kept away from heat sources, open flames, direct sunlight, and electrical switches.
- Make certain that there is no open flame or exposed heating element nearby when pouring highly volatile liquids.
- Clean up chemical and liquid spills immediately.
- Always pour acid into water; never pour water into acid.
- Keep oily rags in a metal, airtight, closed container. Do not store oily rags in cabinets or drawers.
- Make certain laboratory is adequately ventilated.
- Check fire fighting equipment periodically to make certain it is properly serviced and ready for use. This is done by checking seals, tags, pressure gages, and hoses.

1-9. Extinguishing Fires. Be familiar with the nature of petroleum fires; with procedures for fighting fires; and with the fire extinguishing equipment in the laboratory. Do not use water for extinguishing oil fires because it will spread the fire. Also, water is a conductor of electricity and should not be used on electrical fires.

1-10. Handling Chemicals. The following safety precautions need to be observed by all personnel while handling chemicals.

- Store heavy and large containers of chemicals on or as near the floor as possible.
- Never fill a container with materials other than that indicated on the label. Make sure that every container is properly labeled.
- Never place bottles containing acids or alkalis on high shelves or on top of equipment.
- Always wear goggles when breaking up solid chemicals which might chip, or when handling quantities of corrosive liquids such as strong acids and strong bases.
- When opening new bottles of acid, always wear goggles.
- When pouring a sample from a container, hold the container cap or stopper in the hand. Never place the cap or stopper on a counter where it may come in contact with a contaminating agent.
- Always wipe up any acid that spills or splashes on benches, tables, or floors.
- If any chemical is spilled or splashed on the body, immediately wash the contaminated area thoroughly with water.
- Keep all sample containers that are in use capped or stoppered at all times except when pouring out test portions. Always replace the same cap or stopper in the container from which it was removed.
- Never handle mercury with bare hands; never heat mercury in an open container; and never shake more than 20 milliliters of mercury in a glass container.
- Never taste laboratory chemicals. Smell a chemical only when necessary and then only by wafting a small amount of vapor with the hand toward the nose.
- Dispose of all unlabeled chemicals.

1-11. Controlling Pressure and Vacuum. The following safety precautions should be observed by all personnel while operating the air/vacuum systems.

- Do not use faulty copper, plastic, or rubber tubing when performing operations requiring pressure or vacuum.
- Make sure that glass vacuum apparatus is properly shielded when it is in use.
- Always wear goggles when opening air valves that are close to the face.

- Make sure that chemical containers having vent caps are inspected, and that containers which do not have vent caps are vented periodically.
- Keep containers of volatile liquids as cool as possible. Exercise caution in releasing any pressure which may have formed in the container; always release the pressure gradually. Remove caps or stoppers periodically to vent the vapor. The practice of venting containers of volatile liquids does not apply to those samples collected for vapor pressure tests.
- Vent separator funnels frequently when shaking volatile liquids. Always wrap the funnel with a rag when shaking an extremely volatile liquid.
- Store propane cylinders in the safety storage cabinet for flammable liquids.

1-12. Controlling Fumes. The following safety precautions are presented to aid operators of the laboratory in controlling toxic fumes.

- Make certain the laboratory is properly ventilated at all times.
- Perform all gas alarm system tests and calibrations as specified to ensure proper operation of system.
- If any material is spilled which gives off toxic fumes, all personnel should leave the area immediately and return only after the area has been adequately purged.

1-13. Electrical Safety. The following electrical safety precautions apply to all operators and maintenance personnel for the laboratory.

- Equipment producing a tingle sensation will be reported promptly for repair.
- Keep the use of extension cords to a minimum and the cords as short as possible. Be sure insulation and wire size are adequate for the voltage and current to be carried.
- Work on electrical devices should be done after the power has been disconnected or shut off, and suitable precautions taken to keep the power off during the work.
- Never use metallic pencils or rulers, or wear rings or watches when working on electrical equipment.
- Avoid using or storing flammable liquids near electrical equipment.

1-14. Nomenclature Cross-Reference List.

<i>Common Name or Abbreviation</i>	<i>Official Nomenclature</i>
AOAP Laboratory	Army Oil Analysis Program (AOAP) Mobile Laboratory, Semi-Trailer Mounted
Gas Alarm	Gas Detection and Alarm System
ASTM	American Society for Testing and Materials
FTMS	Federal Test Methods Standards
ECU	Environmental Control Unit
LCD	Liquid Crystal Display
Hg	Mercury
Hz	Hertz
V	Volts
psi	Pounds per Square Inch
amp	ampere
W	Watt
RPM	Revolutions per Minute
AC	Alternating Current
DC	Direct Current
lel	Lower Explosive Limit
hp	Horsepower
pH	Degree of Acidity or Alkalinity
gph or GPH	Gallons per Hour
gpm or GPM	Gallons per Minute
%v	Percent of Volume
AOAP SDS	Army Oil Analysis Program Standard Data System
PM	Photo Multiplier
CPU	Central Processing Unit

Section II. EQUIPMENT DESCRIPTION AND DATA

1-15. Equipment Characteristics, Capabilities, and Features.

- Purpose of AOAP Mobile Laboratory.* Provides mobile oil analysis capability for aeronautical and selected nonaeronautical equipment in a theater of operations.
- Capabilities and Features.*
 - Consists of one M971 Semi-trailer modified to contain the following major system components:
 - Fluid Analysis Spectrometer, Model A/E 35U-3A, NSN 6650-01-149-8430
 - AOAP Standard Data System, WANG MICROVP-2 w/three operating stations
 - Viscometer Set, Model 706, NSN 6630-01-037-5147
 - Fluids Contamination Set, Model 71, NSN 6630-01-037-5149
 - Drying Oven, BLUEMOV-51 OA-3, NSN 6640-01-182-9294
 - Hot Plate Set, Model 11496-3, NSN 6630-01-037-5151
 - Duplex Ferrograph System, Model 8472, NSN 6630-01-158-7638
 - Flash Point Tester, Model 03SF
 - Oscilloscope, Model AN/USM-488
 - Refrigerator, Model UC5B
 - Ultrasonic Cleaner
 - Water Purification System
 - Environmental Control System
 - Electrical Power Distribution System
 - Water Supply System

(2) Incorporates the following features:

- Air and ground transportable for rapid deployment
- Rigid wall construction
- All weather operational
- Rapid set-up for use
- Self-contained environmental control system
- Self-contained water system
- Self-contained air system
- Self-contained vacuum system
- Trailer-mounted for long distance towing
- Designed to operate under blackout conditions with door activated blackout switches
- Extends application of AOAP for aeronautical and selected nonaeronautical equipment operating in a tactical theater of operations.

1-16. Location and Description of Major Components.

NOTE

Van exterior sides and interior walls are designated "curbside" (right) and "roadside" (left) when viewed from the rear of the van.

a. *Rear and Curbside Exterior (Figure 1-2).*

TRAILER ACCESSORIES STORAGE DOOR: Provides access to storage area for trailer accessories; i.e., roadside reflectors, wheel chocks, various tools, wiping rags, etc.

PURGE INTAKE DOOR: Hinged, double-latched access door for purge intake damper. Must be open during purge cycle to allow environmental control unit to suck outside air into the laboratory.

WATER INLET BOX DOOR: Hinged, double-latched access door to facility and suction water connections.

UTILITIES BOX DOOR: Hinged, double-latched access door for compressed air, vent and drain connections.

LABORATORY ENTRANCE DOOR: Primary entry/exit for the laboratory section of the van. Provided with an internal door lock release mechanism to facilitate an emergency exit.

CURBSIDE STORAGE BOXES: Provides storage area for miscellaneous equipment. Provided with fork truck lift slots and retaining pins for removal/installation.

SYSTEM DRAIN: Drains all lines in tank. Located in center of trailer, beneath the mechanical room.

WASTE WATER TANK DRAIN: Drains all waste water from laboratory. Located in the center of trailer, beneath the mechanical room.

REAR DOOR: Primarily used to load and unload overpack boxes. Provides a secondary entrance/exit for the laboratory. Provided with an internal door lock release mechanism to facilitate emergency exit.

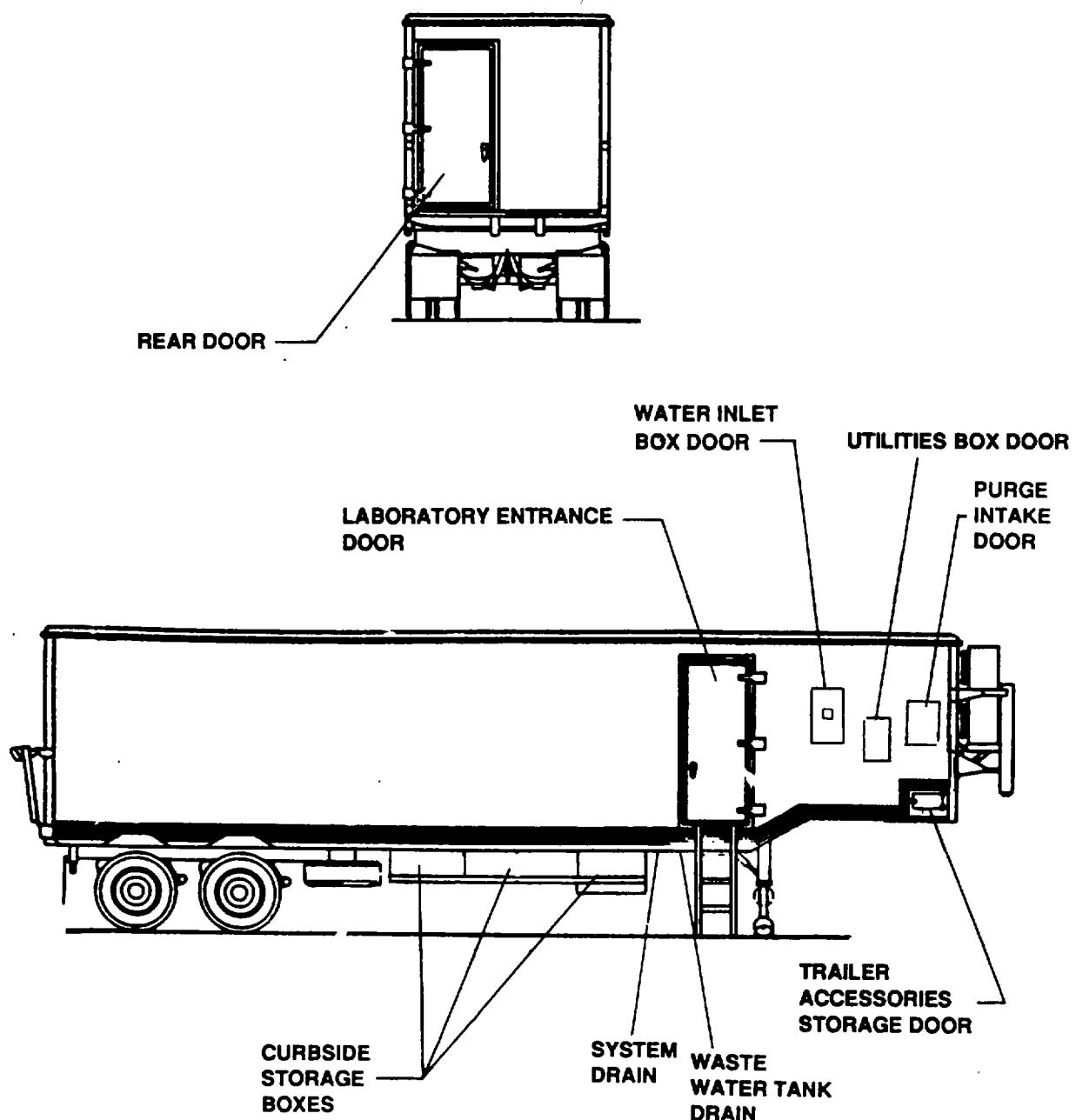


Figure 1-2. Rear and Curbside Exterior

b. *Front and Roadside Exterior (Figure 1-3).*

ELECTRICAUTELEPHONE BOX DOOR: Hinged, double-latched access door to electrical and telephone connection points.

ROADSIDE STORAGE BOXES: Provides storage area for main power input cable, ground rod, ground rod driver/puller, hose adapter, coupler and fire hose. It is equipped with fork truck lift slots and retaining pins for installation/removal.

CABLE REEL STORAGE BOX: Provides storage area for cable reel.

FUME HOOD VENT DOOR: Hinged, double-latched access door for fume hood vent. Must be open when operating exhaust blowers.

PURGE INTAKE DOOR: Hinged, double-latched access door for purge intake damper. Must be open during purge cycle to allow environmental control unit to suck outside air into the laboratory. An alarm buzzer, which indicates a purge door closed during a purge cycle, is located behind this door.

PURGE EXHAUST DOOR: Hinged, double-latched access door for purge exhaust damper. Must be open during purge cycle to allow air to be exhausted from the laboratory. An alarm buzzer which indicates a purge door closed during a purge cycle, is also located behind this door.

TRAILER ACCESSORIES STORAGE DOOR: Provides access to storage area for trailer accessories; i.e., roadside reflectors, wheel chocks, various tools, wiping rags, etc.

ENVIRONMENTAL CONTROL UNITS: Provide heating and cooling of the laboratory. The four units are identical but each has its own individual controls.

SPECTROMETER HOT GAS VENT; Vents hot gas from spectrometer cabinet.

POWER ENTRANCE BOX: Provides power input to van and connection for grounding generator. Also contains purge alarm and purge timer.

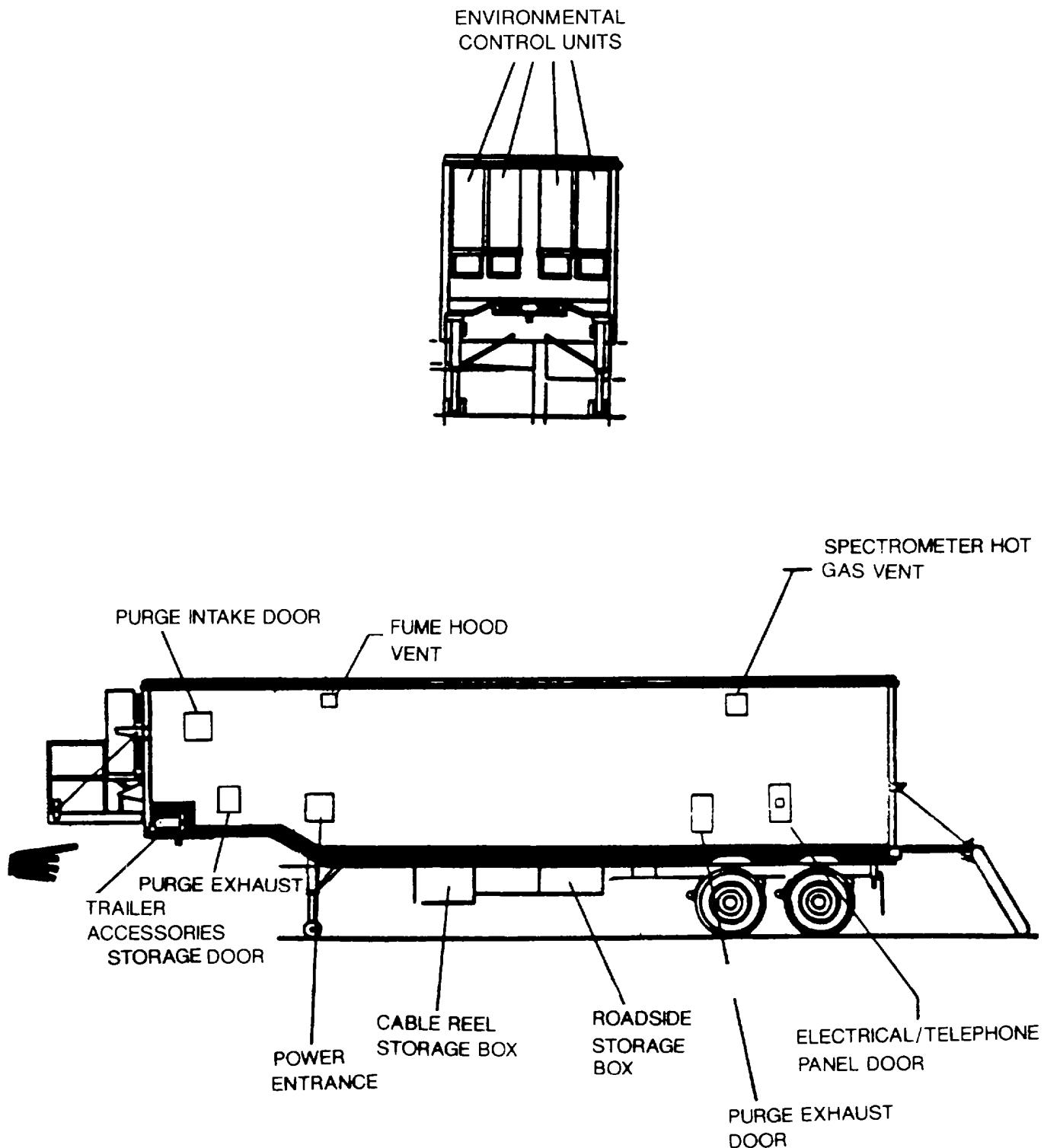


Figure 1-3. Front and Roadside Exterior.

c. *Roadside Interior (Figure 1-4).*

FIRST AID KIT (GENERAL BURNS): Provides essential items required to treat minor injuries and burns.

PRINTER: A component of the AOAP Standard Data System, which prints out the information generated from sample analysis.

PRIMARY DATA ENTRY TERMINALS: A component of the AOAP Standard Data System, used for initial sample documentation, data entry, and correlation.

SECONDARY DATA ENTRY TERMINAL: A component of the AOAP Standard Data System used for in-process data entry.

COMPUTER CABINET: Contains the primary components of the AOAP Standard Data System, which consists of the Central Processing Unit (CPU), the Disk Drive, Diskette Drive and Processing Unit, and the Diskette Controller. An interface panel is located at the rear of the cabinet which contains connector and cabling to interface peripheral equipment with the computer (i.e., terminals, printer, spectrometer).

OVERHEAD STORAGE CABINETS: Provide storage for equipment, manuals, and supplies.

FLAMMABLE STORAGE CABINET: Provides for fireproof storage of equipment.

GAS DETECTOR: Detects dangerous accumulation of gases in laboratory.

FUME HOOD: The fume hood is used to protect the operator from toxic, corrosive, poisonous, explosive, radioactive, odoriferous, and other harmful and dangerous materials. Exhaust fan is located behind Environmental Control Unit (ECU) controls and is used to exhaust noxious and dangerous fumes from the fume hood.

HOT PLATE: Located in the cabinet K2 during storage. It is explosion-proof and used during the crackle test.

VACUUM PUMP: A 2-stage rotary pump which provides the vacuum system required in the laboratory.

WATER TANK: The water tank is a 60-gallon stainless steel tank which is used as a supply source when operating the water system as a closed system.

WATER PUMP: The water pump is centrifugal and self-priming. It is used to pump water from the water tank or from an outside source.

AIR COMPRESSOR: The air compressor is a base mounted, 2-cylinder, single stage compressor driven by a 3-hp electric motor. The compressor is capable of providing air at 120 psi.

VOLTAGE REGULATOR: The voltage regulator is a base-mounted, three-phase, 120 volt output. Provides voltage to the computer.

FERROGRAPH: Designed with two stations for making ferograms side by side. Each station magnetically precipitates ferrous wear particles from the oil samples. Located in curbside storage box when not in use.

STOOL: Three stools are provided for the operator's use.

FIRE EXTINGUISHER: The five fire extinguishers are Halon, Type 1211 extinguishers. Three are located in the laboratory, one in the receiving compartment, and one in the mechanical room.

FLUID ANALYSIS SPECTROMETER (A/E35U-3A): Used to determine the type and amount of wear metals in oil samples. Oil samples are analyzed for up to 15 wear metals on the spectrometer. It is interfaced with the computer system.

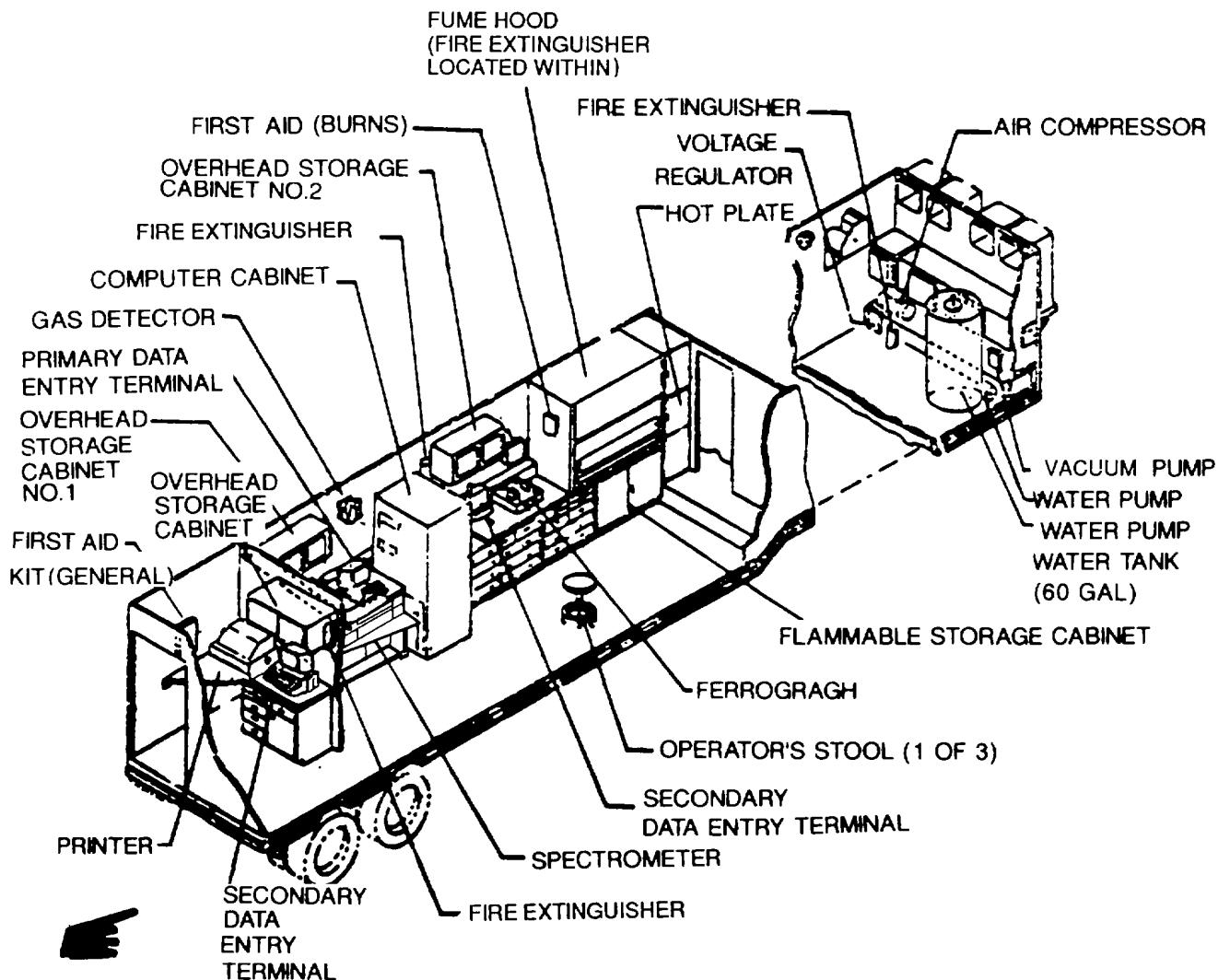


Figure 1-4. Roadside Interior

d. *Curbside Interior (Figure 1-5).*

OVEN: The oven is permanently installed and used to dry samples from the filter blotter test. Maximum operating temperature is 260° Centigrade, with a consistency of plus or minus 4° Centigrade.

WATER PURIFICATION SYSTEM: Removes minerals from the water.

UTILITY LINES (EXPOSED): Provides capabilities for water and air in the laboratory.

SAFETY SHOWER: Used to wash contaminants, corrosives and acids from operating personnel.

SINK: Used for general purpose cleaning.

WASTE OIL DRAIN: Used to dispose of sample oil.

ANEROID BAROMETER: Measures atmospheric pressure within the laboratory. It is temperature compensated and graduated in both English and metric systems.

HYGROMETER: Measures the water vapor content within the laboratory.

THERMOMETER: Measures the temperature change within the laboratory.

EMERGENCY LIGHTS: Three emergency lights are provided with the system in case of electrical failure. One is located in main laboratory, one in mechanical room, and one in the receiving room.

SECONDARY SWITCH PANEL: Located in the receiving room. Contains circuit breakers for various utilities.

GENERAL STORAGE CABINET: Located in the receiving room and is used to store general equipment and supplies.

WASTE OIL HOLDING TANK: Holds contaminated oil until it is ready to be disposed.

ULTRASONIC CLEANER: Used to clean instruments and lab glass wear.

EYE WASH: Used to wash eyes in an emergency.

REFRIGERATOR: This refrigerator provides 6.5 cubic feet (118 cmm) of refrigerated space.

MAIN POWER PANEL: Located in the mechanical room and is the control point for power supplies to the laboratory. Contains the main circuit breakers, environmental, water and electrical system circuit breakers, and various component circuit breakers.

EQUIPMENT PLENUM: Runs rearward, from the roadside air conditioning unit, along the interior roadside wall, to the computer cabinet. This plenum supplies cooled/heated air to the computer cabinet and its components.

GENERAL ENVIRONMENTAL DUCT: Runs from the remaining three air conditioning units rearward, forming the center ceiling panel, through the forward and rear bulkhead and terminates at the rear semitrailer wall. Adjustable vents are installed in the duct to provide for balancing the air flow.

VISCOMETER: Used to determine relative viscosity of the oil system.

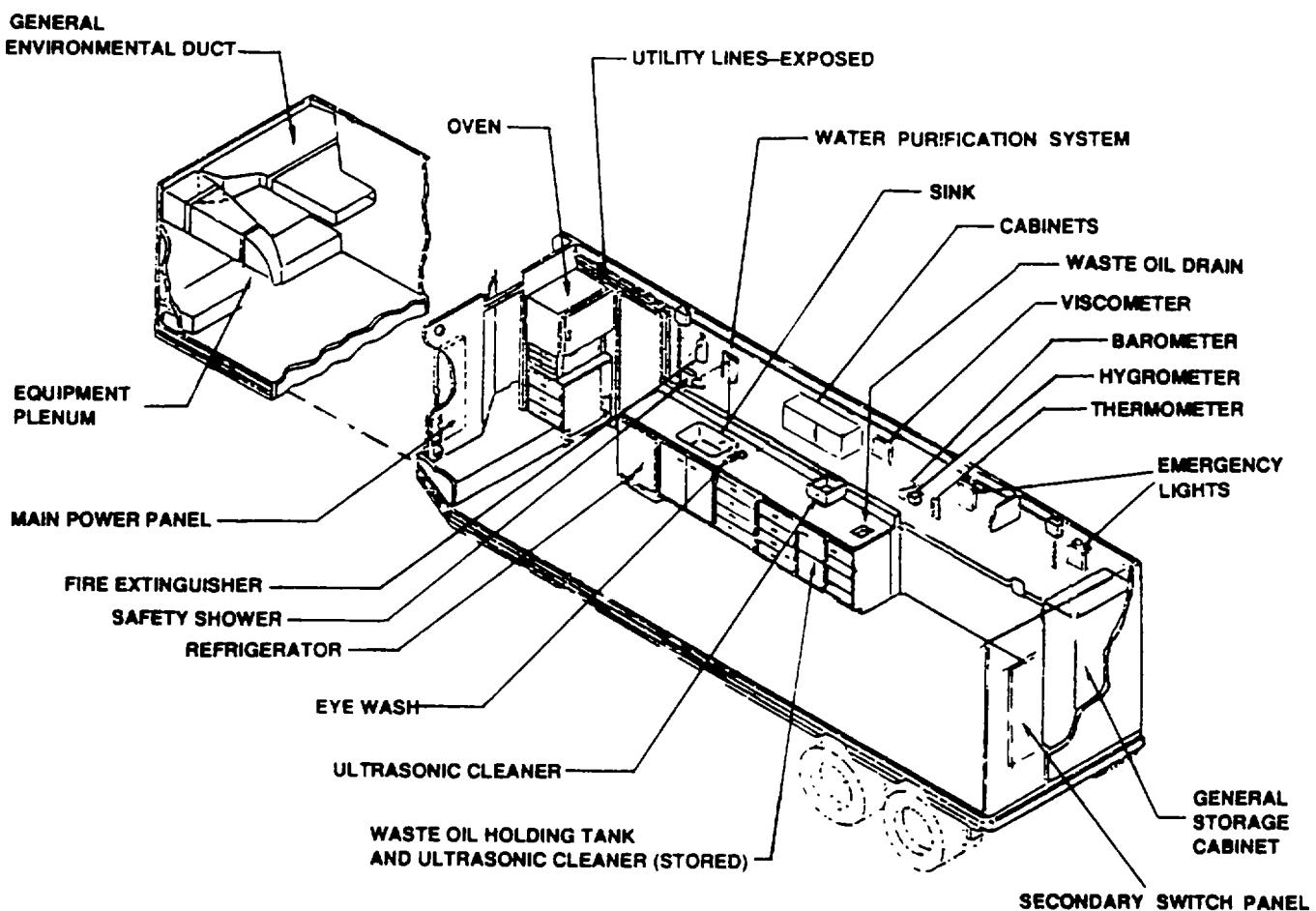


Figure 1-5. Curbside Interior

1-17. EQUIPMENT DATA.

Exterior Dimensions

Length	35.42 ft (10.80 m)
Width	8.00 ft (2.44 m)
Height	11.71 ft (3.57 m)

Interior Dimensions

Length (Laboratory Compartment)	27.29 ft (8.32 m)
Length (Mechanical Room)	7.75 ft (2.36 m)
Width (Both)	7.50 ft (2.29 m)
Height (Laboratory Compartment)	7.55 ft (2.30 m)
Height (Mechanical Room)	6.64 ft (2.03 m)
Total Interior Cubage (Laboratory Compartment)	1545.30 ft ³ (43.77 m ³)
Total Interior Cubage (Mechanical Room)	385.95 ft ³ (10.93 m ³)

Power Requirements 208V, 60Hz, 3-phase, 5-wire

Electrical Connections

Power	One 208V, 60Hz, 3-phase, 5-wire power input cable
Ground	Ground lug to ground rod cable

Environmental Control (Heating and Cooling)

Model	Four KECO Model FI 8T-2S Vertical Compact Units
Rating	(Cooling) 18,000 BTU/Hr (Heating) 12,000 BTU/Hr
Power	208V, 3-phase, 60Hz
Control	Individual

Air Compressor Model GH-610-HI 0, with 208V, 60Hz, 3-phase, 3-hp motor
Air Tank Capacity 30 gallon (113.55 l)

Vacuum Pump Model 1405B
Free Air Capacity 58 liters per minute
Motor 1 1/2-hp, 115V, 60Hz

Water Pump Model 2P373
Capacity 75 gpm at zero total head in feet
Motor Model 6K709A, 3/4-hp, 115V, 60Hz

Water Tank 60 gallon (227.10 l) (stainless steel)

Water Connections

Suction and Discharge	Quick disconnect with standard garden hose fitting
Tank Drain	Gate valve open to gravity deck drain
Sink Drain	Gravity deck drain with hose connection

Voltage Regulator Topaz P/N 75507
Power 120V, 3-phase, 47-63Hz

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-18. Functional Description of AOAP Mobile Laboratory Support Systems. The following paragraphs describe the systems designed to support the AOAP Mobile laboratory. For details of major equipment, refer to the appropriate equipment manual.

a. *The semitrailer* is divided into three individual compartments. Each compartment is separated from the next by insulated metal bulkhead. The bulkheads separate the receiving compartment from the main laboratory, and the main laboratory from the mechanical room. The forward bulkhead has a latched and lockable door capable of being latched during transit. The aft bulkhead helps control the ambient temperature within the main laboratory by providing a separate compartment for the receipt of samples and personnel entry and exit. Undercarriage compartments provided for stowage of miscellaneous gear and overpack items (i.e., power reel, hosing, two 12-volt batteries, access ladders, etc.). These compartments are separable to facilitate air transport (C 141 & C5A/B) of the AOAP Mobile laboratory. The AOAP Mobile laboratory floor is of laminar design. It consists of formed aluminum sheets, polyurethane foam formed in place, and a marine plywood subfloor with linoleum over it. Structural members that are on 16-inch centers and run the length of the trailer provide load support adequate for equipment and personnel. The interior ceiling of the AOAP Mobile laboratory contains the environmental air plenum and the fluorescent light fixtures. The light fixtures are contained within hinged panels which are adjacent to the centrally located air duct. The hinged panels run the entire length of the laboratory ceiling and provide access to both the light fixtures and the corresponding portion of the power distribution system. The main and aft compartments have solid epoxy countertops, with steel cabinetry below. They are located on the roadside and curbside wall areas which are not occupied by major floor-mounted equipment. The countertops serve as mounting surfaces for smaller major items. Support apparatus and devices are located within the cabinets. The cabinetry does not block or interface with the aisle or means of exit from any compartment.

b. *Environmental Control System.* The four Environmental Control Units (ECUs) are identical units, each with its own controller. They operate on 208V, 60Hz, 3-phase power and are rated at 18,000 BTUs per hour when cooling and 12,000 BTUs per hour when heating. They are in fact heat pumps and provide both cooling and heating for the laboratory. During the purge cycle, their blowers are utilized to over pressurize the laboratory and expel any explosive gases. They are installed on the front wall, exterior of the semitrailer. The units do not transfer vibration to the semitrailer nor are air leaks present at the intake or supply interface. The units are grounded and piping is provided to remove the condensate from the air conditioning units to an outboard position on the roadside of the trailer. The environmental controls are located in one panel/switchbox positioned in the main laboratory compartment, on the forward roadside wall adjacent to the fume hood. The air conditioning portion of the control consists of two rotary switches and one external thermostat. ECU controls No.1, 2 and 3 activate the three environmental control units supplying air to the general environment duct. ECU control No.1, paired with an internal thermostat located within the computer cabinet, activates and controls the environmental control unit supplying air to the equipment plenum. The heating controls consist of two rotary switches, one for the equipment plenum and one for the general environment duct, neither of which functions without the corresponding air circulating fans located within the environmental control units in operation. Indicator lights are incorporated in the environmental control panel as an indication of operational feedback. Green is used as an indication of normal computer operation.

c. *The Electrical Distribution System (Figure 1-6)* is 208-240 volts at 50-60 hertz. A power regulator (shielded and grounded) is utilized to regulate the voltage requirements of both the primary and secondary electrical systems. The primary electrical system provides power to the four air conditioning units, the 12 heating elements, the purging fan/blowers, water pump, the air compressor and vacuum pump, and laboratory equipment requiring 220 volts. The primary circuit panel is located on the roadside of the interior bulkhead dividing the utility and the main laboratory compartments. The secondary electrical distribution system provides power for lighting and the laboratory equipment requiring 110 volts ac. The secondary circuit panel is located in the aft compartment, on the curbside interior wall. Instruments and gages deemed necessary for monitoring of service systems operating conditions are integral to the secondary circuit panel (i.e., vacuum gage and pressure gage). A power entry receptacle is located on the forward roadside exterior of the trailer. Located adjacent to the receptacle is a timer used to activate the environmental control units when purging the laboratory of toxic fumes prior to entry. A cable reel assembly is provided on the undercarriage of the trailer. The assembly contains the 100-foot cable required to interface with the 60 KW DED generator set. The AOAP Mobile Laboratory has a 24-volt dc, emergency electrical system. Each of the van's three compartments contains one 24-volt emergency lighting fixture capable of adequate illumination during emergencies. The batteries supplying the 24 volts required for the system, two 12-volt MS35000, are located in the cable reel box. A battery charger is also provided to maintain battery charge while the laboratory is deployed. Laboratory equipment permanently affixed to countertops or anchored in place is "hard wired" through switchboxes or motor starter-relay boxes mounted on the curbside or roadside walls, as applicable. Wall outlets are provided at 3-foot intervals above the counter surfaces. All outlets are "one-way" 110 volts ac. A microswitch is installed in each of the two trailer access door frames. Each compartment is provided with an override switch to bypass the microswitch circuit for the door accessing it. Under normal conditions, opening either van access door activates the blackout lamp(s) and deactivates the incandescent and/or fluorescent lighting in the compartment serviced by that door. The power required by the computer and its peripherals is filtered, shielded, and buffered. No additional power taps are available on the computer line other than those required by the data system. The line runs from noise filter located in the primary switch panel directly to the computer cabinet.

d. *Lighting System.* Lighting for the AOAP Mobile Laboratory is provided by 15 fluorescent ceiling light fixtures. Thirteen are located in the laboratory compartment and two are in the mechanical room. Power for the laboratory compartment lights is provided by circuit breaker main panel assembly.

(1) *Blackout Lighting.* The center lamp in each of the light fixtures is covered with a blue filter. When an access door is opened, its door interlock switch is activated. This will turn off all white lights and leave energized all blue filtered lights. When the access door is closed, the interlock switch is again activated, returning power to the white lights.

(2) *Emergency Lighting.* Emergency lighting is provided to the laboratory compartment by light fixtures and two emergency light ballast boxes. When normal power is available, phase A power continually charges the battery device in ballast box. The device in ballast box receives its charge from phase C power. When normal power is lost, power from ballast box will be provided via the Forward Emergency Light Switch in the ON position. Power from ballast box will be provided via the Rear Emergency Light Switch in the ON position.

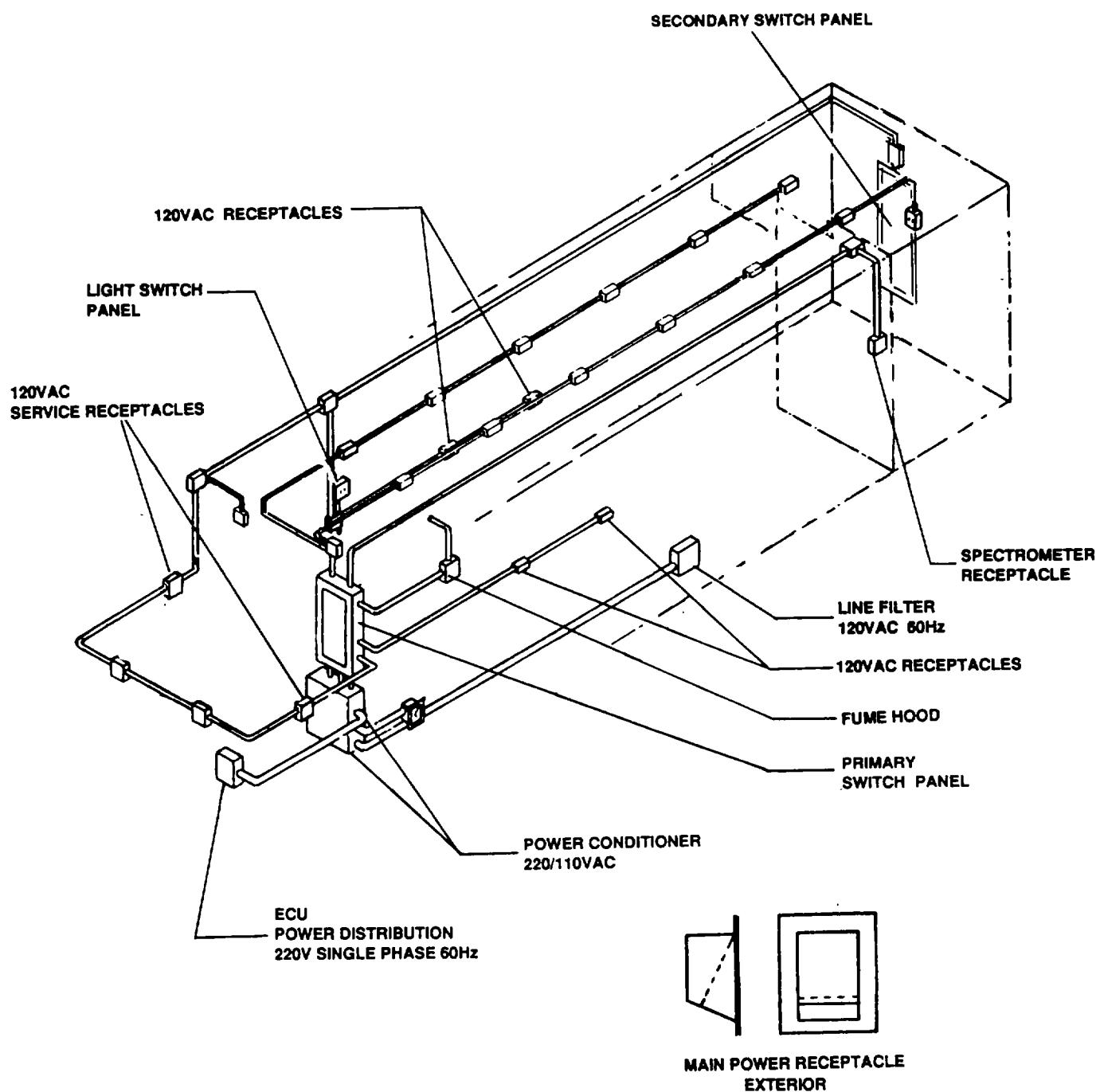


Figure 1-6. Electrical Distribution System

e. *Purge System.* The purge system is used to exhaust potentially dangerous contaminated air inside the laboratory to the outside. The system consists of the following components:

- (1) Power control relay located in panelboard assembly number 1.
- (2) Time delay relay located in explosion proof distribution box A3.
- (3) Blower control relays located in explosion proof distribution box.
- (4) Two purge intake doors and two purge exhaust doors located on the outside wall of the laboratory.
- (5) Four purge door limit switches.
- (6) Two intake dampers and two exhaust dampers located behind the external purge doors.
- (7) Three ventilation dampers mounted in the ECU plenum located in the mechanical room.
- (8) Seven purge damper motors.
- (9) One purge alarm buzzer located at the power entrance panel.

A purge cycle can be initiated in two ways, one of which is by the application of external power after a power shutdown, the other is by an alarm generated by the gas detector system. When external power is first applied, the power required for a purge cycle is picked off ahead of the main circuit breaker. Main circuit breaker is held open by power control relay. This prevents power from being applied to any equipment or lighting in the laboratory until the purge cycle is completed. Relay routes the power that was picked off ahead of the main circuit breaker to start the 5-minute time delay relay and to energize the four blower control relays which provide power to the ECU blowers. Power is also routed to the purge door damper motors and to the ventilation damper motors so that the purge door dampers are opened and the ventilation dampers are closed. The ECU blowers suck outside air into the ECU ducting where it is dumped into the laboratory creating a pressure which forces any gases or contaminated air to the outside via the purge exhaust doors. After 5 minutes have elapsed, time delay relay de-energizes. This causes power control relay to change state which de-energizes relays. Power is removed from the ECU blowers, the dampers are driven to their normal positions and the main circuit breaker may now be closed to supply normal power to the laboratory. If at the end of the purge cycle the gas detector alarm system is in an alarm condition, the time delay relay is activated causing the cycle to be repeated. This will continue until the alarm clears. When external power is applied and a purge cycle initiated, one of the external purge doors is closed, the purge alarm buzzer will be activated by the purge door limit switch and will remain activated until the door is opened.

f. *Air System (Figure 1-7).* The air system consists of the air compressor, air tank, pressure switch, moisture trap, and associated piping and valves. The air compressor is located in the mechanical room and operates on 208V, 60Hz, 3-phase power. It can supply air at 120 psi to the system. In automatic operation, the compressor is controlled by a pressure switch which shuts it off when the pressure has reached 120 psi and turns it back on when the pressure in the system drops to 60 psi. The air tank relief valve is set to operate at 150 psi. There are air service valves located within the main laboratory work area and are color coded orange.

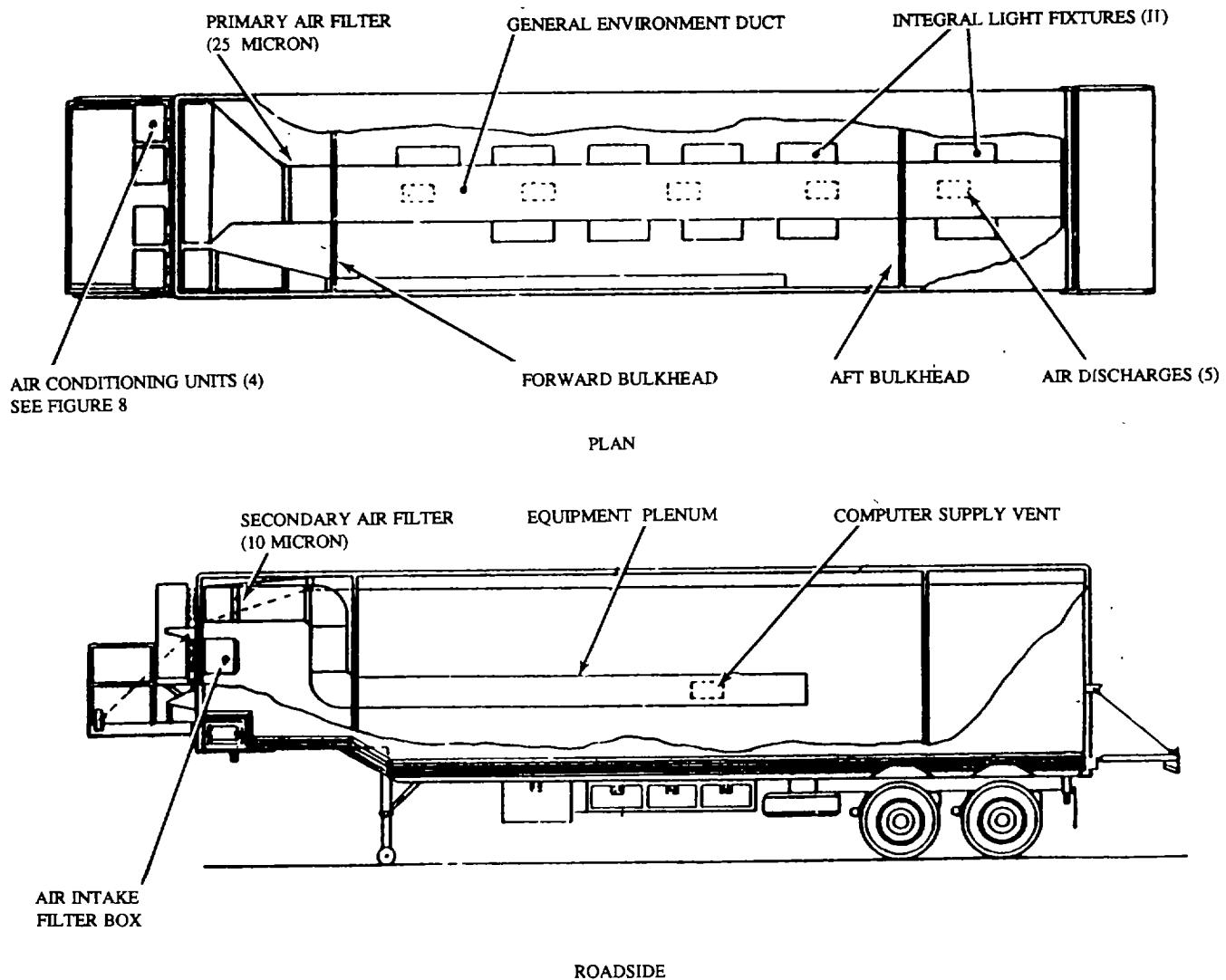


Figure 1-7. Air Distribution System

g. *Vacuum System.* The vacuum system consists of the vacuum pump and associated piping and valves. The vacuum pump is located in the mechanical room and operates on 11 0V, 60Hz, single-phase power. It has a free air capacity of 58 liters per minute and supplies vacuum where required. Vacuum valves are color coded yellow and are located in the main laboratory work area.

h. *Water System.* The water system consists of the water pump, pressure switch, water tank, filter, waste water heater, water heater and associated piping and valves. The water pump operates on 11 0V, 60Hz, single-phase power. It is controlled by the pressure switch. It turns on when a water outlet is opened and off when the outlets are all closed. The water surge tank removes oscillations from the system while the water tank acts as the system supply source. The water cooler operates on 11 0V, 60Hz, single-phase power. The water heater operates on 11 0V, 60Hz, single-phase power. The system may be supplied with water from an outside pressurized source, from an outside unpressurized source, by using the system pump, or by its own water tank. Water supply piping is color coded blue and valves are color coded green. While water return piping and valves are color coded white, drain piping is colored black. Water supply valves are located in the main laboratory work area. Cold water is marked CW and color-coded green and hot water is marked HW and color-coded red.

i. *Drain System.* The drain system consists of valving and piping required to route condensate and waste water from the sink to the deck drains located underneath laboratory exterior.

1-19. Functional Description of AOAP Mobile Laboratory Unique Equipment. The following paragraphs describe some of the equipment mounted or stored within the laboratory. For equipment not described in these paragraphs, refer to the appropriate equipment manual.

a. *The fluid analysis spectrometer display (A/E35U-3A) (Figure 1-8) is a 1-meter emission spectrometer with an LED liquid readout specifically designed for sample oil analysis. It has a console-type equipment cabinet permitting the operator to carry out the routine procedures of analysis while seated at one location. Except for the main power circuit breaker control, all operating controls are conveniently within the reach of the operator while in a seated position. Panels have been designed to permit quick removal and provide access for performing required maintenance. The spectrometer equipment includes personnel safety features such as safety interlocks, venting of noxious fumes, and protection from ultraviolet rays. Equipment protective features include circuit breakers, fuse, interlocks, and venting. Electromagnetic interference is controlled by RFI filters and proper grounding of all electrical components within the instrument, while critical items have been individually shielded. The sample excitation chamber is interlocked to protect the operator from high intensity ultraviolet light, shock from the carbon rod/disk are (22,000 volts peak), and exposure to noxious or flammable fumes while sample analysis is in progress. During normal operation, the carbon arc will totally "burn" the sample, leaving no residual flammable fumes or vapors. The chamber venting is adequate to purge the chamber of all noxious or flammable/combustible fumes. The spectrometer is a preventive maintenance tool used to determine the type and amount of wearmetals in lubrication oil samples of engines/transmissions and in fluids of hydraulic equipment. The spectrometer is capable of detecting and measuring the concentration of the following elements:*

Iron (Fe)	Nickel (Ni)	Cadmium (Cd)
Silver (Ag)	Lead (Pb)	Molybdenum (Mo)
Aluminum (Al)	Silicon (Si)	Zinc (Zn)
Chromium (Cr)	Tin (Sn)	Sodium (Na)
Copper (Cu)	Titanium (Ti)	Manganese (Mn)
Boron (B)	Magnesium (Mg)	Vanadium (V)
Barium (Ba)	Beryllium (Be)	

The operation of the spectrometer is based on the atomic emission technique. This technique depends on the fact that atoms of elements can be energized (excited) to emit radiant energy when exposed to a suitable excitation source. When this radiant energy is dispersed by either a prism or a diffraction grating, it emerges as a light spectrum having a pattern determined by the structure of the atoms that have been excited. Since atoms of different elements contain different electron configurations, each element has a distinct and characteristic spectrum, with spectral lines occurring at different wave- lengths. Each element can be identified by its characteristic lines. In quantitative analysis, line brightness represents element concentration in the sample. Line brightness is converted from radiant energy into electrical energy by a suitable photomultiplier tube. The electrical signal at the output of the photomultiplier tube is processed and displayed on a readout device.

The spectrometer can be divided into seven main groups. The groups have been given titles according to their functions, and with the exception of a few items, assemblies and subassemblies are physically located in the cabinet or chassis of their respective groups. The groups are as follows:

- a. Sample excitation group
- b. Optical processing group
- c. Control group
- d. Electronic processing group
- e. Integration group
- f. Power distribution group
- g. Optional group (automatic printer)

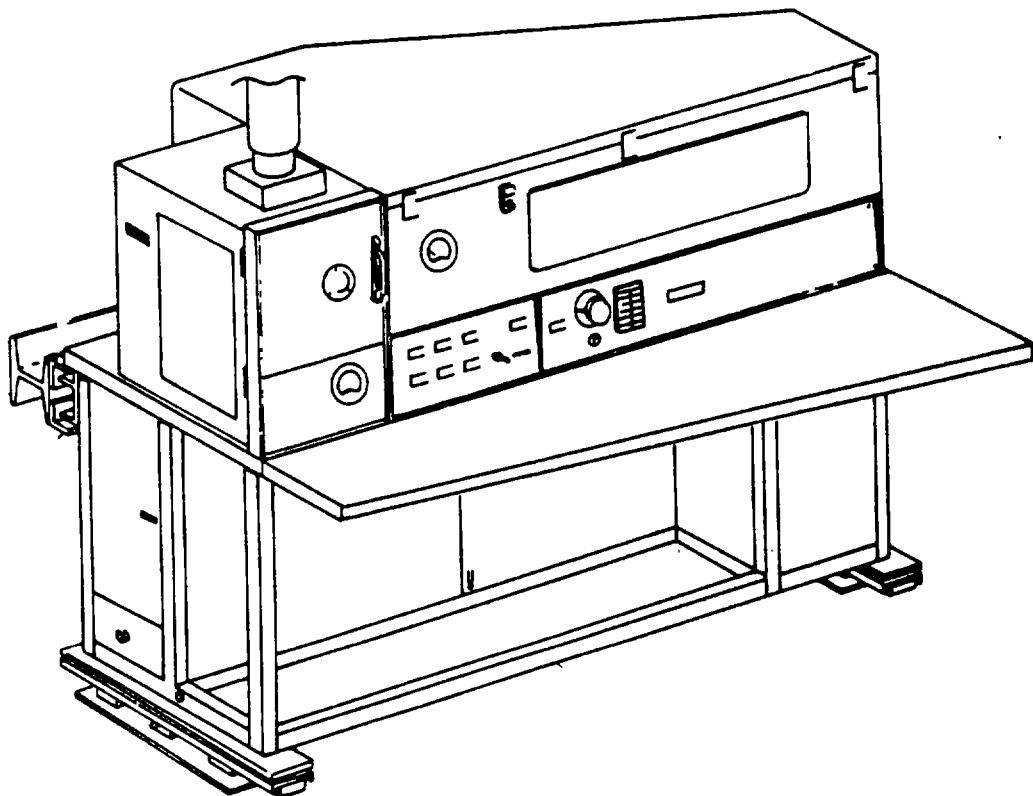


Figure 1-8. Fluid Analysis Spectrometer

The sample to be analyzed is electrically excited in the analytical gap. Light from the resulting arc passes through the entrance lens where the light is formed into a beam. The beam passes through a deflection plate which swivels back and forth during the integration process. This motion deflects the beam away from its direct (or forward) path providing background light subtraction. The beam then strikes the grating, which acts as a prism to disperse the light into spectral lines. Each spectral line of interest passes through its exit slit (located on the focal curve) to the photomultiplier (PM) tube of the channel assigned to the spectral line. The PM tube converts the light into electrical current that builds up a charge on the integrating capacitor of the subject channel. The analog voltage on the capacitor is processed by the data conversion circuitry and fed to the readout electronics circuits.

b. *The AOAP Standard Data System (SDS) (Figure 1-9).* The information generated from the spectrometer can be displayed on the numerical LED indicators or printed out by the autoprinter interface which is used by the AOAP Standard Data System (SDS). The AOAP SDS is comprised of the following modular components:

- Wang Model MICROVP-2 Central Processing Unit (CPU)
- Three Wang Model 2336DW Integrated Terminal Sets
- Wang Model 2280-3A Disk Drive
- Wang Model 2270A-2 Diskette Drive and Processing Unit (DPM)
- Data Products No.2273-2 LPM Line Printer
- Wang Model 22C03 Diskette Controller

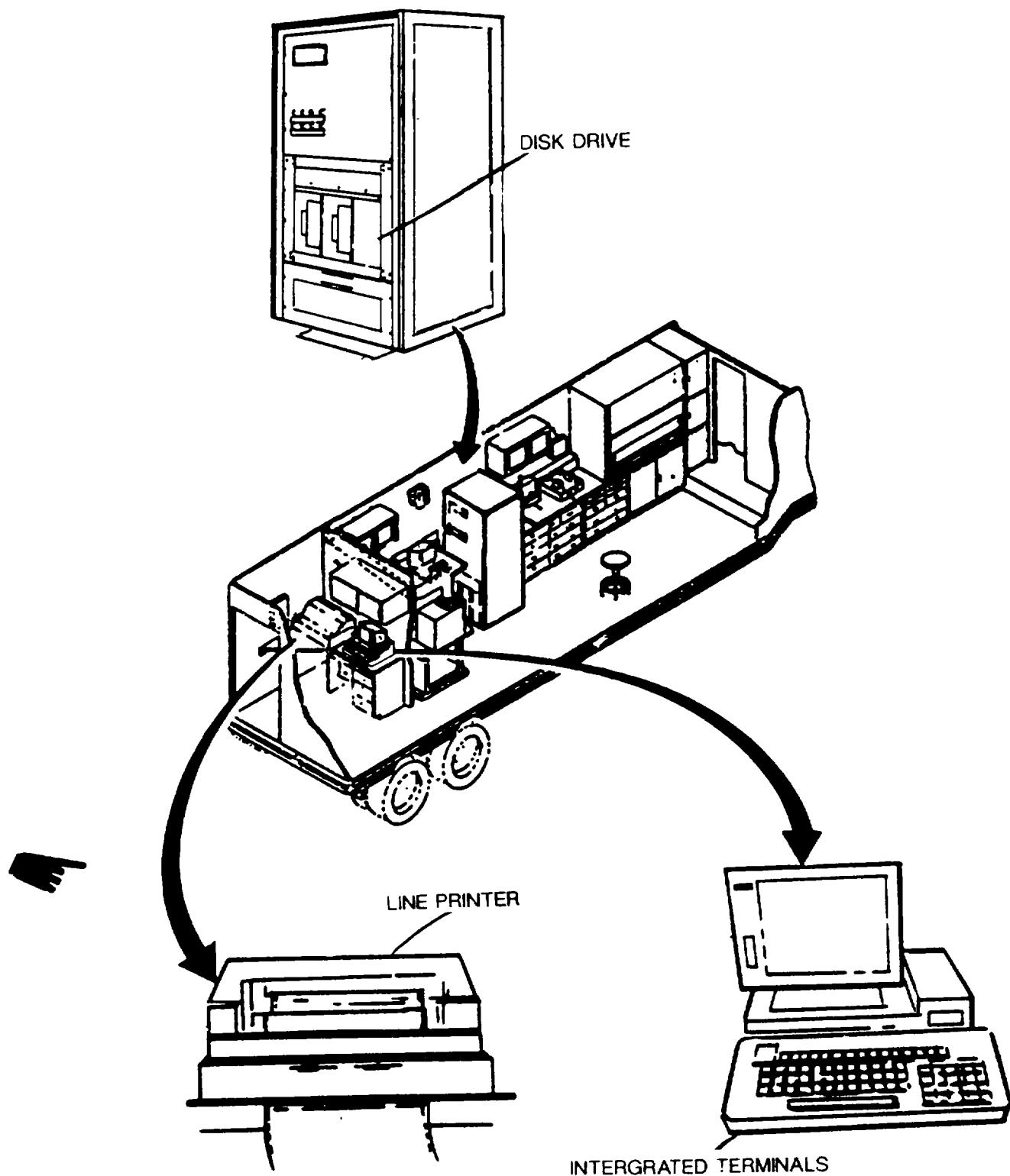


Figure 1-9. The AOAP Standard Data System (SDS)

(1) The computer cabinet contains the primary components of the AOAP SDS. Suspension slides are provided for the computer power unit, disc power unit, and the 13.4 megabyte disk drive. The floppy disk drive is hard mounted in the cabinet frame.

(2) An interface panel located at the rear of the cabinet contains the bulkhead connectors and cabling required to interface the internal cabinetry components to the peripheral devices (i.e., the terminals and cathode ray tube monitors, the printer, and the spectrometer).

(3) All cabling is shielded and grounded to the cabinet frame. The frame is then grounded to the van. The cabinet rear interfaces with the equipment plenum. Airflow deflectors are provided to insure adequate ventilation and proper environment for the computer and its components. Nonventilated disk storage is provided at the top of the cabinet.

(4) The three integrated terminals and the line printer are not located within the computer cabinet. One terminal and the printer are located in the rear (entry/receiving) compartment. Initial sample documentation, data entry, and correlation are performed at this position. The second terminal is adjacent to the computer cabinet and spectrometer; in-process data entry is performed at this position. The third terminal is located at the physical property processing area.

(5) When interfaced with the spectrometer, the AOAP data system provides current and historic wear metal content analysis not available in any other form. The data can be formulated to satisfy the individual commander's requirements and provide rapid status reports of flight and materiel readiness.

c. *Viscometer Set (Figure 1-10).* An electronic device used to determine the relative viscosity of the oil sample. The unit is located on the curbside wall. The unit provides a 3 1/2-inch digital panel meter for simple readout of the sample viscosity.

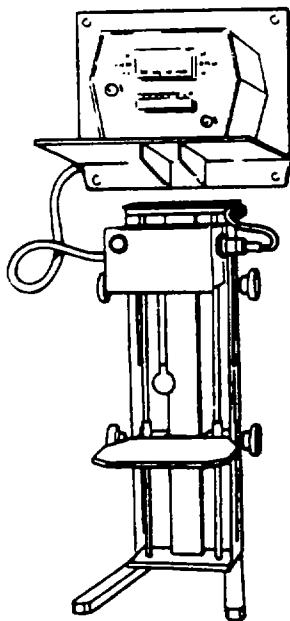


Figure 1-10. Viscometer Set

d. The fluids contamination set (Figure 1-11) is capable of extracting metallic and nonmetallic particulate matter from used oil samples for microscopic examination. The set requires the presence of a vacuum to expedite the participation process. Normally stored within the cabinet K3, this unit is positioned on the curbside countertop next to the waste oil drain when deployed.

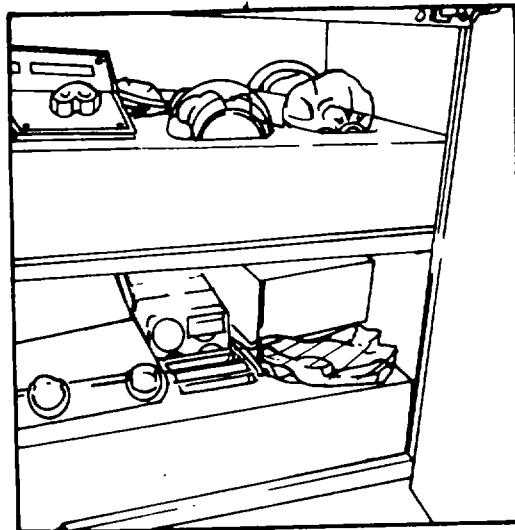


Figure 1-11. Fluids Contamination Set

e. The drying oven (Figure 1-12) and hot plate set (Figure 1-13) are comprised of a mechanical convection oven and an explosion-proof hot plate. The oven is used to dry samples from the filter blotter test and the hot plate is used during the crackle test. The maximum operating temperature of the oven is 260 degrees Centigrade with a consistency of plus or minus 4 degrees C. The oven is permanently installed against the forward, curbside bulkhead. The hot plate is stored in cabinet K2 and used in the fume hood when deployed.

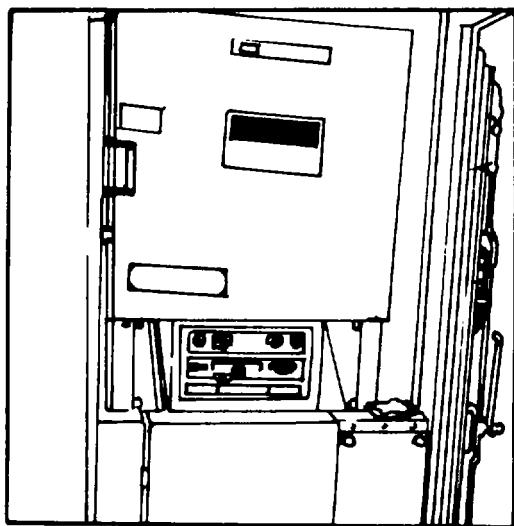


Figure 1-12. Drying Oven

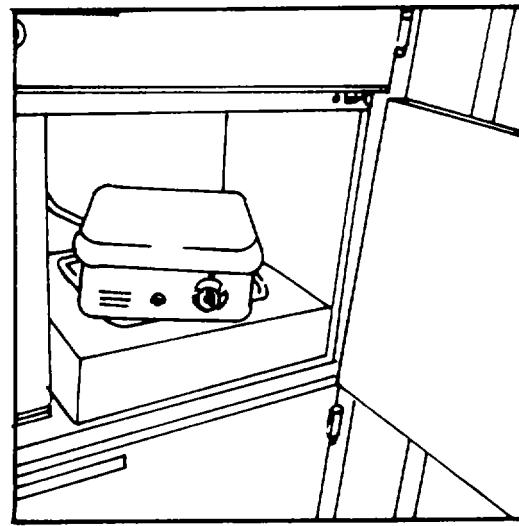
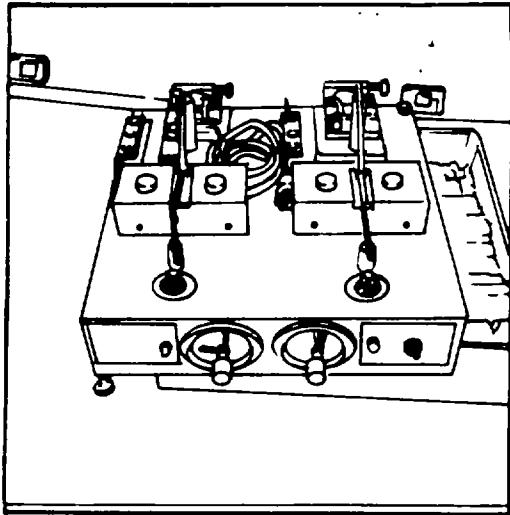


Figure 1-13. Hot Plate Set

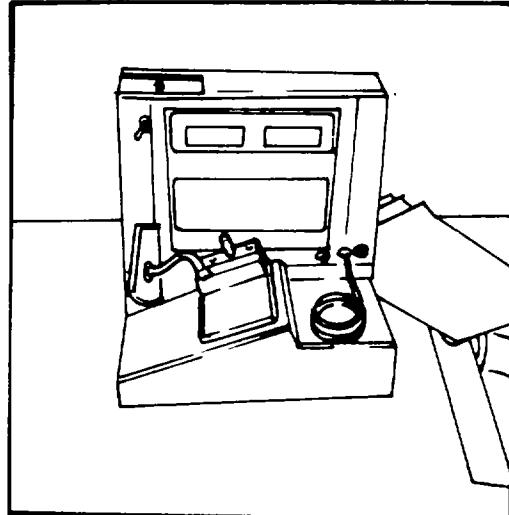
f. *Duplex Ferrograph System (Figure 1-14).* The Duplex Ferrograph System consists of the Dual Ferrograph Analyzer, Direct Reading Ferrograph, and a ferroscope with camera. The duplex ferrograph is located in the curbside storage box.

(1) The dual ferrograph is designed with two stations for making ferrograms, side by side. Operated simultaneously or separately, each ferrograph station magnetically precipitates ferrous wear particles from the samples and deposits them selectively on a thin glass slide called an ogram. After the oil is washed away by a solvent, the remaining particles are left affixed to the glass slide. The ferrograms are then analyzed with the ferroscope.

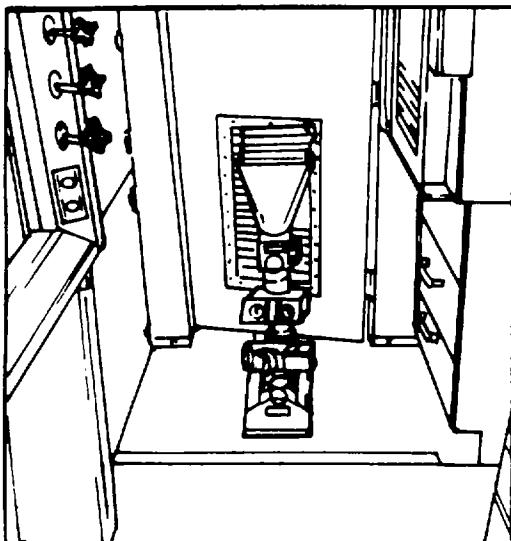
(2) The ferroscope is a special bichromatic microscope system developed for fast and efficient ferrogram analysis. With both reflected and transmitted light and magnifications of 100X, 500X, and 800X, the ferroscope readily identifies wear particle size, shape, texture, and color. The system includes a 35mm camera to record particulate data. Also a polaroid camera is provided for instant analysis.



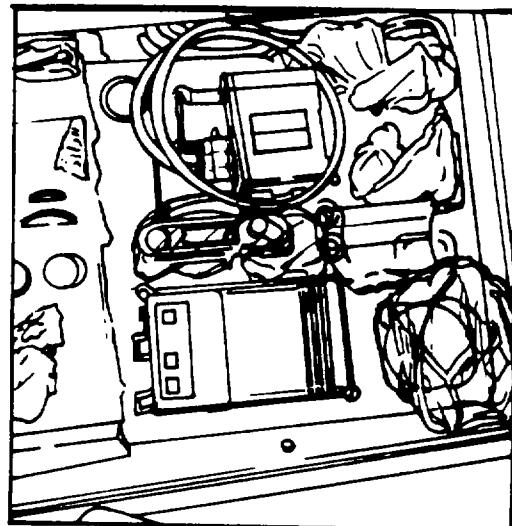
Dual Ferrograph Analyzer



Direct Reading Ferrograph



Ferroscope



Duplex Ferrograph Camera (Ferroscope)

Figure 1-14. Duplex Ferrograph System

g. *Flashpoint Tester* (Figure 1-15). The Flashpoint Tester is designed to determine the presence of a fuel dilution in lubricating oils in nonaeronautical engines.

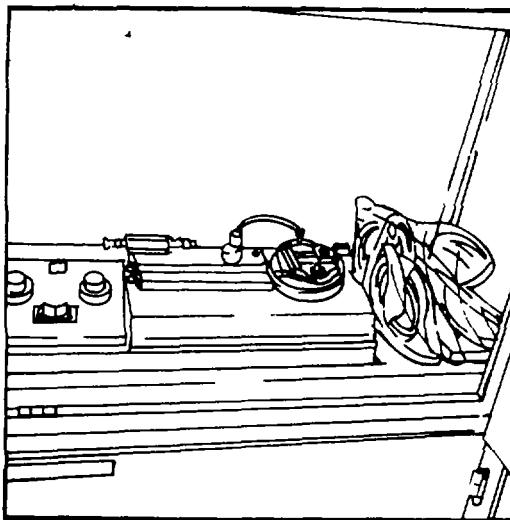


Figure 1-15. Flashpoint Tester

h. *Refrigerator* (Figure 1-16). The refrigerator is mounted on the curbside of the laboratory. It operates on 11 OV, 60Hz, single-phase power. It provides 6.5 cubic feet (0.182 cubic meters) of refrigerated storage.

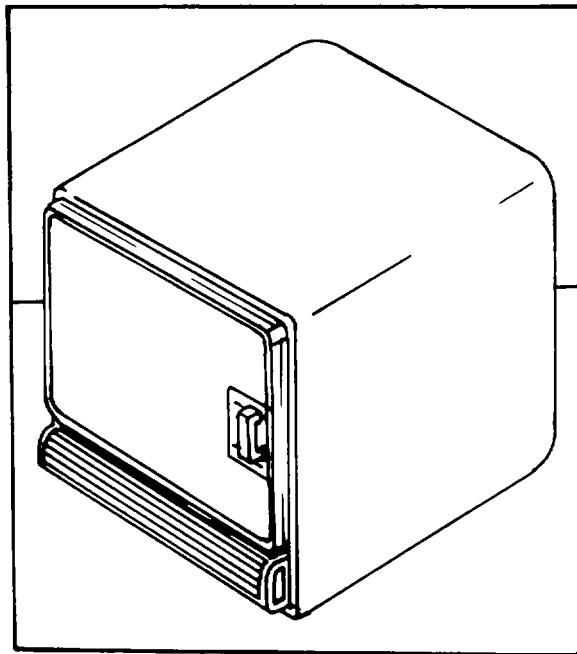


Figure 1-16. Refrigerator

i Gas Alarm System (Figure 1-17). The gas alarm system consists of a main control unit (cabinet assembly) and two remote detector assemblies. The main control unit is wall-mounted on the roadside and connects electrically to the two detector assemblies. The system operates on 110V, 60Hz, single-phase power. The main control unit supplies 5.5 Vdc to the detectors. The alarm is calibrated for propane and has a setting of 20 to 40 percent of the lower explosive limit (ell) of gasoline. An indicating meter in the control unit shows the concentration being monitored and adjustable dual-level alarm circuits are triggered whenever a concentration exceeds the ell. The alarm alerts personnel of combustible mixtures that could cause explosions or fires, and it automatically activates the air purge system.

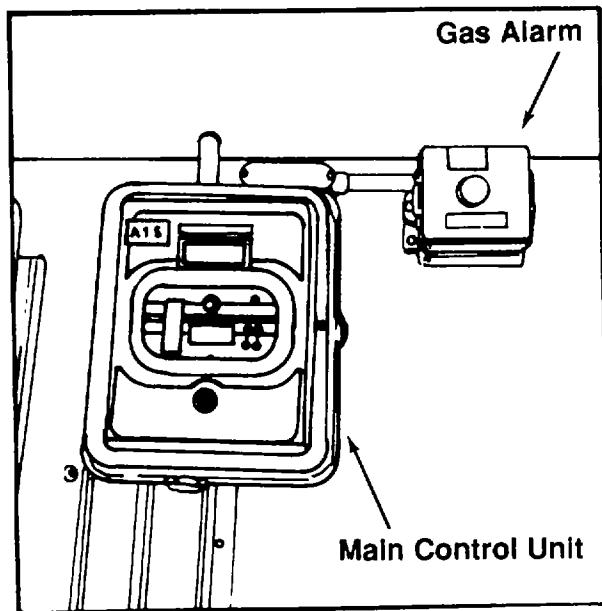


Figure 1-17. Gas Alarm System

j. *Fume Hood* (Figure 1-18). The exhaust blower and the light are activated by switches located on the right side near cabinet K 1. The fume hood incorporates two electrical receptacles. The glass window moves vertically for access to the interior. Three stopcocks in the unit provide capability for the use of water supply, air, and vacuum. The fume hood is used to protect the operator from toxic, corrosive, poisonous, explosive, radioactive, odoriferous, and other harmful and dangerous materials. It provides an area in which solids can be crystallized by controlled evaporation, and in which heat and steam can be removed from hot object.

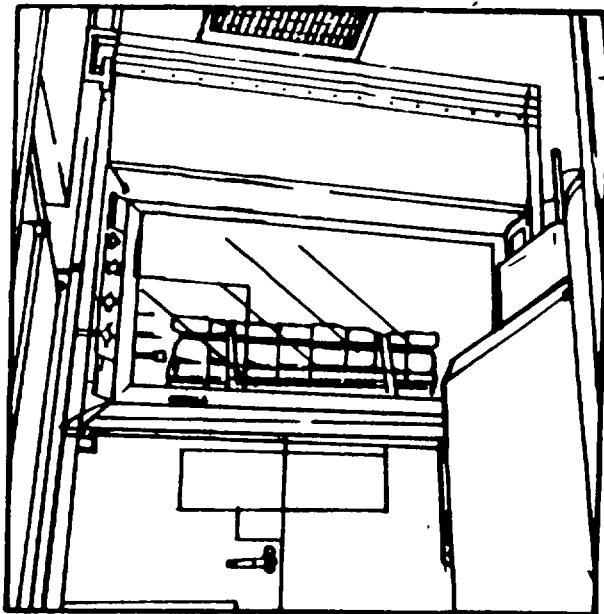


Figure 1- 18. Fume Hood

k. *Ultrasonic Cleaner* (Figure 1-19). Cleans laboratory instruments and glassware and is stored in cabinet C when not in use.

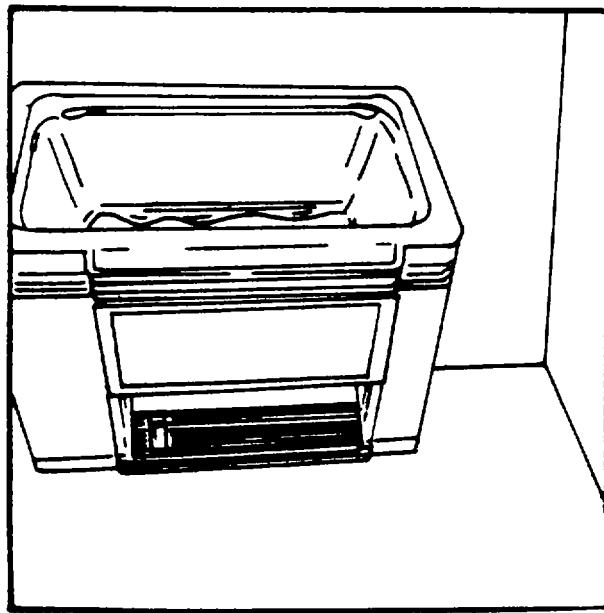


Figure 1-19. Ultrasonic Cleaner

1. *Water Purification System (Figure 1-20).* The Water Purification System is designed to produce Type I Reagent Grade Water equal to or exceeding standards established by ASTM. It can be used on pretreated or high quality tap water.

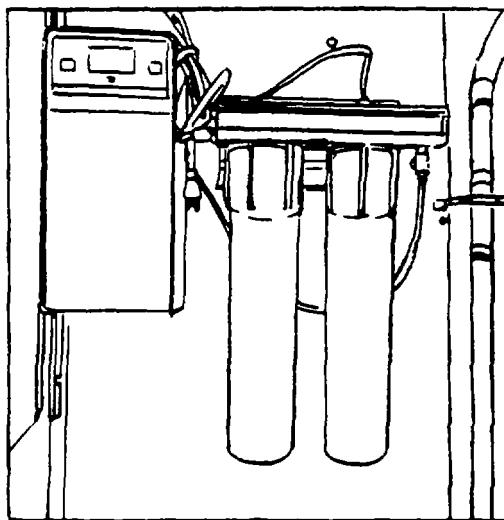


Figure 1-20. Water Purification System

m. *Oscilloscope (Figure 1-21).* The oscilloscope is a rugged lightweight, dual channel 100-MHz instrument that features a bright, sharply-defined trace on an 80- by 100-mm cathode ray tube (crt). Its vertical system supplies calibrated deflection factors from 2 mV per division to 5V per division. It is used to troubleshoot the electronic equipment within the laboratory.

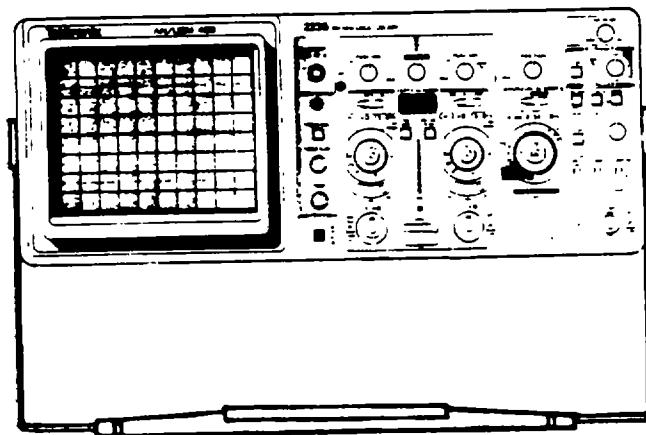


Figure 1-21. Oscilloscope

n. *Laboratory Reagent Dispenser (Figure 1-22).* The Laboratory Reagent Dispenser is a precision dispenser for almost all laboratory reagents, except HF. Very strong oxidizing acids, such as nitric acid and organic solvents at high concentrations, may cause some warping of the fluorocarbon, which could adversely affect the performance of the instrument. The fumes from organic solvents (such as toluene) may attack the magnifying indicator. Only glass and fluorocarbons contact the reagents.

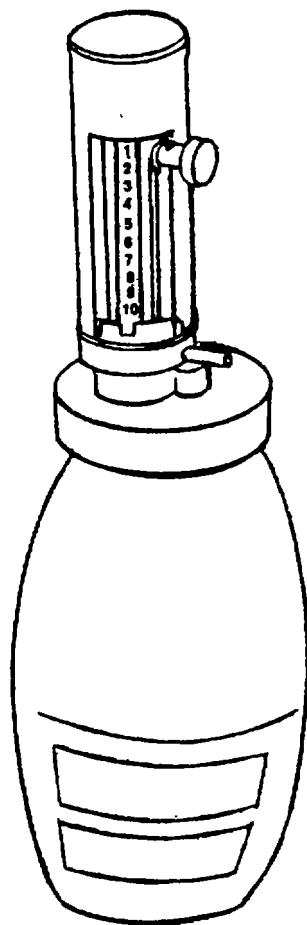


Figure 1-22. Laboratory Reagent Dispenser

o. *Test Tube Mixer (Figure 1-23).* The Test Tube Mixer has both vortex and shaking actions and allows very slow operation without sacrificing high speed performance. Any desired mix homogeneity can be achieved (and repeated) according to viscosity, miscibility, and container. The mixer is equipped with interchangeable snap-on heads, which are a cup head and a platform head.

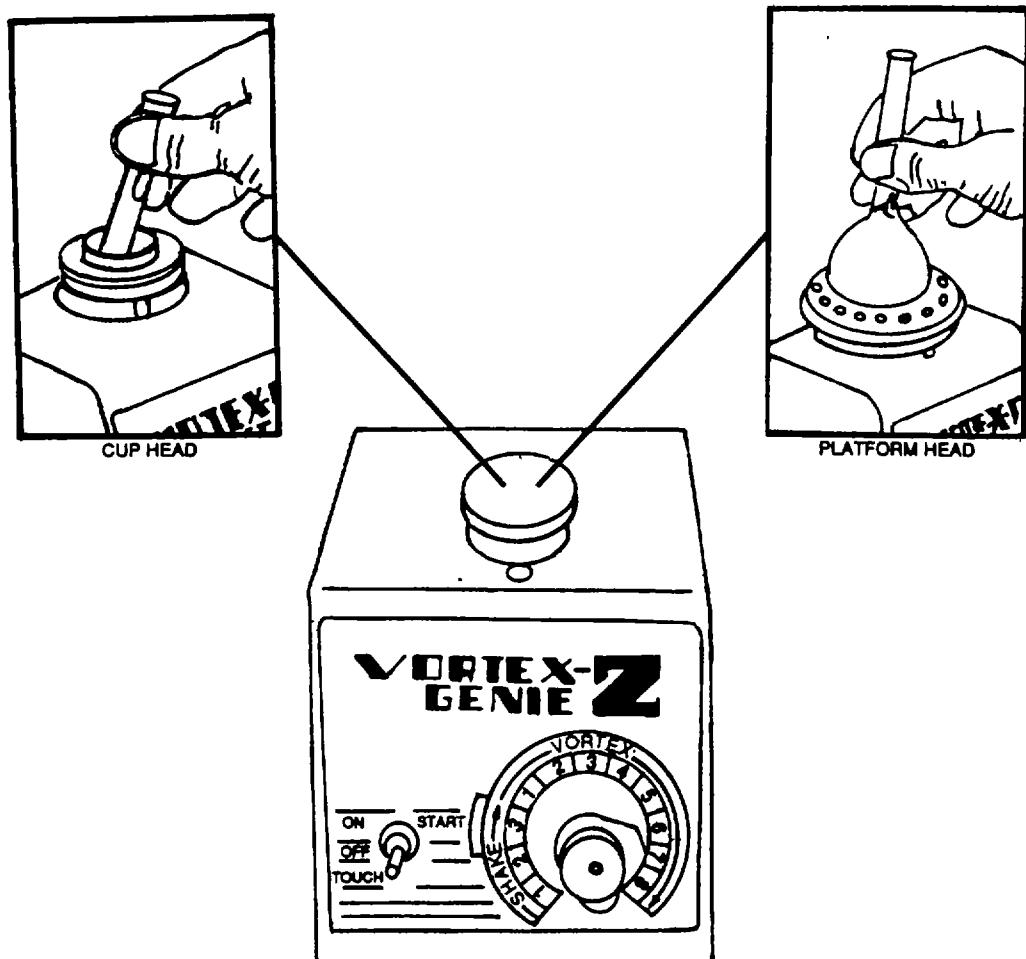


Figure 1-23. Test Tube Mixer

1-20. Laboratory Operating Procedures. The following scenario pertains to the AOAP Mobile Laboratory processing selected aeronautical and nonaeronautical oil samples in a tactical environment. Further, it is not to be conceived as the "ONLY" way of performing specified AOAP analysis.

a. The process begins with the soldier in the field who takes an oil sample and fills in applicable data elements on a DD Form 2026, Oil Analysis Request. The completion of this form, which accompanies the sample to the laboratory, is critical to the success of the analysis, since all data relating to the component from which the oil was taken is entered off this form. Component serial number, hours since last oil change, and hours since last overhaul are examples of data required by the evaluator for accurate assessment of component wear or changes to the lubricating oil's physical properties.

b. On receipt of the oil sample at the AOAP Mobile Laboratory, the components sample's header information is entered in the AOAP Mobile Laboratory's Standard Data System (SDS) computer. The SDS assigns an index number to each serial numbered component. The index number is where the current and/or historical analysis information is stored in the computer, which is retrieved by entering components serial numbers.

c. The oil sample at this time can have spectrometric or physical property analysis performed, since the aeronautical oil samples require only spectrometric analysis to be performed, except for selected AH- 1's components requiring ferro graphic analysis. Thus, for discussion purposes ONLY, oil analysis process will begin with spectrometric analysis test, which is performed on all components enrolled in AOAP.

d. The oil sample is analyzed for up to 15 wear metals on the spectrometer. The spectrometer is interfaced with a Wang MICROVP-2 computer system. This system has been loaded with AOAP wear metal guidelines for components enrolled in AOAP. If element(s) exceed(s) the specified spectrometric guidelines for that component, then the evaluator reviews analysis data and makes a recommendation to the owning unit. These recommendations can range from an oil and filter change to the removal of the component from service. To ensure the proper operation of the spectrometer, the operator performs daily standardization checks on the instrument before each day's start up. However, if the spectrometer does not pass these prescribed daily standardization checks, then a complete standardization is performed. Additionally, periodic standardization checks are made throughout the day. At a minimum, these checks are made when switching from analysis of aeronautical to nonaeronautical samples (and vice versa), or whenever the spectrometer has not been operated for 30 minutes or more.

e. Physical property testing is performed on nonaeronautical engine and transmission oil samples to determine the on-condition of the oil in these components.

f. The Crackle Test is performed utilizing a hot plate set at 300 to 350 degrees Centigrade (150-175 degrees Fahrenheit) surface temperature to ascertain presence of water contamination. This test is accomplished by placing one drop of oil on the surface of the hot plate. A positive test is indicated by an audible crackling and spattering of the oil.

g. The determination of the viscosity of used oils is performed using a Direct Readout Viscometer. The viscosity reading is obtained by immersing the viscometer's vibrating sphere into the nonaeronautical oil sample. If the viscosity reading of the used oil sample obtained is below the prescribed lower criteria guidelines, then additional testing is conducted to determine if fuel dilution, contamination, or lubricant degradation has occurred. Additionally, if the viscosity readings obtained are above the upper criteria, then the evaluator may recommend an oil and oil filter change.

h. The Blotter Test is used to determine the insoluble contaminants, dispersant ability, and alkalinity of used oil from diesel engine samples. This test is performed by placing one drop of used oil in the center of an oil print filter circle. The oil spot is allowed to develop for 15 minutes, and the resulting spot is evaluated for total contaminants, cooling contaminants, and dispersant effectiveness. An alkalinity indicator is added to the spot and, after one or two minutes, the alkaline reserve is determined from the color ring that develops.

i. The Flash Point Tester is used in determining the percentage of fuel dilution in used oil samples from diesel engines.

j. The Microscopic Analysis Test is used to determine wear and contamination of suspect spectrometric oil samples from aircraft components as relates to the components condition. This is accomplished by placing a few milliliters of the suspect oil sample in a test tube and mixing with solvent. This mixture is then filtered through a .01 45u (Micron) membrane filter. The remaining insoluble debris and filter membrane are carefully rinsed with solvent to remove oil and then allowed to air dry. The dry membrane is transferred to a petri slide and the debris examined under a low-power microscope. The debris are identified as to type of wear metal with respect to wear and contamination.

k. Ferrographic analysis is currently performed on selected aeronautical components (i.e., AH-I swashplates and Scissors & Sleeves Assembly) as a supplement to spectrometric analysis.

CHAPTER 2

OPERATING INSTRUCTIONS

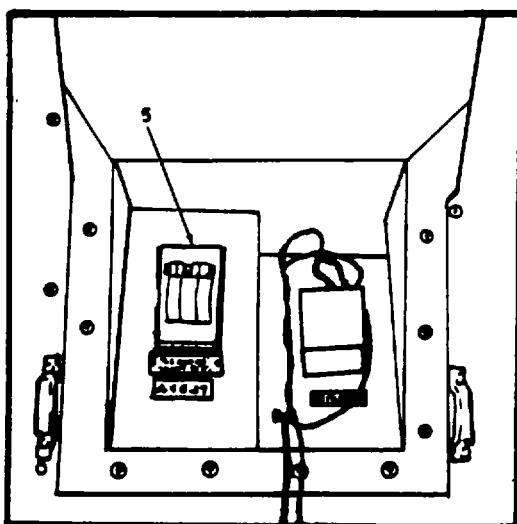
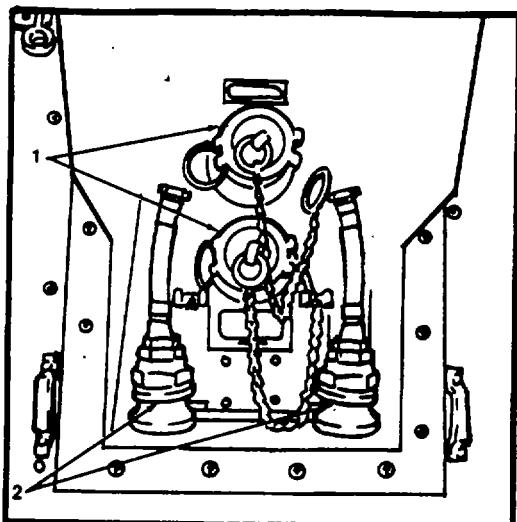
Section		Page
Section I	Operator's Controls and Indicators.....	2-1
Section II	Operator Preventive Maintenance Checks and Services	2-16
Section III	Operation Under Usual Conditions	2-27
Section IV	Operation Under Unusual Conditions.....	2-47

Section I. OPERATOR'S CONTROLS AND INDICATORS

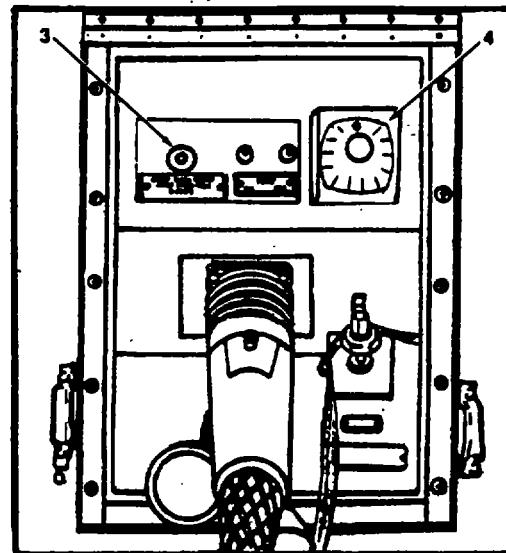
2-1. Damage From Improper Settings. All operators should become thoroughly familiar with the operator's controls and indicators, and with the proper operating procedures for the AOAP Mobile Laboratory. Certain precautions must be observed in the operation of the equipment and its components. Some procedures are presented in a set sequence and must be followed in sequence.

2-2. Operator Controls and Indicators. Table 2-1 contains the controls and indicators for the AOAP Mobile Laboratory exterior. Tables 2-2 through 2-11 are for the other functional systems within the AOAP Mobile Laboratory. Operator's controls and indicators for the refrigerator, oven, Fluid Analysis Spectrometer, AOAP Standard Data System, Viscometer Set, Fluid Analysis Set, Duplex Ferrograph System, etc., are described in their respective Technical Manuals (TMs) (see Appendix A for TM number).

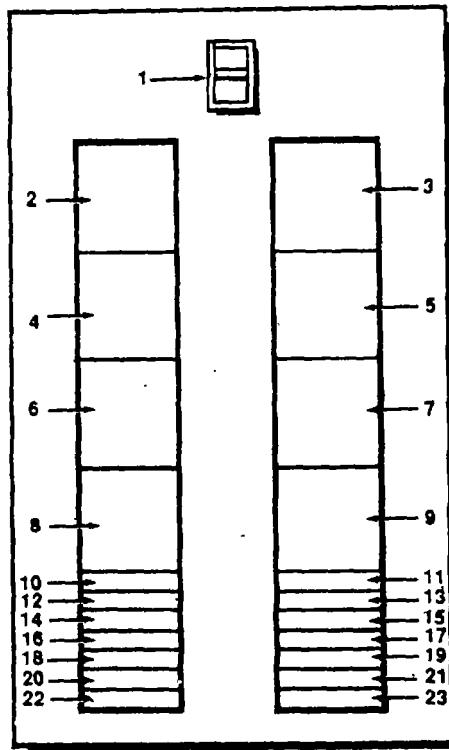
Table 2-1. Exterior Controls and Indicators



Electrical/Telephone

Power Entrance
w/Purge Timer

Control or Indicator	Function
1. Facility/Suction Hookup	Facility or suction inlets for desired water source.
2. Adapters	Provides capability for garden hose inlet.
3. Purge Alarm Buzzer	Indicates by sound if one of purge doors is not opened when purge cycle is initiated. Located in Power Input Panel Door.
4. Purge Timer	Times the purge cycle of 5 minutes.
5. Electrical/Telephone Hookup	Provides external 11 OV power and telephone hookup for trailer.

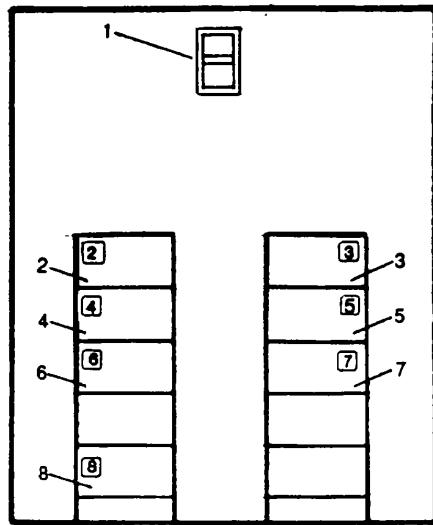
Table 2-2. Main Power Panel

Control or Indicator	Function
1. Circuit Breaker	Serves as the main circuit breaker. In the ON position, applies power to all system circuit breakers.
2. Circuit Breaker 2	Provides circuit protection for the ECU's.
3. Circuit Breaker 3	Provides circuit protection for the ECU's.
4. Circuit Breaker 4	Provides circuit protection for the ECU's.
5. Circuit Breaker 5	Provides circuit protection for the ECU's.

Table 2-2. Main Power Panel (cont.)

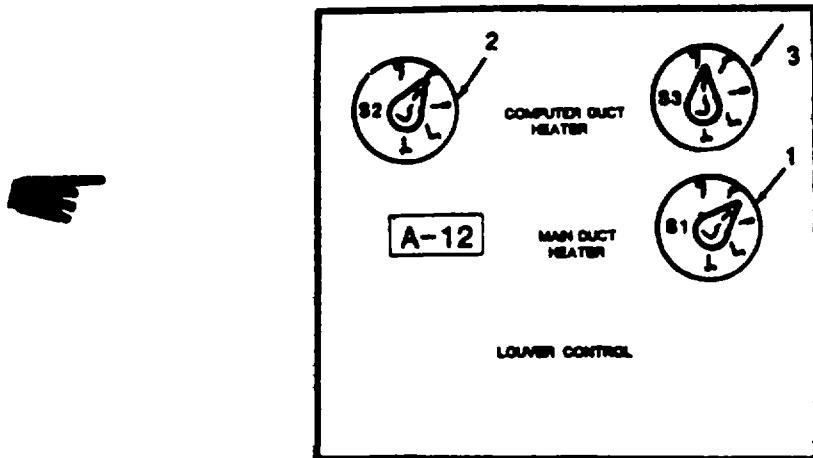
Control or Indicator	Function
6. Circuit Breaker 6	Provides circuit protection for the Computer Duct Heater.
7. Circuit Breaker 7	Provides circuit breaker protection for Environmental Duct Heater.
8. Circuit Breaker 8	Provides power to Panelboard No.2.
9. Circuit Breaker 9	Provides circuit breaker protection for Computer Power Regulator.
10. Circuit Breaker 10	Provides circuit breaker protection for Fume Hood Light and Blower.
11. Circuit Breaker 11	Provides circuit breaker protection for Vacuum Pump.
12. Circuit Breaker 12	Provides circuit breaker protection for Utility No. 1 and Emergency Light No. 3.
13. Circuit Breaker 13	Provides circuit breaker protection for Lights.
14. Circuit Breaker 14	Provides circuit breaker protection for Water Pump.
15. Circuit Breaker 15	Provides circuit breaker protection for Emergency Lights No. 1 and 2.
16. Circuit Breaker 16	Provides circuit breaker protection for Fume Hood Utility Receptacle.
17. Circuit Breaker 17	Provides circuit breaker protection for Oven.
18. Circuit Breaker 18	Provides circuit breaker protection for Cable Reel.
19. Circuit Breaker 19	Provides circuit breaker protection for Microscope and Ferrograph.
20. Circuit Breaker 20	Provides circuit breaker protection for Air Compressor.
21. Circuit Breaker 21	Serves as a spare circuit breaker.
22. Circuit Breaker 22	Provides circuit breaker protection for the Spectrometer.
23. Circuit Breaker 23	Serves as a spare circuit breaker.

Table 2-3. Power Panel Number 2



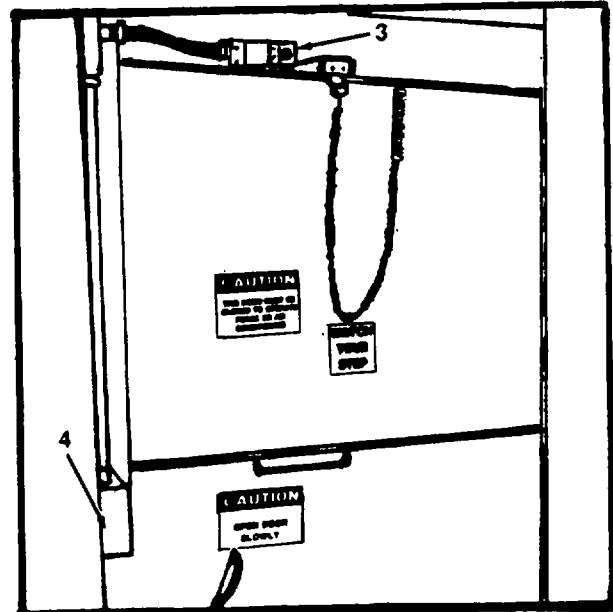
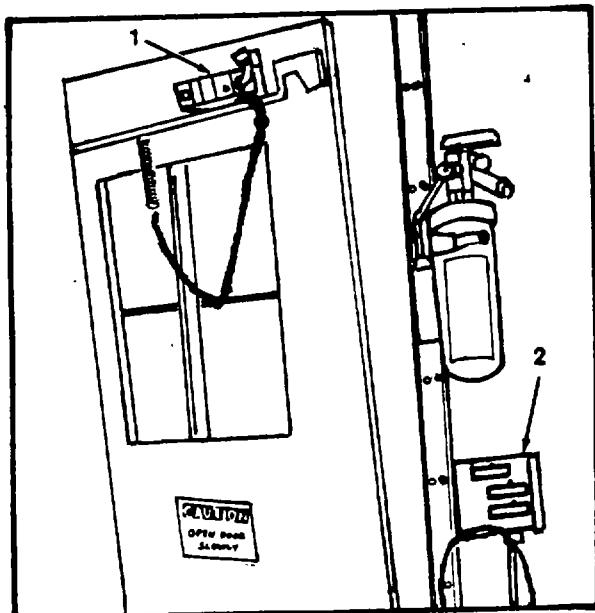
Control or Indicator	Function
1. Circuit Breaker 1	Serves as the main circuit breaker for Power Panel No. 2, and provides circuit breaker protection in the "on" position; provides power to Power Panel Number 2.
2. Circuit Breaker 2	Provides circuit breaker protection for Viscometer.
3. Circuit Breaker 3	Provides circuit breaker protection for Water Heater.
4. Circuit Breaker 4	Provides circuit breaker protection for the Ultrasonic Cleaner.
5. Circuit Breaker 5	Provides circuit breaker protection for Utility No. 3 and No. 4.
6. Circuit Breaker 6	Provides circuit breaker protection for the Refrigerator.
7. Circuit Breaker 7	Provides circuit breaker protection for Utility No. 2, outside receptacle.
8. Circuit Breaker 8	Provides circuit breaker protection for Waste Tank Heater.

Table 2-4. Electrical Switches



Control or Indicator	Function
1. Switch 1	Louver control switch. Controls louver. (OFF, 100%,50%,35%,OFF)
2. Switch 2	Computer duct switch. Controls Computer Duct Heater. (OFF,LOW,MED,HIGH)
3. Switch 3	Main duct heater switch. Controls Main Duct Heater (OFF,LOW,MED,HIGH)

Table 2-5. Lighting

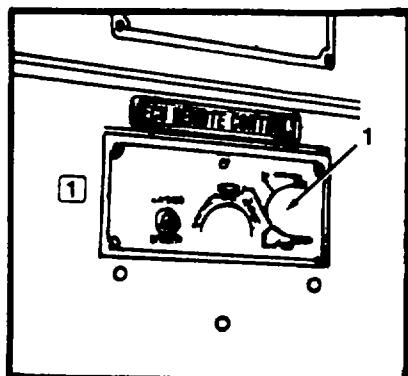


Micro Switch and Flourescent Light Switch

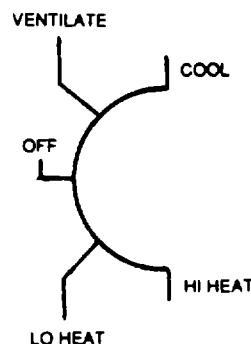
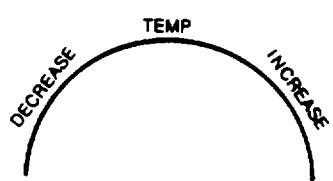
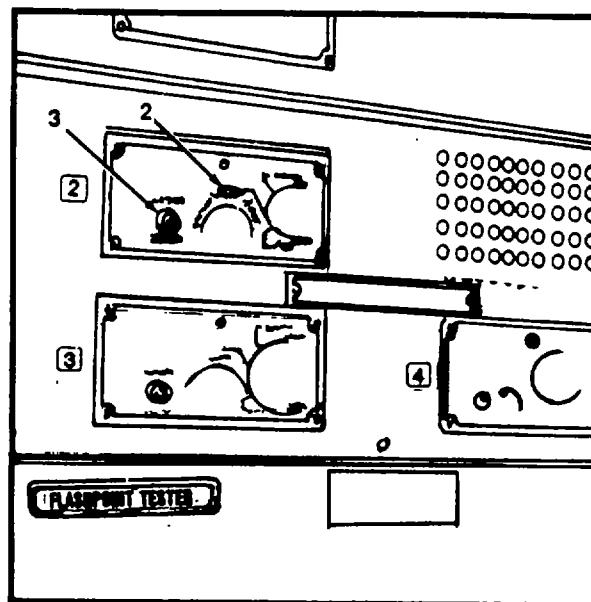
Control or Indicator	Function
1. Curbside Microswitch	Controls blackout lights.
2. Curbside Door Fluorescent Light Switches	Controls fluorescent light operation.
3. Receiving Room Door Microswitch	Controls blackout lights.
4. Receiving Room Door Fluorescent Light Switches	Controls fluorescent light operation.

Table 2-6. Environmental Control Units (ECU's)

(Control No. 1 Located on Computer)



(Controls No. 2-4 Located Adjacent to Fume Hood)

**NOTE:**

**IF MORE THAN ONE UNIT IS OPERATING,
SETTINGS MUST BE SIMILAR.**

Control or Indicator	Function
1. ECU Selector Switch	Selects the mode of ECU operation.
2. ECU Thermostat	Controls temperature of AOAP Mobile laboratory.
3. ECU Speed Selector Switch	Controls speed (Hi or Lo) of ECU's.

Table 2-7. Purge System and Gas Alarm

Control or Indicator	Function
1. Purge Doors Limit Switches	Provides signal to purge alarm buzzer if one of purge doors is not opened when purge cycle is initiated.
2. Gas Alarm Green Pilot Light	Provides indication when the instrument power is on and detector circuit is energized.
3. Indicator Meter	Provides indication of the concentration of combustible gas at detection point.
4. Gas Alarm Blue Fail Light	Provides indication when there is equipment failure or malfunction.
5. Yellow Warning/Test Light	Provides indication when a combustible gas condition exceeding the low alarm setting exists at the remote detector, or when the alarm test switch has been activated. When depressed, provides a simulation of an alarm level of gas concentration at the remote detector. It also provides a functional check of the analyzer and remote alarm circuit.
6. Red Alarm Light	Provides test of alarm buzzer.
7. Alarm Reset Switch	When depressed, 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.
8. Detector/Selector Switch	Provides automatic or manual selection of individual alarm detectors.

Table 2-7. Purge System and Gas Alarm (Cont.).

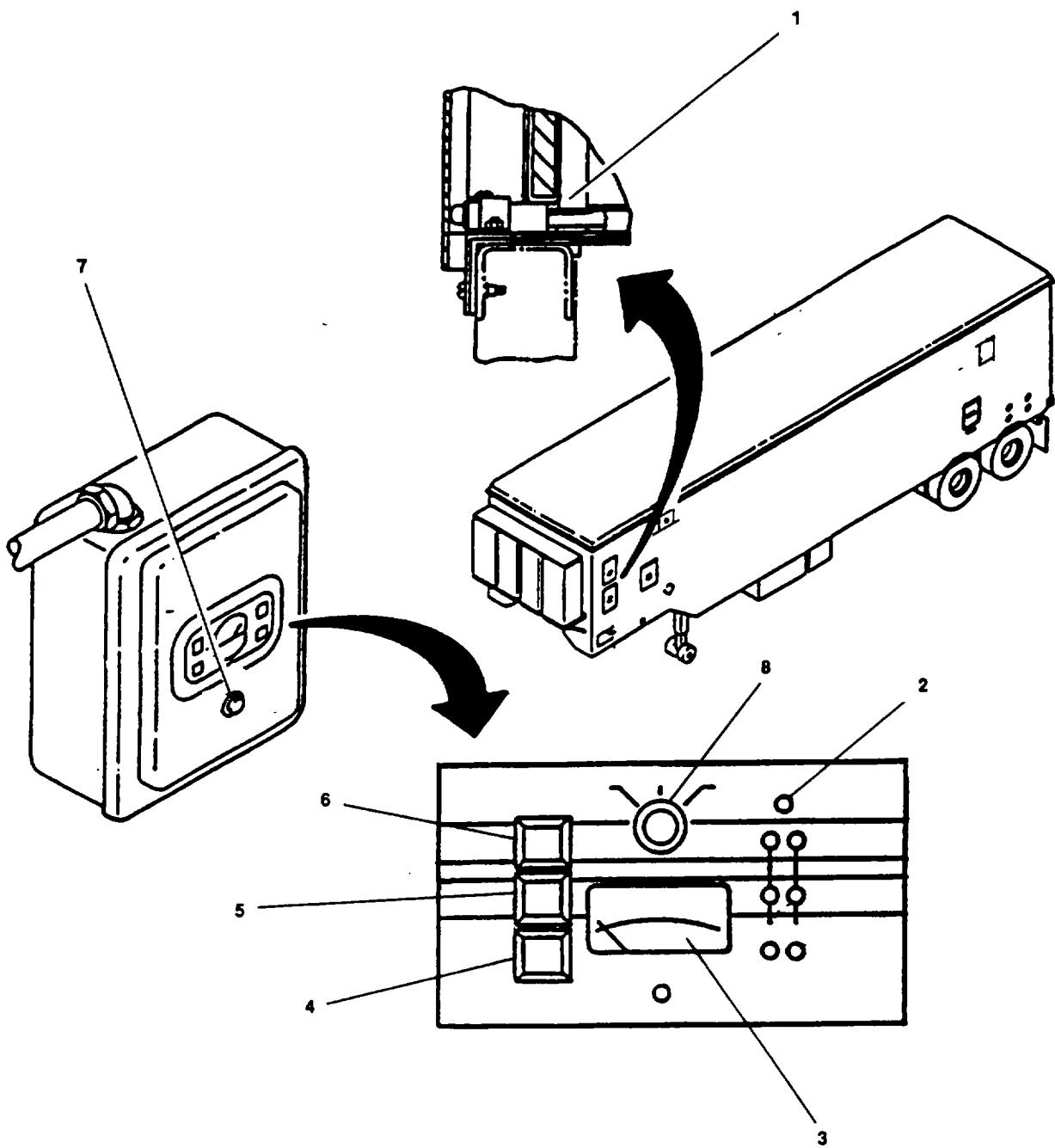
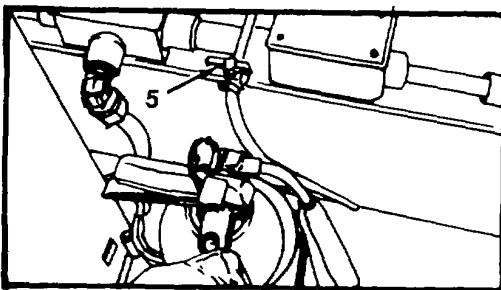
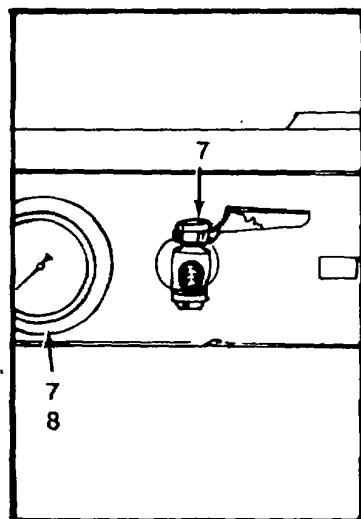
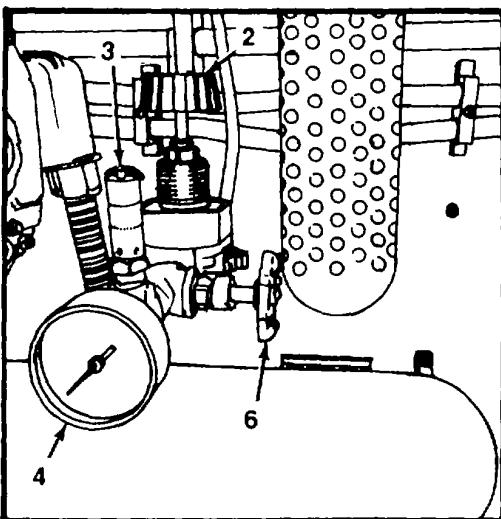
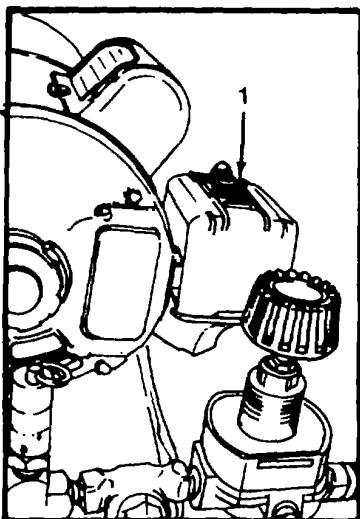
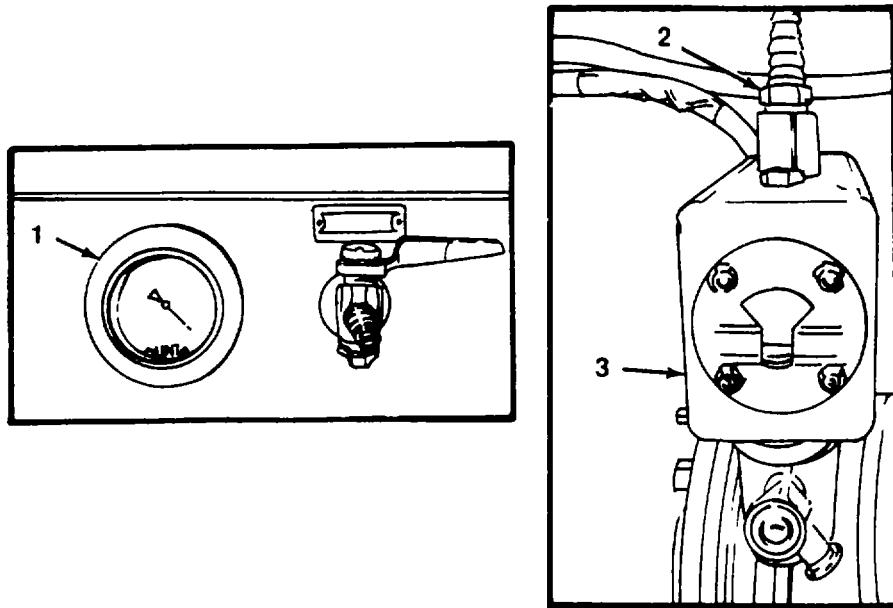


Table 2-8. Air System



Control or Indicator	Function
1. Pressure Switch	Starts and stops compressor automatically at the required pressures. Compressor starts at 60 psi, and stops at 120 psi.
2. Pressure Valve	Provides manual control of pressure.
3. Safety Valve	Provides safety relief if air pressure in tank goes above 150 psi.
4. Air Tank Pressure Gage	Indicates the air pressure in the tank.
5. Drain Valve	Drains water Air Compressor Tank. Tank should be drained twice daily.
6. Air System Isolation Valve	Provides for isolation of air compressor.
7. Air Service Valves	Provides service access to the air system.
8. Service Pressure Gage	Indicates air pressure at service valve.

Table 2-9. Vacuum System



Vacuum System

Vacuum System

Control or Indicator	Function
1. Vacuum/Pressure Gage	Indicates the system vacuum in inches of mercury (HG).
2. Vacuum System Isolation and Service Valves	Provides for system isolation and service access in the AOAP Mobile laboratory.
3. Oil Level Indicator	Indicates the level of oil in vacuum pump.

Table 2-10. Water System

Control or Indicator	Function
1. Pressure Switch	Starts/stops water pump at desired pressure.
2. Pressure Regulator	Controls/regulates water pressure to service outlets.
3. Tank/System Switch	Controls flow to tank and system.
4. Filter Valve Switch	Directs flow to filters or isolates flow from filters.
5. Pump/Suction Valve	Controls external source water flow to pump suction port.
6. Tank Pump Valve	Controls flow of water from tank to pump.
7. Tank Bubble Indicator	Indicates water level in the water tank.
8. Tank Drain Valve	Tank drain located on tank.
9. Bubble Level Isolation Valves	Isolates level indicator from tank.
10. Water Flow Facility Supply Switch	Directs water flow to system or filters.
11. Filter Reservoir Drain Valve	Drains system water to external (outside) receiving facility/container.
12. Exterior Tank Drain Valve	Drains tank water to external (outside) receiving facility/container.

Table 2-10. Water System (cont.)

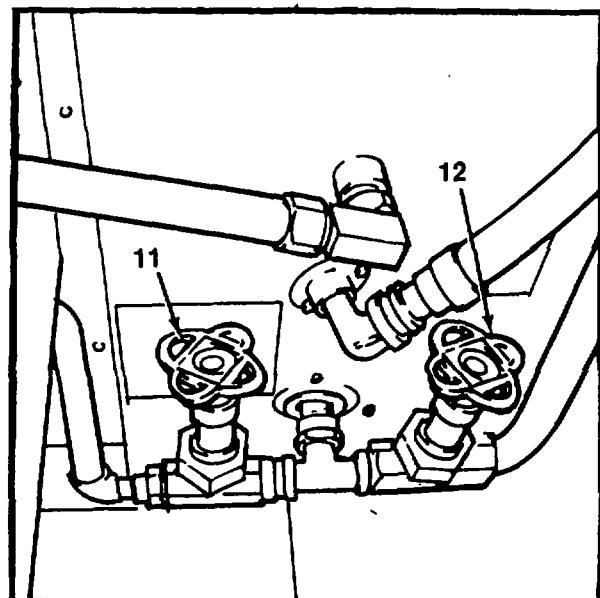
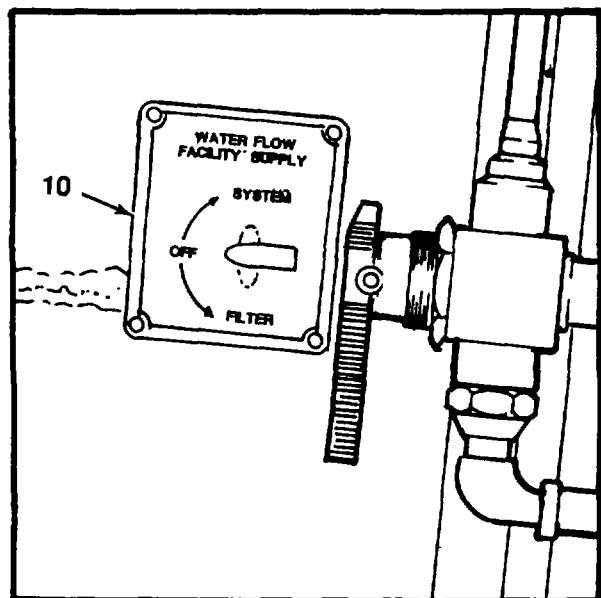
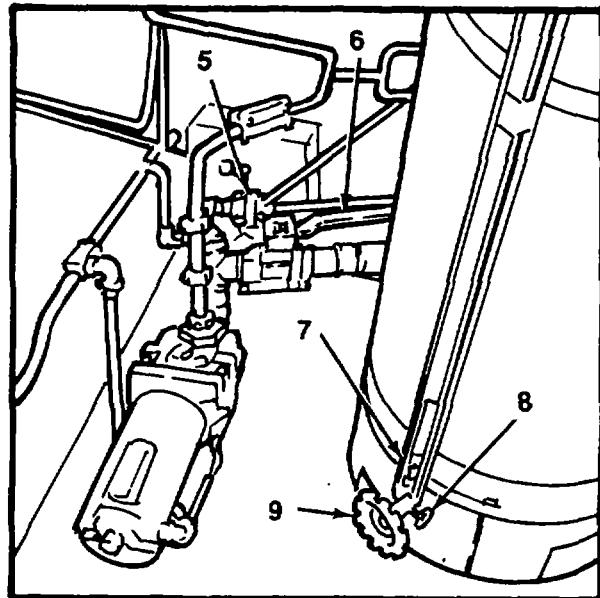
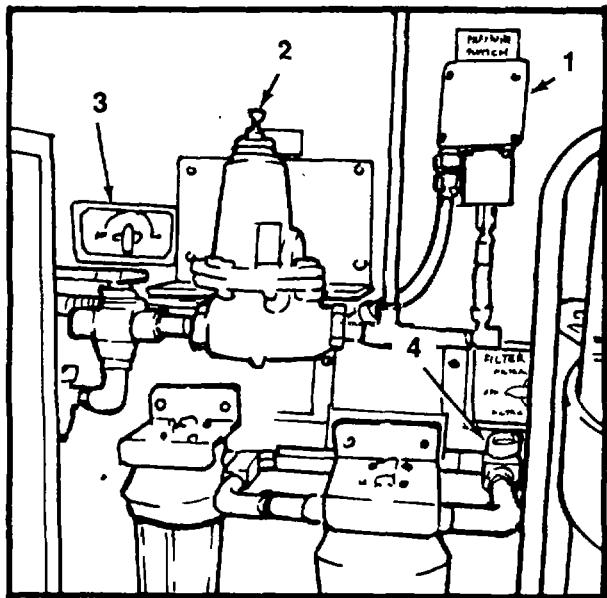
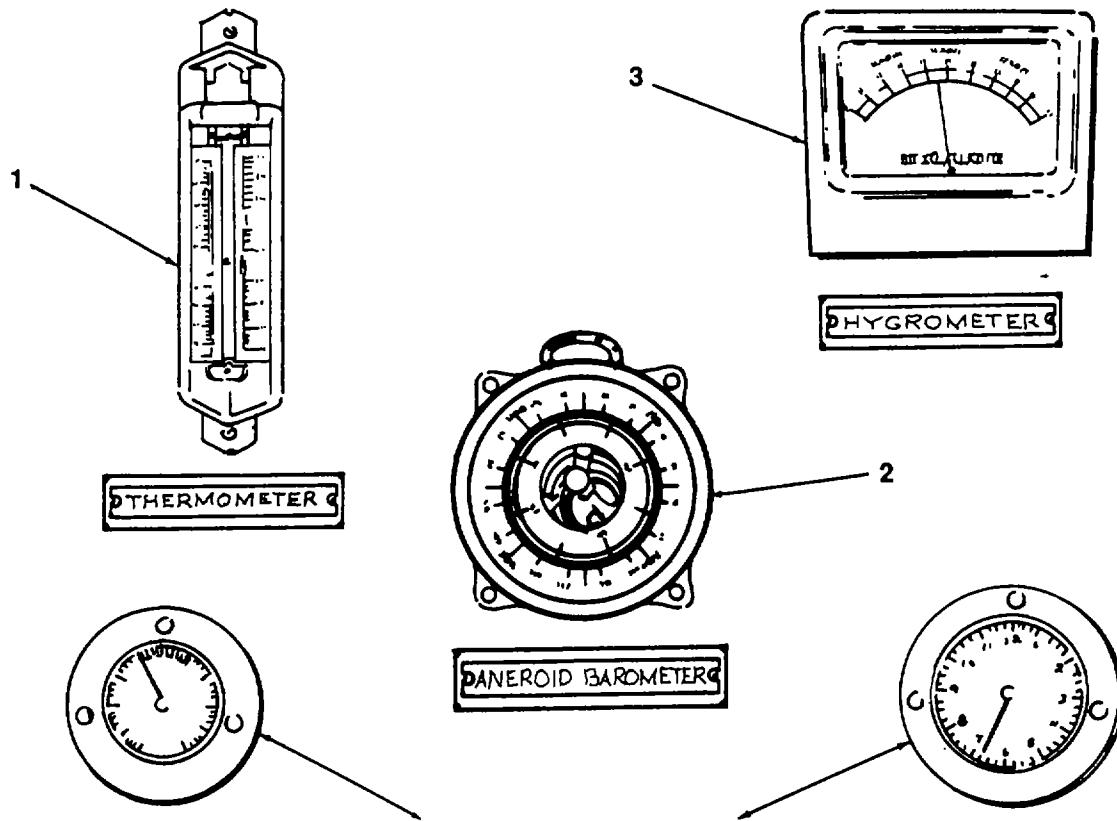


Table 2-11. Support Items



Control or Indicator	Function
1. Thermometer	Indicates temperature within the AOAP Mobile Laboratory.
2. Aneroid Barometer	Indicates atmospheric pressure within the laboratory.
3. Hygrometer	Indicates the water vapor content in the laboratory.
4. Clock	Indicates time in 12 or 24 hour increments.
5. AOAP Standard Data System	Indicates the temperature inside the computer Temperature Gage cabinet.

Section II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-3. General. The following paragraphs describe general information concerning when to do PMCS and what to do if a failure is discovered.

- a. *Before You Operate.* Always keep in mind the CAUTIONS and WARNINGS. Perform your before (B) PMCS prior to the equipment leaving the laboratory or performing its intended mission.
- b. *While You Operate.* Always keep in mind the CAUTIONS and WARNINGS. Perform your during (D) PMCS when the equipment is being used in its intended mission.
- c. *After You Operate.* Be sure to perform your after (A) PMCS after the equipment has been taken out of its mission mode or returned to the laboratory.
- d. *If Your Equipment Fails to Operate.* Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

2-4. PMCS Procedures. The following paragraphs describe your PMCS, Table 2-12.

- a. *Purpose of PMCS Table.* Your PMCS table lists the inspections and care your equipment requires to keep it in good operating condition.
- b. *Item Number Column.* Item numbers are assigned in chronological, ascending sequence regardless of interval designation. These numbers are used for your "TM number" column on DA form 2404, Equipment Inspection and Maintenance Worksheet in recording results of PMCS.
- c. *Service Interval Column.* The "Interval" column of your PMCS table tells you when to do certain checks or services.
- d. *Item to be Inspected Column.* This column lists functional groups and their respective assemblies and subassemblies. The appropriate check or service procedure follows the specific item to be inspected.
- e. *Procedures Column.* This column of your PMCS table tells you how to do the required checks and services. Carefully follow these instructions. If you do not have the tools, or if the procedure tells you to, have unit maintenance do the work.
- f. *After Prolonged Shutdowns.* Perform weekly as well as before operations if you are the assigned operator and have not operated the item since the last weekly or if you are operating the item for the first time.
- g. *Reporting and Correcting Deficiencies.* If your equipment does not perform as required, refer to Chapter 3, Troubleshooting for possible problems. Report any malfunctions or failures on the proper DA Form 2404, or refer to DA Pam 738-750.

CAUTION

- Equipment operation is allowable with minor leakages (Class I or II). Of course, you must consider the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.
- When operating with Class I or Class II leaks, continue to check fluid levels as required in your PMCS.
- Class III leaks should be reported to unit maintenance.

h. *Leakage.* Leakage definitions for operator/crew PMCS shall be classified as follows:

Class I Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

Class II Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.

Class III Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

i. *Individual Equipment PMCS.* PMCS for the laboratory equipment such as environmental control unit, refrigerator, oven, etc., are contained in their respective TMs (refer to Appendix A for TM numbers).

2-5. Equipment is Not Ready/Available If Column. This column is used for identification of conditions that make the equipment not ready/available for readiness reporting purposes or denies use of the equipment until corrective maintenance is performed.

NOTE

The terms ready/available and mission capable refer to the same status; Equipment is on hand and is able to perform its combat missions.

Table 2-12. Operator Preventive Maintenance Checks and Services**NOTE**

If the equipment must be kept in continuous operation, check and service those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

Table 2-12. Operator Preventive Maintenance Checks and Services (cont.)

ITEM NO.	INTERVAL					ITEM TO BE INSPECTED	Procedures Check for and have repaired or adjusted as necessary.	Equipment is Not Ready/ Available
	B	D	A	W	M			
1				•	1	Trailer Walls	Inspect skin surface for paint damage, corrosion, cracks, or punctures.	Wall skin, cracked, or punctured.
2		•				Utilities Box	<ul style="list-style-type: none"> a. Inspect for condition and security. b. Inspect access door for defective or missing latches, keepers, seal, and hinge. c. Check coupling assembly for security and damaged threads. d. Inspect gasket for condition and security. 	Box damage, missing rivets. Latches, keepers, seals, or hinges damaged or missing.
3	•	•			•	Power Entrance Panel	<ul style="list-style-type: none"> a. Inspect for damage to panel. b. Inspect access doors for defective or missing latch, keeper, seal, or hinge. c. Inspect power cable connector for loose and damaged pins. 	Defective coupling. Defective gasket. Panel damaged. Latch, keeper, seal, or hinge damaged or missing. Defective connector.

Table 2-12. Operator Preventive Maintenance Checks and Services (cont.)

ITEM NO.	INTERVAL					ITEM TO BE INSPECTED	Procedures Check for and have repaired or adjusted as necessary.	Equipment is Not Ready/ Available
	B	D	A	W	M			
4	•	•			•	Electric/ Telephone Access Panel	d. Check ground cable is properly connected to ground lug and grounding rod. Inspect for condition and security.	Grounding connections are damaged. Damaged door assembly. Damaged or missing telephone connection and/or power outlet.
5				•	•	Fume Chamber Vent Exhaust and Spectrometer Hot Gas Vent	a. Inspect for condition and security. b. Inspect access door for defective or missing latches, keepers, seals, and hinges. c. Inspect gasket for condition and security.	Damaged door assembly, missing rivets. Latches, keepers, seals, or hinges damaged or missing. Defective gasket.
6	•	•			•	Power Cable	Inspect cable for damaged connector, cuts, and deep abrasions.	Cable damaged.
7	•			•	•	Purge Intake Doors	a. Inspect access doors for defective or missing latches, keepers, seals, and hinges. b. Inspect door micro-switches to be sure they activate properly when door is closed, and deactivate when door is opened. c. Inspect gasket for condition and security. d. Inspect motor for operation. e. Inspect filters for obstructions and security.	Latches, keepers, seals, or hinges damaged or missing. Microswitches do not operate properly. Defective gasket. Motor does not operate. Clogged, dirty, or defective filter.

Table 2-12. Operator Preventive Maintenance Checks and Services (cont.)

ITEM NO.	INTERVAL					ITEM TO BE INSPECTED	Procedures Check for and have repaired or adjusted as necessary.	Equipment is Not Ready/ Available
	B	D	A	W	M			
8	•	•			•	ECU Intakes	<ul style="list-style-type: none"> a. Inspect dampers and motors for operation. b. Inspect filters for obstructions and security. 	Motor does not operate. Clogged, dirty, or defective filter.
9	•	•			•	Purge Exhaust Doors	<ul style="list-style-type: none"> a. Inspect access doors for defective or missing latches, keepers, seals, and hinges. b. Inspect door micro-switches to be sure they activate properly when door is closed, and deactivate when door is opened. c. Inspect gasket for condition and security. d. Inspect motor for operation. 	Latches, keepers, seals, or hinges damaged or missing. Microswitches do not operate correctly. Defective gasket. Motor does not operate.
10		•			•	TRAILER INTERIOR	Inspect bulbs and starter for operation.	Lights not operating.
11	•	•			•	Fluorescent Light Assembly	Inspect for operation.	Lights not operating.
12		•			•	Emergency Lights	Inspect for condition and security.	Damage to junction box, missing cap-screws.
13		•			•	ECU Remote Control Junction Boxes	Inspect for condition and security.	Equipment does not operate.
14		•			•	Motor Controllers	Inspect for operation.	ECUs do not operate.
						Environmental Control Units (ECUs)	Inspect for proper operation.	

Table 2-12. Operator Preventive Maintenance Checks and Services (cont.)

ITEM NO.	INTERVAL					ITEM TO BE INSPECTED	Procedures Check for and have repaired or adjusted as necessary.	Equipment is Not Ready/ Available
	B	D	A	W	M			
15	•					Air Compressor	a. Check for loose mounting bolts.	Mounting bolts loose or missing.
	•						b. Check crankcase oil level.	Low oil level.
	•						c. Check intake for obstructions.	Intake is obstructed.
		•					d. Check air filter for obstructions.	Clogged or dirty filter.
		•					e. Listen for rattles, knocks, squeaks, or hums that may indicate trouble in air compressor or motor.	Vibration or unusual noise occurs.
		•					f. Observe motor for indication of overheating and smoke.	Motor overheats.
16	•					Air Tank and System Piping	a. Check for loose mounting bolts.	Missing bolts.
							b. Inspect for leaks, leaky valves, or inoperative valves.	Air leaks or defective valves.
		•	•				c. Drain air tank as required.	
17	•					Vacuum Pump	a. Check for loose mounting bolts.	Mounting bolts missing.
	•						b. Check crankcase oil level.	Low oil level.
		•					c. Listen for rattles, knocks, squeaks, or hums that may indicate trouble in air compressor or motor.	Vibration or unusual noise occurs.
		•					d. Observe motor for indication of overheating and smoke.	Motor overheats.

Table 2-12. Operator Preventive Maintenance Checks and Services (cont.)

ITEM NO.	INTERVAL					ITEM TO BE INSPECTED	Procedures Check for and have repaired or adjusted as necessary.	Equipment is Not Ready/ Available
	B	D	A	W	M			
17 (cont)	•	•					<ul style="list-style-type: none"> e. Observe drive belts for cracks, slippage or binding caused by excessive looseness or tightness of belt. Proper drive belt deflection should be 3/4 inches under moderate thumb pressure. 	Drive belts are loose or cracked.
18		•				Vacuum System Piping and Valves	Inspect for leaks, leaky valves, or inoperative valves.	Leaks or defective valves.
19	•					Water Pump, Valves, and Piping *	<ul style="list-style-type: none"> a. Check for loose mounting bolts. b. Check water piping in mechanical and laboratory compartments for signs of leakage. c. Make sure tank contains sufficient water. d. Inspect pump and motor for unusual noises or heat that could indicate malfunction. e. Make sure pump does not leak at shaft seal. f. Make sure all outlet valves deliver full flow when open and do not leak when closed. 	Missing bolts. Class III leaks detected. Low water level. Pump or motor overheats. Shaft seal leaks. Defective valves.
20	•	•				Water Tank	<ul style="list-style-type: none"> a. Check for loose or missing mounting bolts. b. Inspect for leaks detected. 	Missing bolts. Class III leaks

Table 2-12. Operator Preventive Maintenance Checks and Services (cont.)

ITEM NO.	INTERVAL					ITEM TO BE INSPECTED	Procedures Check for and have repaired or adjusted as necessary.	Equipment is Not Ready/ Available
	B	D	A	W	M			
21				•		Water Filter	<ul style="list-style-type: none"> a. Inspect for loose or missing mounting screws. b. Inspect for leaks detected. c. Inspect for dirty filters 	<p>Missing mounting screws.</p> <p>Class III leak</p>
22	•					Water Pressure Switch	Observe for proper starting and stopping of water pump.	Pump does not operate automatically at the set pressure settings.
23	•					Water Heater	Inspect for proper operation. Check for hot water at faucet.	Water heater does not produce hot water.
24			•			Wall Cabinets	<ul style="list-style-type: none"> a. Check for broken latches and hinges. b. Inspect contents for damaged or missing items. 	<p>Hinge or latch broken.</p> <p>Items damaged or missing.</p>
25			•			General Storage Cabinet	Inspect for loose or missing mounting bolts.	Missing mounting bolts.
26			•			Stool and Stool Bracket	<ul style="list-style-type: none"> a. Inspect condition of stool. missing. b. Inspect securing device. device. 	<p>Stool is damaged/</p> <p>Defective securing</p>
27			•			Fume Hood	<ul style="list-style-type: none"> a. Inspect for condition and security. b. Check light operation. on. c. Check lights. d. Check blower operation. 	<p>Defective door, missing screws.</p> <p>Light does not come on.</p> <p>Light does not come on.</p> <p>Inoperative blower.</p>

Table 2-12. Operator Preventive Maintenance Checks and Services (cont.)

ITEM NO.	INTERVAL					ITEM TO BE INSPECTED	Procedures Check for and have repaired or adjusted as necessary.	Equipment is Not Ready/ Available
	B	D	A	W	M			
28					•	Oscilloscope	Check operation. Refer to applicable TM.	Oscilloscope is inoperative.
29	•				•	Test Tube Mixer	Check operation. Refer to applicable TM.	Test tube mixer is inoperative.
30	•				•	Refrigerator	a. Inspect for security. b. Check operation. Refer to applicable TM.	Missing screws. Refrigerator is inoperative.
31	•				•	Drying Oven	a. Inspect for security. b. Check operation. Refer to applicable TM.	Missing screws. Ovens are inoperative.
32					•	Ultrasonic Cleaner	Check operation. Refer to applicable TM.	Inoperative ultrasonic cleaners.
33	•				•	Fluids Contamination	Check for missing/damaged components. Set	Components missing/damaged.
34					•	Duplex Ferrograph System camera.	Check operation of all components. Check for damaged ferroscope and camera.	Inoperative components. Damaged lenses in ferroscope
35					•	Flashpoint Tester	Check operation. Check for missing components. Refer to applicable TM.	Components missing. Inoperative flashpoint tester.
36					•	Viscometer Set.	Check operation. Refer to applicable TM.	Inoperative viscometer set.

Table 2-12. Operator Preventive Maintenance Checks and Services (cont.)

						B - Before D - During	A - After W - Weekly	M - Monthly	
ITEM NO.	INTERVAL					ITEM TO BE INSPECTED	Procedures Check for and have repaired or adjusted as necessary.	Equipment is Not Ready/ Available	
	B	D	A	W	M				
37		•			•	Fluid Analysis Spectrometer.	Check operation. Refer to applicable TM.	Inoperative Fluid Analysis Spectrometer	
38					•	Hot Plate	Check operation. Refer to applicable TM.	Inoperative hot plate.	
39					•	AOAP Standard Data System	Check operation. Refer to applicable TM's.	AOAP standard data systems inoperative.	
40	•				•	Support Items	a. Inspect fire extinguishers. charge indication.	Broken seal or low	
					•		b. Inventory first aid kit.	Low supplies.	
					•		c. Inspect Barometer	Broken glass, inoperable.	
					•		d. Inspect Hygrometer	Broken glass, inoperable.	
					•		e. Inspect Thermometer	Broken glass, inoperable.	
					•		f. Inspect AOAP Standard Data System temperature gage.	Broken glass, inoperative.	

Section III. OPERATION UNDER USUAL CONDITIONS

ALPHABETICAL INDEX

PARAGRAPH TITLE	PARAGRAPH
Assembly and Preparation for Use	2-7
Laboratory Operating Procedures	2-10
Operation of Air and Vacuum Systems	2-8
Operation of Water System	2-9
Preparation for Movement	2-11
Site and Shelter Requirements	2-6

2-6. Site and Shelter Requirements. Select a site that provides or has the following features:

- a. Ample space for maneuvering the vehicles that may be used to move and position a trailer-mounted generator set and the AOAP Mobile Laboratory.
- b. Site has a firm, well drained terrain, and is reasonably level.
- c. Site is at least 500 feet away from other areas of operation and is not uphill or upstream from other facilities which might be in the path of escaping fuel or vapor.
- d. Site is not located adjacent to low areas where dangerous vapors might collect.
- e. Site should be- near a stream, a pond, or an established water facility. This not only provides an outside water source for the AOAP Mobile Laboratory water system, but it also aids in control of potential fires.
- f. Site should have easy access to road nets, and at least one road should run in the vicinity of AOAP Mobile Laboratory.

2-7. Assembly and Preparation For Use.

a. *Inspection.* Inspect the exterior of the laboratory to make sure everything is in good condition. Check the semi-trailer body, doors, near axle assembly and front landing gears to see that they are secure, clean, and correctly lubricated. Inspect the vents, water inlet, purge doors and the power input panel for damage. If damage is found, notify your supervisor. Refer to TM 9-2330-362-14&P for authorized repair of basic semitrailer van.

b. *Initial Setup* (Refer to Figure 2-1).

NOTE

Access ladders are located in the roadside storage carriage labeled "Tool Kit/Ladders and Rails/Storage."

(1) Drop and secure the Environmental Control Units (ECU's) maintenance and boarding platform. Raise covers on ECU's and secure.

(2) Drop and secure in position the rear entry platform.

(3) Remove and store all panel, door, and vent locks and/or locking fasteners.

(4) Remove the two access ladders and rear platform from their storage rack beneath the laboratory. Place one ladder at the rear door and the other ladder at the laboratory entrance door.

(5) Connect drain hoses to the waste water drain and the system drain located beneath the mechanical room. Dig a drainage ditch or sump and place the ends of the drainage hoses in it.

(6) The following procedure is used to properly ground the laboratory.

WARNING

Do not connect power cable assembly to the AOAP Mobile laboratory before properly grounding the laboratory. Failure to comply with this warning could result in serious injury or death.

CAUTION

Neutral and Ground Wires are not interchangeable. Also, ONLY 60 Hz power is to be used. Damage to equipment could result if this caution is not followed.

NOTE

The grounding rod driver/puller and grounding cable are stored in the roadside storage box. (a) Remove grounding rod, driver/puller and grounding cable from storage box.

(b) Select an area as close to the power input panel as possible to install grounding rod.

(c) Attach first grounding rod and coupling to the driver/puller rod (Refer to Figure 2-2).

CAUTION

Do not allow grounding rod to rotate when disconnecting the driver/puller rod from the grounding rod. Grounding sections must be kept screwed together to ensure a good electrical ground.

NOTE

Before driving grounding rod, be certain that driver/puller rod and grounding rod are fully threaded into coupling. Be sure collar is hand tight against coupling.

(d) Place driver/puller on driver/puller rod and drive grounding rod into ground, approximately 30 inches.

(e) Loosen coupling and remove driver/puller rod and driver/puller from first grounding rod section.

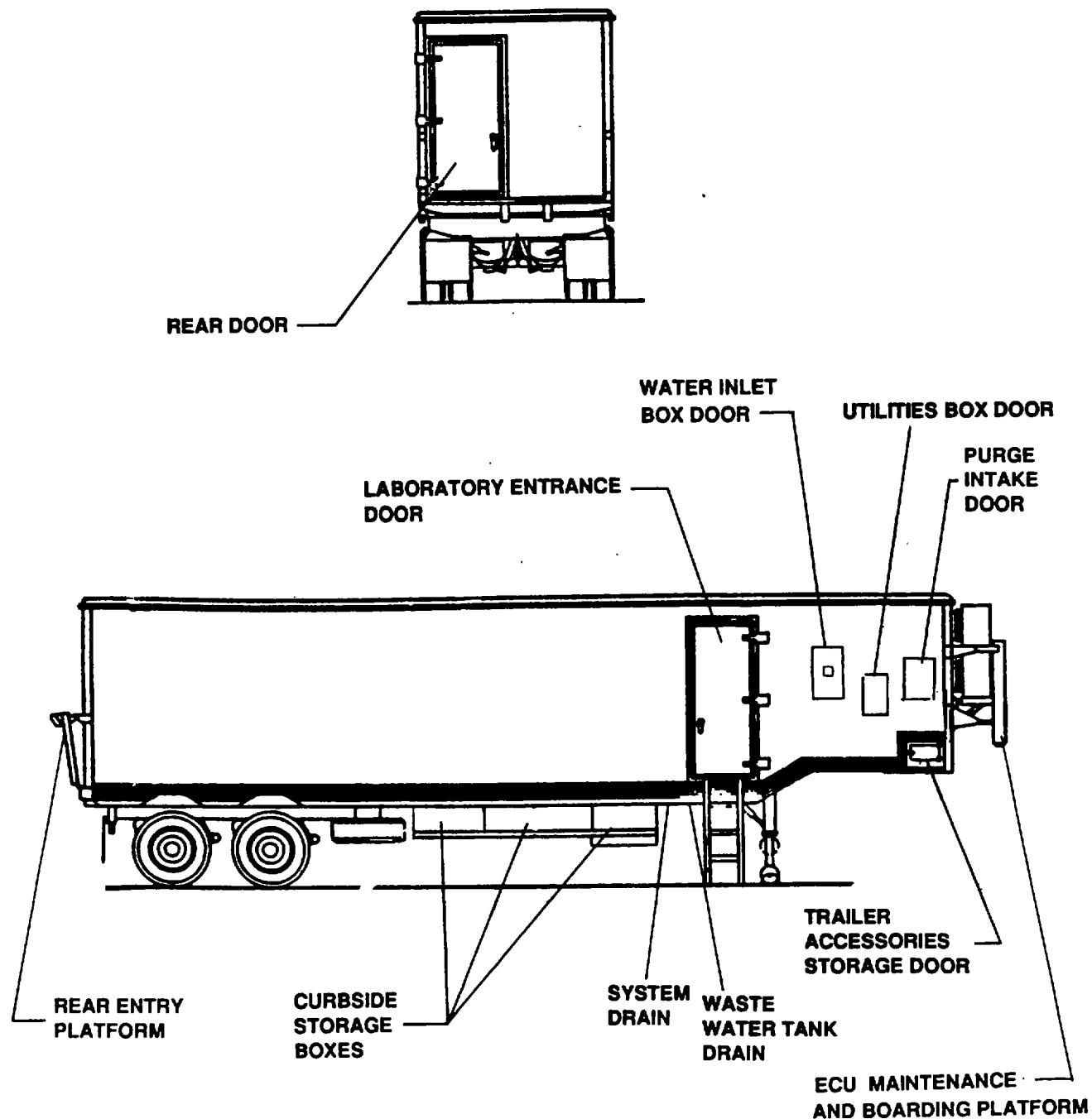


Figure 2-1. AOAP Mobile Laboratory Exterior (Rear & Curbside) (Sheet 1 of 2)

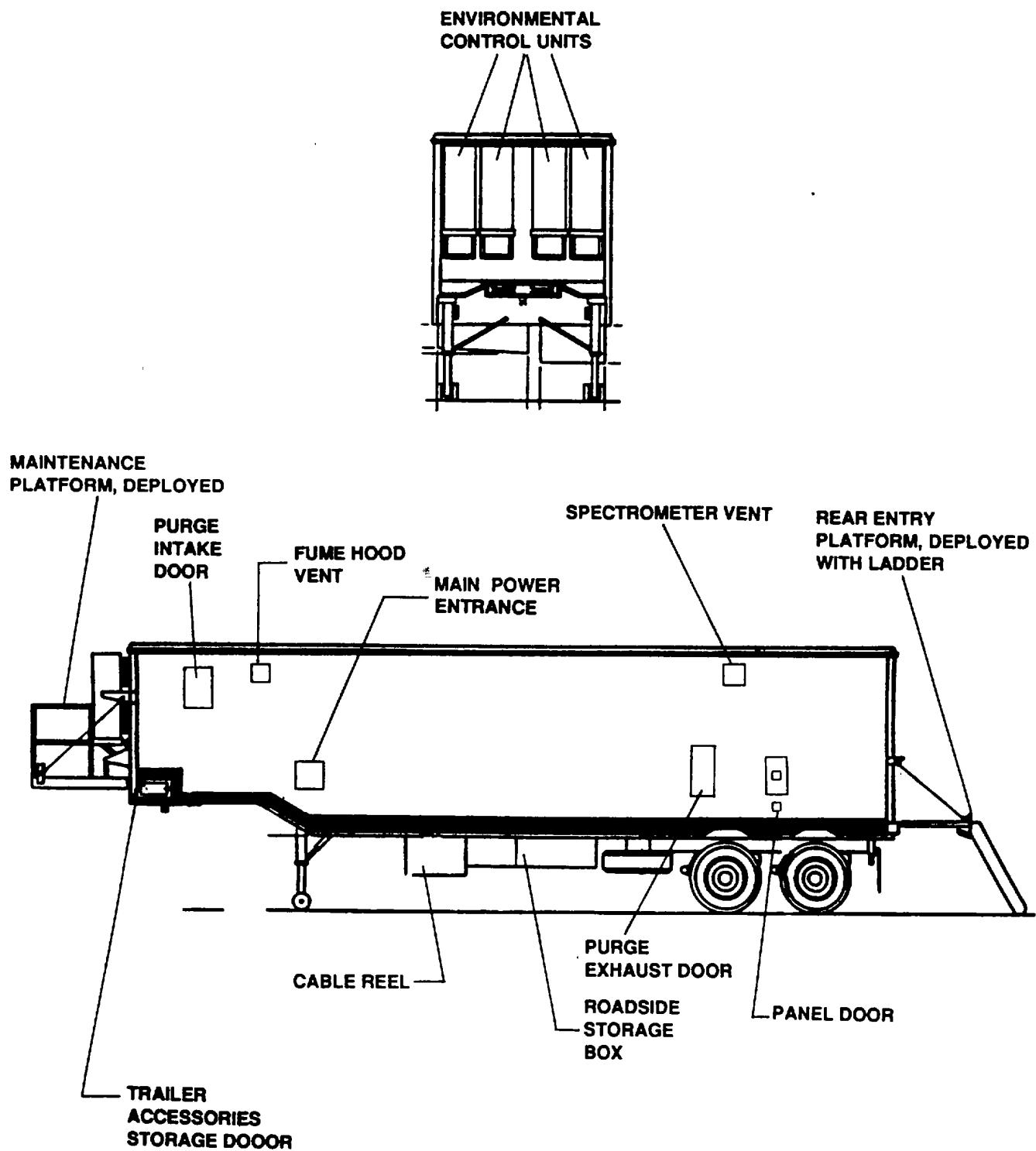


Figure 2-1. AOAP Mobile Laboratory Exterior (Front & Curbside) (Sheet 2 of 2)

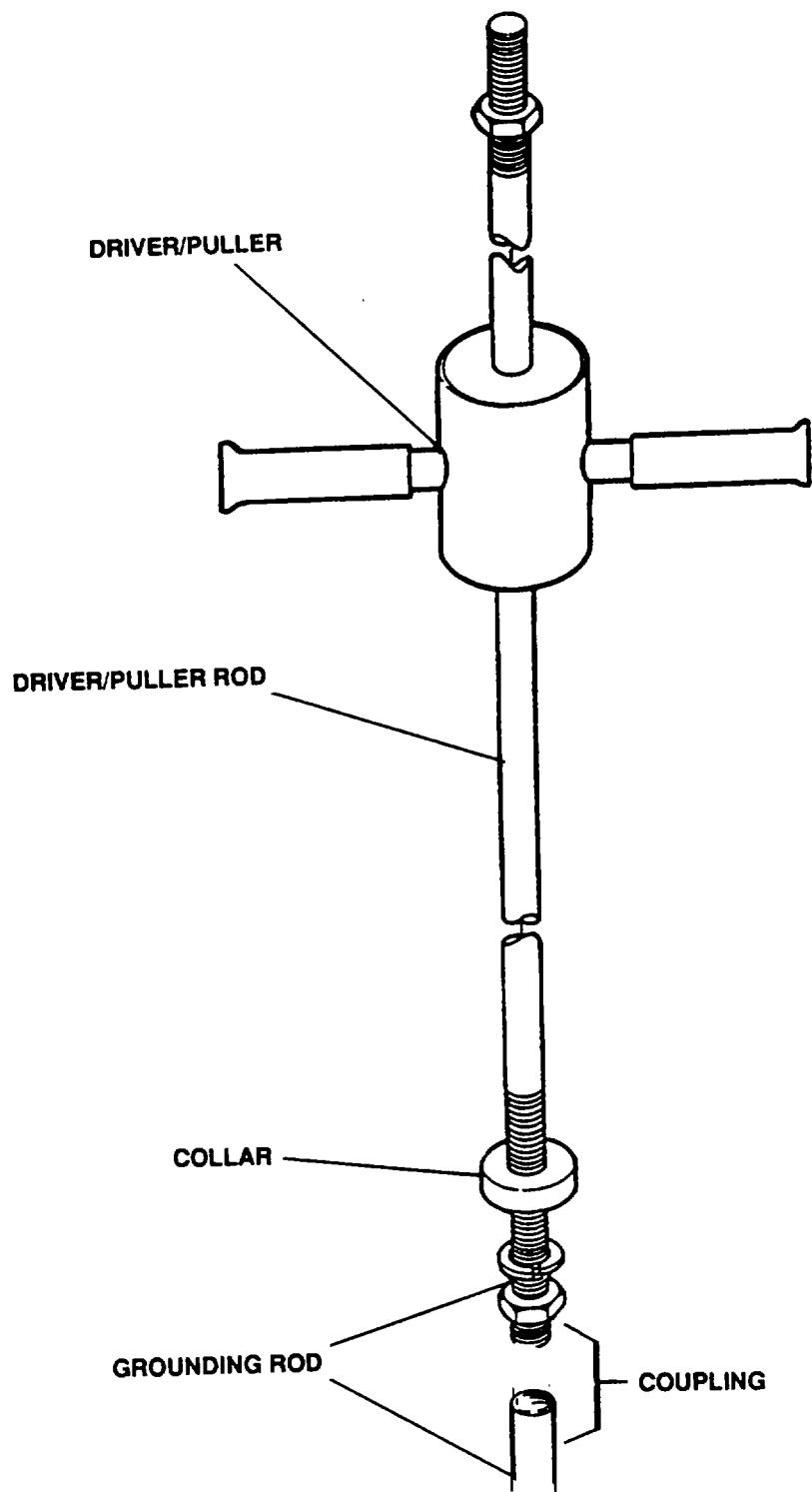


Figure 2-2. Grounding Rod and Driver/Puller

(f) Attach driver/puller rod to second section of grounding rod and repeat steps (d) and (e).

(g) Repeat step (f) and drive third section of grounding rod into ground until only 12 inches (30.5 cm) of rod is above ground.

(h) Remove driver/puller and driver/puller rod from third section of grounding rod.

(i) Place driver/puller and driver/puller rod in storage box.

(j) Slide grounding cable clamp over grounding rod.

(k) Attach grounding cable to grounding rod with grounding clamp.

(l) Attach grounding cable to grounding lug in power entrance panel (Refer to Figure 2-3).

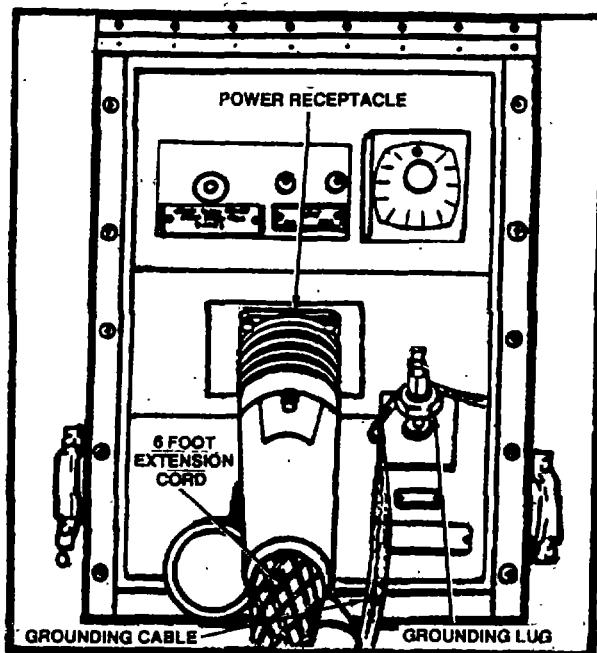


Figure 2-3. Power Entrance Panel

(7) Deploy the power cable assembly as follows (Refer to Figure 2-4):

- (a) Open, and swing down, the roadside storage access door of the cable reel compartment.
- (b) Remove the "6 foot" extension cable from the curbside access door's inner surface; remove cap plugs.
- (c) Depress detent and run the 100 foot power cable to the generator set. Hookup cable to generator set (Refer to generator TM).
- (d) Plug the "6 foot" extension cable into the power receptacle and the cable reel receptacle.

CAUTION

Do not attach the extension cable to the cable reel if additional power cable is to be run off. DAMAGE WILL OCCUR.

- (e) Lock and clamp both ends of the 6 foot extension securely.

NOTE

Battery charger cable is located in the roadside storage box labeled "TOOL KIT/LADDERS AND RAIL/STORAGE."

- (8) Deploy the battery charger cable by hooking one end to the power outlet and the other end to the battery outlet.

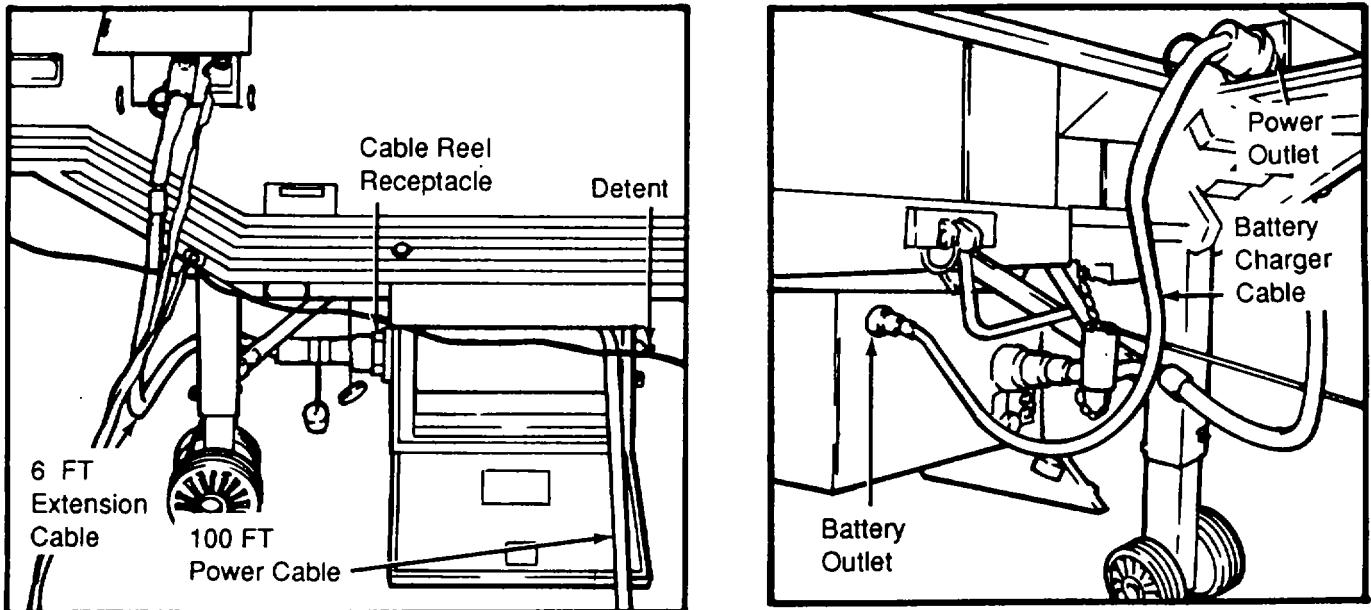


Figure 2-4. Cable Reel Assembly

c. AOAP Mobile Laboratory Electrical Startup and Purge Cycle. The following procedure is used to power up the laboratory.

WARNINGS

- **The noise level of the generator set could cause hearing damage. Hearing protection must be worn when working within 50 feet of the generator set.**
- **Do not attempt to enter the laboratory during start up until automatic purge cycle (5 minutes) is completed and the gas detection indicator lamp is green. Dangerous combustible gases or vapors may be present which could ignite and cause death or serious injury.**

- (1) Turn on power at external power generator set (Refer to generator TM).
- (2) Open all the air intake and exhaust doors (Figure 2-1) on AOAP Mobile laboratory.

NOTE

When power is applied to the laboratory, an air purge cycle utilizing the ECU blowers to pressurize the laboratory and expel any accumulation of gases is automatically initiated. The cycle will last for approximately 5 minutes. During the purge cycle, all the normal electrical circuits within the laboratory are disabled.

- (3) Switch generator to load conditions and actuate the purge timer located in the power entrance box on the AOAP Mobile Laboratory. The phase indicator green light in the power entrance box should now be on. However, if the red light is on, then set generator to a no-load condition and recheck power cable connections and retry for green phase indicator.
- (4) Enter the main laboratory compartment by using the curbside forward door. Unlock the forward door and enter the mechanical room and reset main circuit breaker (Figure 2-5) by turning it to the "on" position.
- (5) Turn S2 Switch (Figure 2-6) to the "ON" position prior to turning the computer duct heater breaker on.
- (6) Turn S1 Switch to 100 percent, S3 Switch to the "ON" position and ECU NO.2, 3, and 4 controls to the "HIGH" speed setting.
- (7) Switch on the circuit breakers in the Main Power Panel (Figure 2-5) as required.

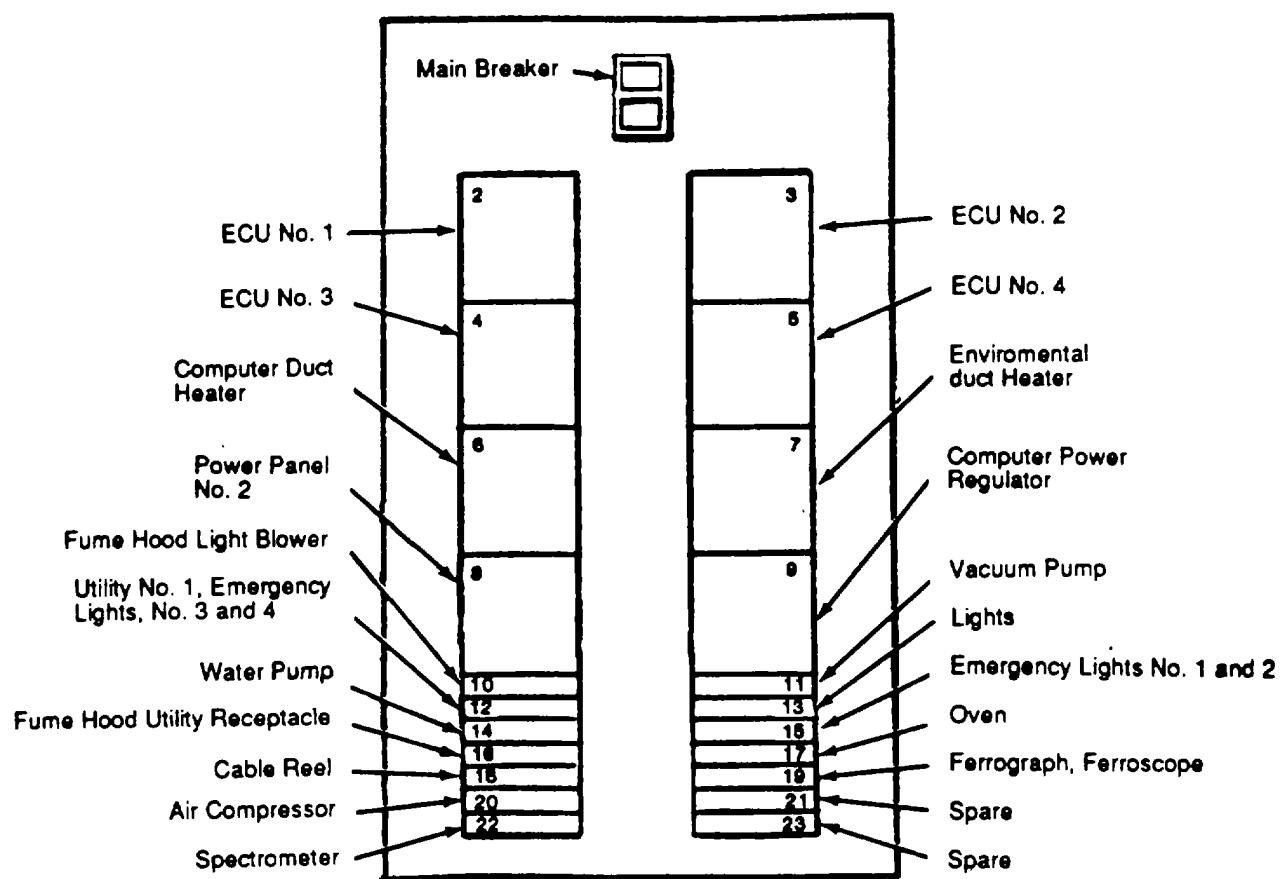


Figure 2-5. Main Power Panel

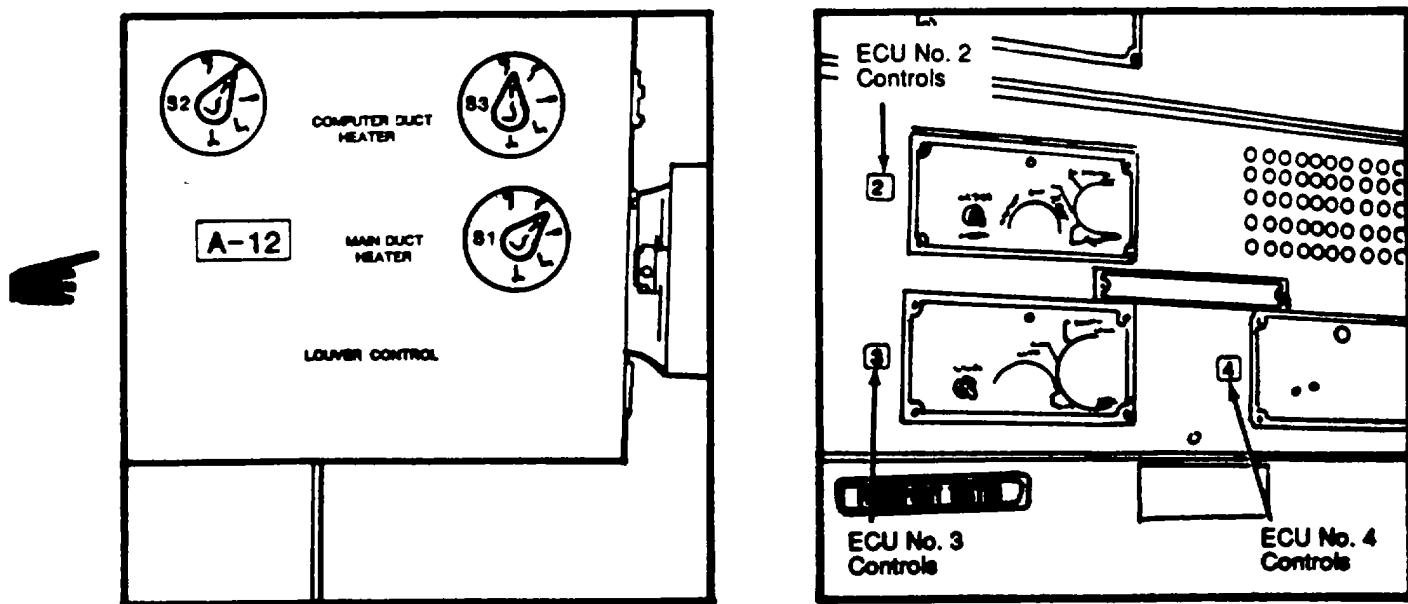


Figure 2-6. Switches S1, S2, S3 and ECU No. 2, 3, 4 Controls

(8) Enter the receiving room located at the rear of the trailer and reset main circuit breaker on Power Panel number 2 (Figure 2-7) by turning it to the "ON" position.

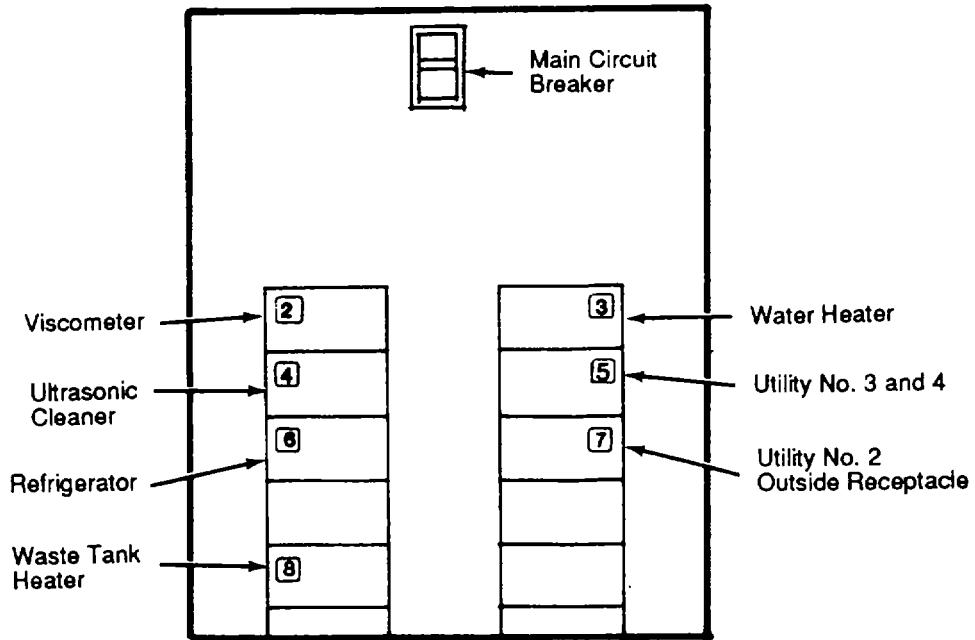


Figure 2-7. Power Panel Number 2

WARNING

Do not turn on Water Heater Circuit Breaker (No. 3) or Water Heater Circuit Breaker (No. 8) until water system has been charged, otherwise death or serious injury to personnel could result.

- (9) Switch on circuit breaker in Power Panel number 2 as required.
- (10) Remove any auxiliary overpack containers from the rear, main and utilities walkways.
- (11) Remove any preservation masks, covers, and panels from the laboratory equipment.
- (12) Remove any preservative/packing material from the compressor, vacuum pump, water pump, and any other support/services device located in the mechanical room.
- (13) As climatic conditions apply, activate the appropriate ECU No. 2, 3, and 4 controls (heating and/or cooling) (Figure 2-6).

NOTE

Auxiliary heating elements are located in the supply ducting. At temperature below zero degrees Fahrenheit (F), these elements will activate in conjunction with the main heating system.

(14) Enable each of the "hard mounted" major items of test equipment by turning their respective power switches to the "ON" position in the following order, as required:

CAUTION

The following enabling sequence of the "hard mounted" major items must be followed to prevent a power surge of the computer system.

- (a) Spectrometer
- (b) Viscometer
- (c) Hot Plate
- (d) Oven
- (e) Refrigerator

(15) Remove the following equipment from storage, overpack, or cabinets and place each item in \ its designated position as shown in Figure 2-8.

- (a) Ultrasonic cleaner
- (b) Fluids Contamination Kit
- (c) Duplex Ferrograph Set

(16) The AOAP Standard Data System (Refer to Figure 2-9).

(a) Once the Wang MICROVP-2 computer has completed purging, then heads have to be manually moved from the "park" position to "ready" position. Once this has been completed the computer is ready for AOAP software program. Start by loading the "GREEN" D 10 System platter first, next "GREEN" DI 4 Aeronautical platter, then the "GREEN" DI 5, Nonaeronautical platter and finally the spare platter.

(b) Before placing the system into operation, activate the ECU Control No. 1.

(17) Unlock any remaining cabinetry and remove the support apparatus as required.

(18) Perform operational checks on each piece of equipment to ensure its readiness. Refer to applicable Technical Manuals for operation of each component.

2-8. OPERATION OF AIR AND VACUUM SYSTEMS.

a. Air System

- (1) Close all compressed air system service valves (Refer to Table 2-8).
- (2) Turn on the air compressor circuit breaker No.20 in Main Power Panel (Refer to Figure 2-5).

WARNING

When using compressed air, always wear eye protection to prevent foreign particles or compressed air from injuring the eyes.

(3) Momentarily open and close each compressed air service valve to blow dust or other contaminant out of the air lines.

(4) Compressed air system is now operational.

b. Vacuum System

- (1) Close all vacuum system service valves (Refer to Table 2-9).
- (2) Turn on the vacuum pump circuit breaker switch No. 11 in the Main Power Panel (Refer to Figure 2-5).
- (3) Vacuum system is now operational.

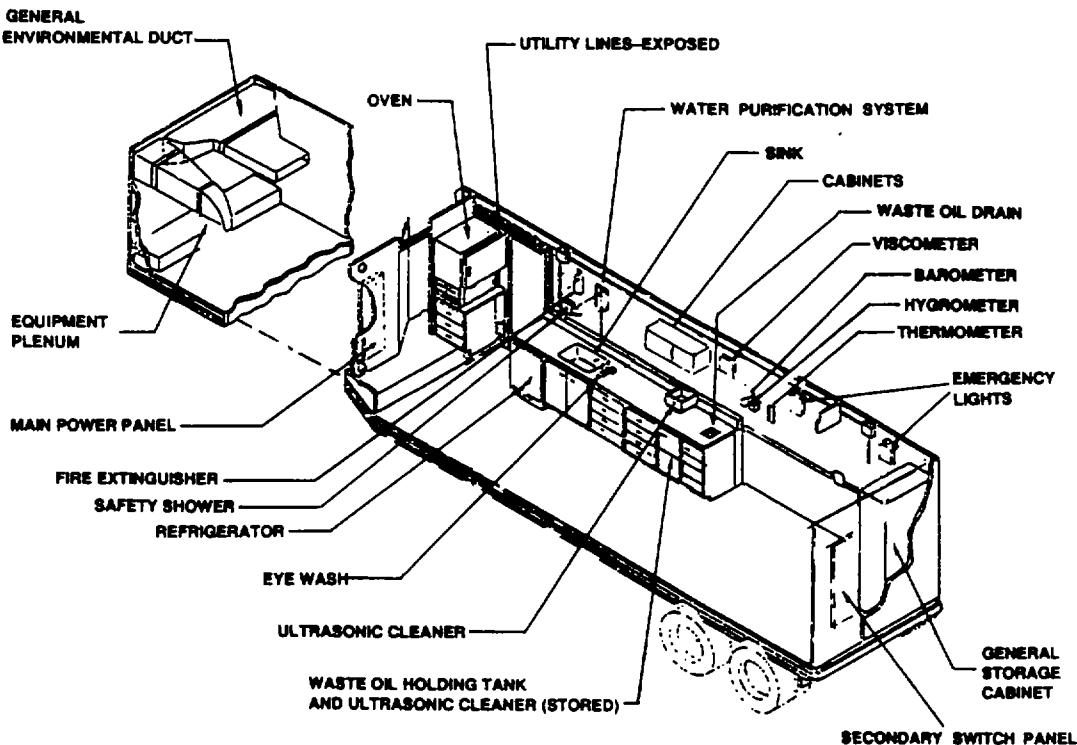
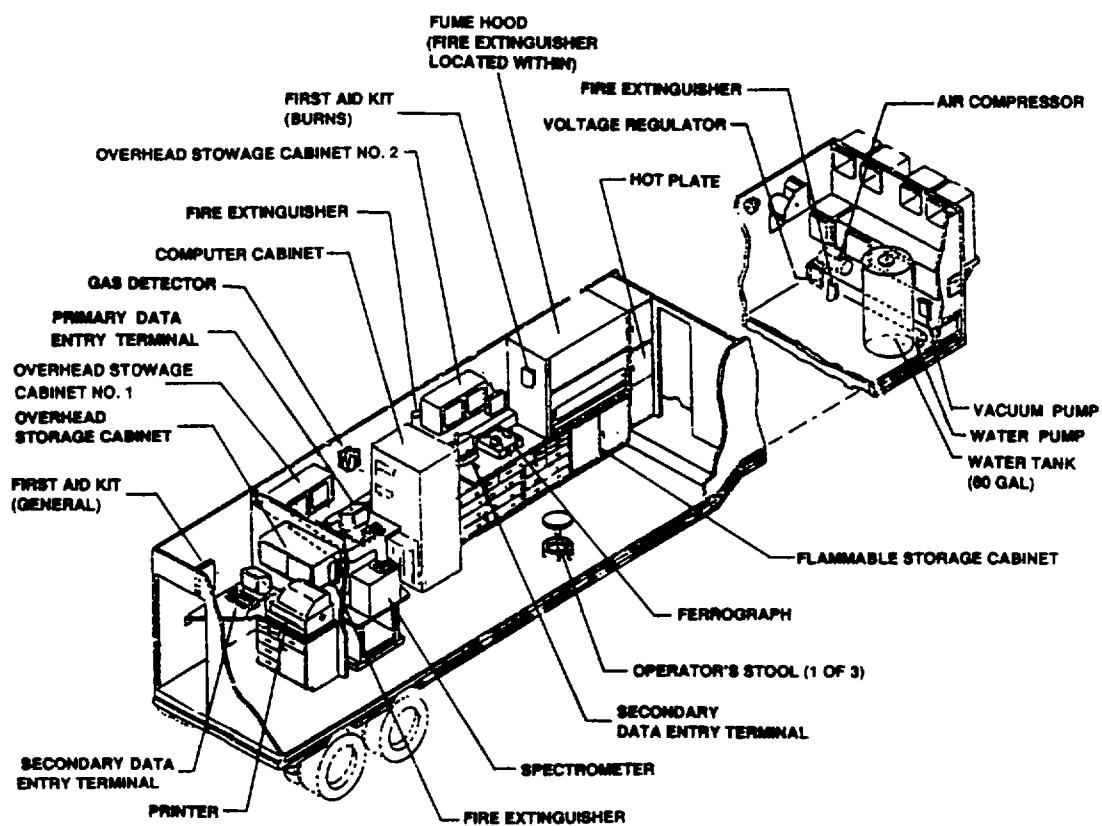


Figure 2-8. AOAP Mobile Laboratory, Interior

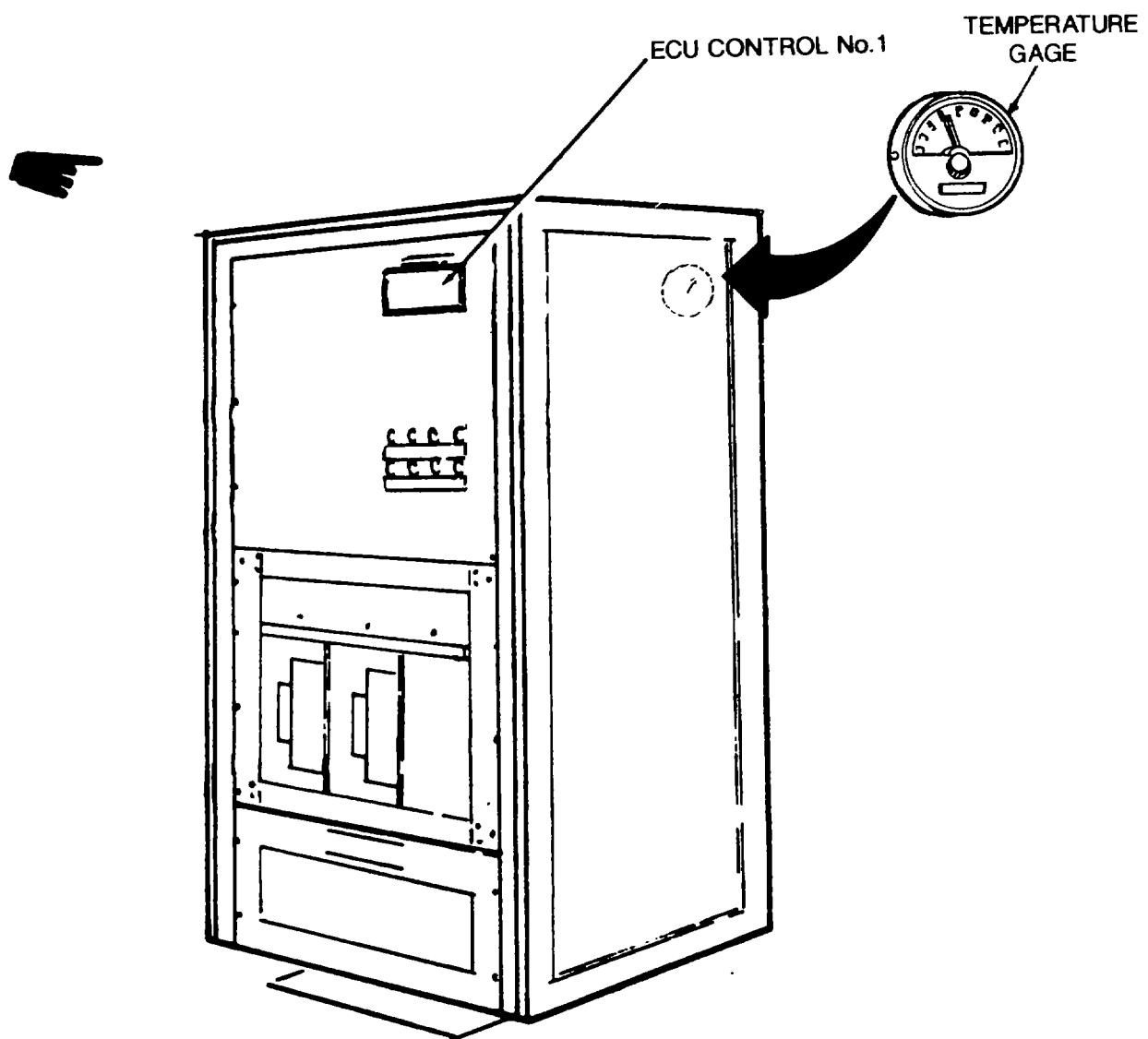


Figure 2-9. AOAP Computer Cabinet MICROVP-2

Change 1 2-39

2-9. Operation of Water System The water system can be filled from potable or unknown water sources using a pressurized or unpressurized system.

NOTE

Prime the water pump before starting.

a. *Potable Source, Pressurized System.*

- (1) Remove a hose adapter from water inlet box and hook up the 50 foot garden hose to the hose adapter.
- (2) Hook up the hose adapter with garden hose, to the facility inlet on the curbside, exterior of the van (Figure 2-10).

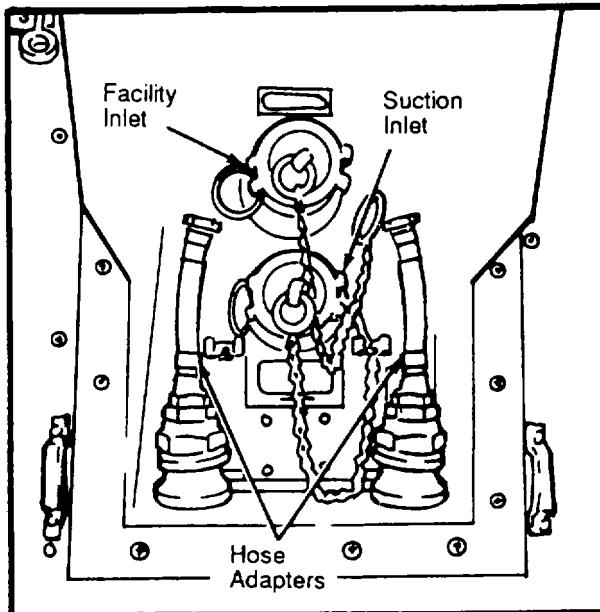


Figure 2-10. Water Inlet Box

- (3) Ensure the water tank drain and reservoir drain valves in the mechanical room are both closed and that exterior drains are closed (Figure 2-11).

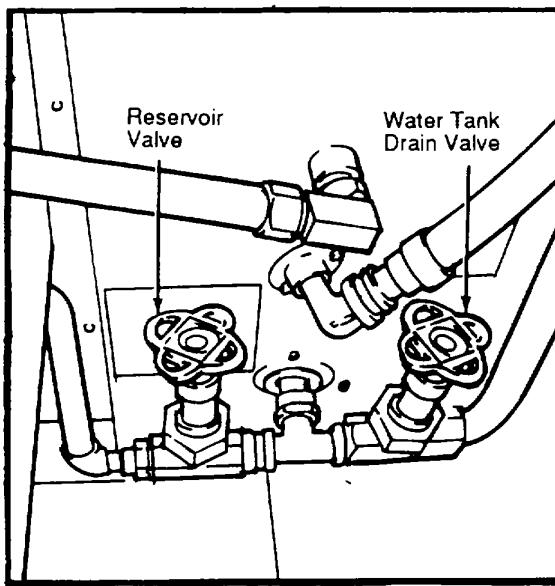


Figure 2-11. Reservoir and Water Drain Valves

(4) Ensure the "TANK/SYSTEM" Switch (Figure 2-12) is in the "TANK" position, the "WATER FLOW FACILITY SUPPLY" Switch is in the "SYSTEM" position, and the "FILTER VALVE" Switch is in the "OFF" position.

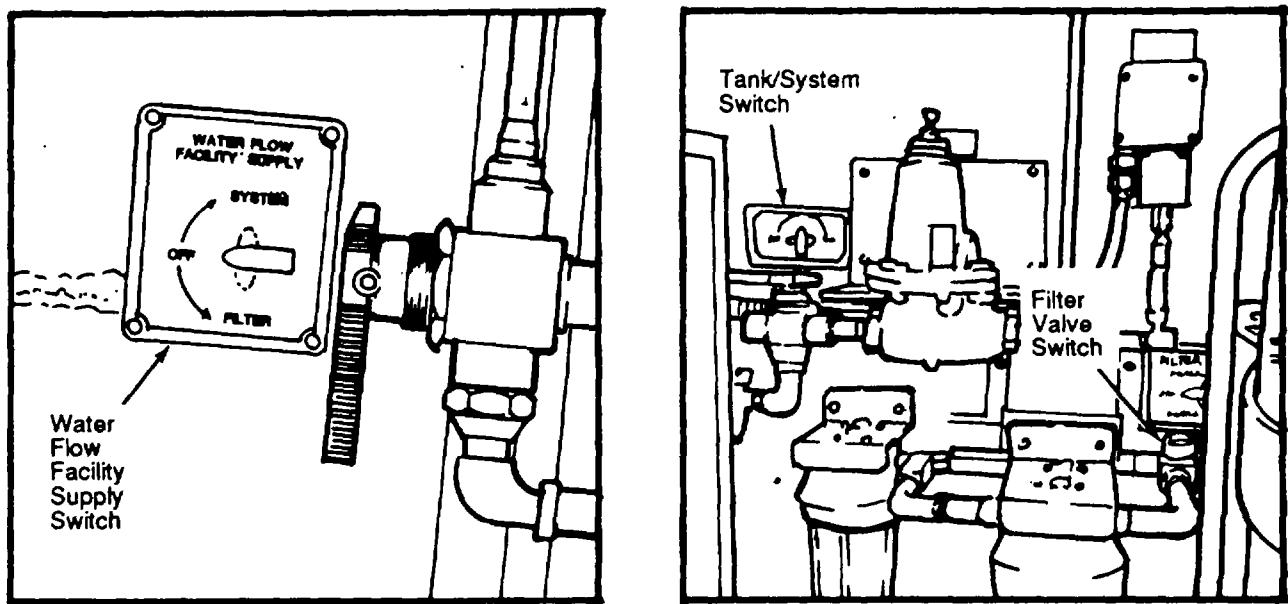


Figure 2-12. Water System Switches

(5) Fill the water tank (60 Gallon Capacity) (Figure 2-13) until the bubble indicator reaches the top, which indicates that the tank is full.

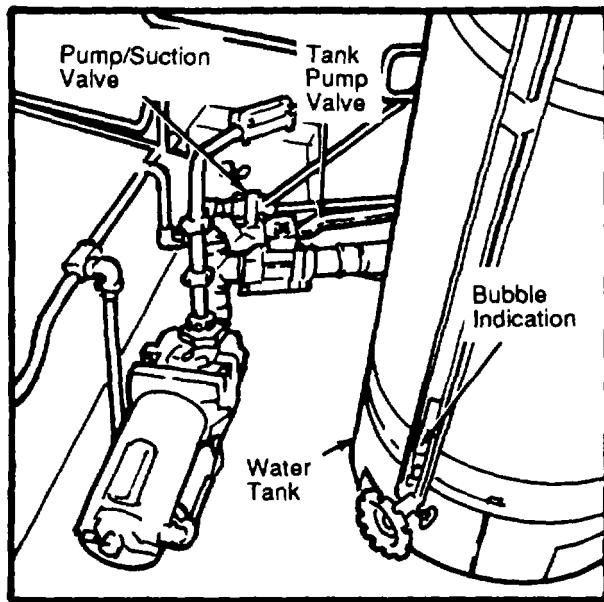


Figure 2-13. Water Tank and Pump

(6) Turn off water source.

b. *Potable Source, Unpressurized System.*

- (1) Perform all steps above for Potable Source, Pressurized System (Paragraph 2-9a).
- (2) Hook up the hose adapter, with garden hose, to the suction inlet (Figure 2-10) on the curbside exterior of the van.
- (3) Close the tank/pump valve (Figure 2-13).
- (4) Open the Pump/Suction Valve.
- (5) Turn on the water pump switch located in the main power panel (Figure 2-5) and proceed to fill the tank.
- (6) Close pump/suction valve (Figure 2-13).

c. *Unknown Water Source, Pressurized System.*

- (1) Hook up the garden hose as outlined in paragraph 2-9a above; however, switch the "WATER FLOW FACILITY SUPPLY" to "FILTER" and switch the "FILTER VALVE" from "off" to "FILTER No. 1" (Figure 2-12).

- (2) Proceed to fill the water tank as described in paragraph 2-9a.

NOTE

When "FILTER VALVE" filter No. 1 is dirty or needs servicing, you can switch to "FILTER No. 2" position on the "FILTER VALVE" switch. These filters remove sediment from the water source.

- (3) Set the "TANK/SYSTEM" Switch and the "WATER FLOW FACILITY SUPPLY" Switch to "SYSTEM".
- (4) Set the "FILTER VALVE" Switch to "OFF".
- (5) Close the pump suction valve (Figure 2-13).
- (6) Open the Tank/Pump valve.
- (7) Turn on the water pump switch located in the main power panel (Figure 2-5) to pressurize the system.

d. *Unknown Water Source, Unpressurized System.*

- (1) Perform all steps in paragraph c above for Unknown Water Source, Pressurized System.
- (2) Perform steps (2) through (6) in paragraph b above for Potable Source, Unpressurized System.

NOTE

The AOAP Mobile Laboratory is now operational and ready to process oil/grease samples from aeronautical or Nonaeronautical components.

2-10. Laboratory Operating Procedures.

a. *Operation of Laboratory Test Equipment.* Operate test equipment, as applicable, in accordance with their respective technical manuals as listed in Appendix A.

b. *Physical Property Laboratory Operating Procedures.* The following is a list of tests that will be performed by the operator on every sample. Refer to TM 38-301-1 through TM 38-301-4, Joint Oil Analysis Program (JOAP) for operating requirements and procedures. Refer to Table 2-13 to determine significance of tests and to Table 2-14 for Oil Sample Analysis Requirements.

- (1) Viscosity of Used Lubricating Fluids.
- (2) Crackle Test for Water Contamination.
- (3) Blotter-Spot Test.
- (4) Microscopic Analysis for Insoluble Debris.
- (5) Setaflash for Determination of Fuels in Used Lubrication Fluids.

Table 2-13. Lubricant Contaminants

<u>Contaminant Type</u>	<u>Significance</u>	<u>Analytical Method</u>
Wear metals	System wear	Spectrometer, Ferrograph
Coolant	Emulsifies oil, impairs lubrication, destroys dispersant additives	Crackle test; blotter spot; spectro for NA, B, and SI.
Water	Corrosion, emulsifies oil, impairs lubrication equipment	Crackle test; blotter spot; spectro for NA with Marine
Fuel	Lowers oil viscosity	Viscosity; Setaflash
Dirt, sand	Causes abrasive wear	Spectro for SI, AL; blotter spot
Blowby products Soot	Increases viscosity, forms sludge	Viscosity, blotter spot
Reactive compounds	Corrosion, viscosity increase	Viscosity, blotter spot for alkalinity reserve

Table 2-14. Oil Sample Analysis Requirements

<u>OIL SAMPLE ANALYSIS</u>			
I. Aeronautical		II. Nonaeronautical	
Engine		Engine	-SPECTROGRAPHIC AND -PHYSICAL ANALYSIS
Transmission		Transmission	
Gearbox	-SPECTROGRAPHIC ANALYSIS	Hydraulic	-SPECTROGRAPHIC ANALYSIS
Hydraulic			
Swashplate	-FERROGRAPHIC ANALYSIS		
Scissors & Sleeves			
Assembly			

<u>SAMPLE PROCESSING</u>			
Special aeronautical		Special Nonaeronautical	
Routine aeronautical		Routine Nonaeronautical	

NOTE

Aeronautical samples shall be processed within 24 hours of receipt and Nonaeronautical samples within 72 hours of receipt, weekends and holidays excluded.

2-11. Preparation For Movement

a. *Interior.* Prior to the AOAP Mobile Laboratory being deployed, assure that the following actions have been performed:

(1) *Wang MICROVP-2 Computer System.*

(a) Manually place Wang Standard Data System (SDS) computer disk drive heads in the park position.

(b) Secure Wang SDS 13.4 megabyte platters (6 Ea) in assigned roadside cabinets (BB).

(c) Place the power "ON" switches in the "OFF" positions for all SDS components mounted in the computer rack and rear compartment.

(d) Place the three computer terminals in their respective boxes located in the receiving room.

(2) *Fluids Analysis Spectrometer.*

- (a) Remove Quartz window from the sample stand.
- (b) Wrap Quartz window in paper and secure in the sample stand drain
- (c) Securely fasten and tape sample stand and power supply doors.
- (d) Place main power circuit breaker in the "OFF" position.

(3) *Viscometer.* Place base stand and cables in assigned roadside storage drawer "G-7".(4) *Duplex Ferrograph System.*

- (a) Store Direct Reader in assigned roadside drawer "H-7".
- (b) Store Dual Ferrograph Analyzer in over pack box and secure in curbside storage box number "3".
- (c) Store Ferroscope III in the over pack box and secure in fume hood of the van.

(5) *Hot Plate.* Store hot plate in cabinet K-2.(6) *Flash Point Tester.* Store flash point tester in cabinet K-1.(7) *General Areas.*

(a) Ensure cabinet drawers are "all" locked and contain applicable AOAP laboratory expendable supplies and spare parts as contained in Appendix A.

(b) Ensure AOAP publications are on-hand as identified in Appendix A.

(c) Ensure water system storage tanks and lines are drained of "ALL" water and drain valves are left in the "DRAIN" position with caps on.

(d) Ensure equipment log books are on hand in the van for the spectrometer, ferrograph, viscometer and an AOAP mobile lab daily operations entry log.

(e) Securely fasten the three stools used inside the van in their travel locks.

(f) Ensure air system reads zero pressure and the air compressor's drain cock valve is in the open position.

(g) Ensure Vacuum System reads zero pressure and the drain valve is in the open position.

(h) Ensure all circuit breakers located in the Main Power Panel and Power Panel No. 2 are in the "OFF" position.

(i) Ensure S1is in the 100 percent range so that purge will operate properly when setting up the AOAP laboratory at a new site.

b. *Exterior.* Prepare the exterior of the laboratory for movement as follows:

- (1) Shut and lock the laboratory access door and the receiving room access door.

WARNING

Ensure generator set is off before disconnecting any cables from laboratory; otherwise DEATH will result.

- (2) Turn off external power to laboratory at generator set.

(3) Disconnect main power cable from laboratory electrical connector at power input panel and install protective cap on connector. Remove battery charging cable.

- (4) Disconnect main power cable from generator set. Clean cable and store in roadside storage box.

- (5) Remove grounding cable from grounding lug in power entrance box panel.

- (6) Close and latch power entrance panel door.

- (7) Remove grounding cable and clamp from grounding rod.

(8) With driver/puller attached to grounding rod, remove rod from ground, uncoupling each rod section as it emerges from the ground.

- (9) Clean and store grounding rod, driver/puller, grounding cable and clamp in roadside storage box.

- (10) Disconnect drain hoses from deck drains. Clean and store hoses in curbside storage box.

- (11) Disconnect hose adapters from deck drains. Place protective caps on deck drains and store.

- (12) Close and latch utilities box door and water inlet box door.

- (13) Close and latch fume exhaust door and spectrometer hot gas vent.

- (14) Close and latch purge exhaust and intake doors.

- (15) Roll down and secure ECU canvas covers.

- (16) Remove ladders from receiving room access door and laboratory compartment access door.

- (17) Secure rear deck platform.

- (18) Secure ECU platform.

- (19) Store and secure ladders in roadside storage compartment.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

ALPHABETICAL INDEX

PARAGRAPH TITLE	PARAGRAPH
-----------------	-----------

Emergency Stopping Procedure	2-13
Operation in Extreme Climates	2-12

2-12. Operation in Extreme Climates. The AOAP Mobile Laboratory is insulated and weatherproofed for operation in hot, cold, or moderate climates. The shelter facility provides complete protection from the elements for personnel and equipment; however, under extreme conditions, the following precautions are necessary.

a. *Cold Climates.*

(1) Procedure for draining the water system prior to storage or shipment to a cold environment is as follows:

- (a) Open all exterior water drain outlets.
- (b) Open tank drain valve in mechanical room and drain water tank.
- (c) Open water system pet cocks on the curbside and roadside faucets.
- (d) Allow water system to drain.
- (e) Cut a piece of plastic tubing about 2 feet in length and of the proper width to fit on the faucet pet

cocks.

to the air outlet.

- (f) Connect one end of the tubing to the roadside water faucet across from the sink and the other end to the air outlet.
- (g) Close all pet cocks.
- (h) Start the air compressor.
- (i) Open the water faucet pet cock with the tubing.
- (j) Open the air outlet pet cock with the tubing and allow the air pressure to force any remaining water

from the system.

- (k) Turn compressor off when complete, close faucets, and remove tubing.
- (l) Remove drain plug from front of the water pump, open connecting pipe valves, and allow water to drain into shallow pan.
- (m) Replace drain plug when complete.
- (n) Remove the filter elements from the primary and secondary water filters. Replace filter covers and attach a note stating the elements have been removed for storage and should be replaced prior to start up procedures.
- (o) Drain water from garden hoses prior to storage.

(2) Extreme cold causes cables and wires to become hard, brittle and difficult to handle. Be careful when handling the cables and connecting them to the laboratory, so that kinks and unnecessary loops will not result in permanent damage. Make sure that connectors in the entrance boxes are free of frost, snow, and ice. Replace connector covers on receptacles as soon as a cable is disconnected. Never drag or place an open cable connector in the snow.

b. *Hot Climates.* In hot, dry climates, connectors and receptacles are subject to damage from dust, sand and dirt. Replace connector covers on receptacles when they are not in use. Never place an open cable connector on the ground.

c. *Warm, damp climates.* In warm, damp climates, the equipment is subject to damage from moisture and fungi. Wipe all moisture and fungi from the equipment with a lint-free cloth.

2-13. Emergency Stopping Procedure. To turn the equipment off in an emergency, set the MAIN circuit breaker to OFF.

CHAPTER 3

OPERATOR MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

3-1. Lubrication Instructions. Lubrication instructions for the basic semi-trailers' doors, leveling jacks, landing gear, etc., can be found in Chapter 3 of TM 9-2330-362-14&P. For lubrication instructions concerning the ECUs, refer to TM 5-4120-317-14. Lubrication requirements for other equipment used in the laboratory are contained in their respective TMs (see Appendix A for TM number).

Section II. OPERATOR TROUBLESHOOTING PROCEDURES

3-2. General. This section contains operator troubleshooting information and procedures for locating and correcting common malfunctions which may develop in the laboratory.

a. *Troubleshooting Table.* Table 3-1 lists common malfunctions which you may find during operation or maintenance of the AOAP Mobile laboratory or its components. You should perform the test/inspection and corrective actions in the order listed.

b. *Unidentifiable Malfunctions.* This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 3-1. Troubleshooting Procedures

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

1. NO ELECTRICAL POWER TO LABORATORY (PURGE SYSTEM DOES NOT OPERATE).

Step 1 Check generator set power output switch is ON.
Place generator output power switch ON.

Step 2. Check generator set output voltage for correct setting.
Adjust voltage to 208-220 Vac.

WARNING

Do not come in contact with main power cable connections on generator set with power applied to laboratory. Death or serious injury may result.

Step 3. Check that main power cable is properly connected to generator set.
a. Turn generator set output power switch OFF.
b. Properly secure main power cable to connectors.

Table 31. Troubleshooting (cont.)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

1. NO ELECTRICAL POWER TO LABORATORY (PURGE SYSTEM DOES NOT OPERATE). (cont.)

Step 4. Check that main power cable is properly connected to laboratory electrical power receptacle.

WARNING

Do not attempt to disconnect or connect main power cable to laboratory electrical receptacle with generator set applying power to the cable. Death or serious injury may result.

- a. Place-generator output power switch OFF.
- b. Make proper power cable connection.
- c. If purge system still fails to operate, notify unit maintenance.

WARNING

If purge cycle has not taken place, do not enter the laboratory without first allowing the laboratory to vent to the atmosphere via the two laboratory doors for a minimum of 20 minutes. Death or serious injury could result.

2. CEILING LIGHTS FAIL TO COME ON.

Check and reset Main Power Panel circuit breaker No. 13.

If lights still fail to operate, notify unit maintenance.

3. WHITE CEILING LIGHTS FAIL TO COME ON (BLACKOUT LIGHTS ARE ON).

Check operation of the door interlock switches.

- a. Ensure door interlock switches are closed. White lights should come on.
- b. If white lights do not come on, notify unit maintenance.

4. WHEN ONE OF THE AOAP MOBILE LABORATORY DOORS IS OPENED, WHITE LIGHTS FAIL TO GO OFF AND BLACKOUT LIGHTS FAIL TO COME ON.

Check operation of the door interlock switch.

- a. Adjust door interlock switch.
- b. If lights still fail to operate properly, notify unit maintenance.

Table 3-1. Troubleshooting (cont.)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

5. EMERGENCY LIGHT FAILS TO COME ON WHEN A POWER FAILURE OCCURS.

Check operation of the appropriate emergency light switch.

- a. Ensure switch is in the ON position.
- b. If emergency light still fails to operate, notify unit maintenance.

6. CEILING LIGHT INOPERATIVE OR DIM.

Step 1. Check fixture for burned out or weak lamps.

Replace defective lamps.

Step 2. Check lamp starter by replacing with a known good starter.

Replace defective starter.

7. NO POWER AT ONE OR MORE CONVENIENCE (UTILITY) OUTLETS.

Check and reset associated circuit breaker. Refer to tables 2-2 and 2-3.

If power is still not available at the outlet(s), notify unit maintenance.

8. ENVIRONMENTAL CONTROL UNIT(S) FAIL TO OPERATE.

Step 1. Check that electrical input connector on ECU(s) is properly mated.

Properly connect power input connector.

Step 2. Check and reset associated circuit breaker(s) located in Main Power Panel.

If unit still fails to operate, notify unit maintenance.

Table 3-1. Troubleshooting (cont.)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

9. PURGE SYSTEM CONTINUOUSLY REPEATS PURGE CYCLE.**WARNING**

Do not enter laboratory for at least 10 minutes after door is opened to allow any gas accumulation to be vented to the atmosphere. Failure to comply with this warning could result in death or serious injury.

Step 1. Carefully open rear laboratory door.

Step 2. Enter laboratory and attempt to reset the gas alarm system.

If alarm system will not reset, place generator output switch OFF and call unit maintenance.

10. AIR COMPRESSOR MOTOR FAILS TO RUN.

Check and reset circuit breaker No. 20 located in Main Power Panel.

If motor still fails to run, notify unit maintenance.

11. AIR COMPRESSOR CONTINUALLY CYCLES ON AND OFF.

Step 1. Check system valves for partially open valves.

Close all system valves.

Step 2. Check operation of air system pressure switch.

a. Adjust pressure switch (refer to appropriate TM listed in Appendix A).

b. If pressure switch will not adjust properly, notify unit maintenance.

Step 3. Check system piping for leaks.

If leaks are found, notify unit maintenance.

12. VACUUM PUMP FAILS TO RUN.

Check and reset circuit breaker No. 11 located in the Main Power Panel.

If vacuum pump still fails to run, notify unit maintenance.

Table 3-1. Troubleshooting (cont.)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

13. VACUUM PUMP FAILS TO DEVELOP A VACUUM (MOTOR RUNNING).

Check for broken or loose drive belt.

Replace or tighten belt as required. (Refer to appropriate TM listed in Appendix A).

14. LOW VACUUM PRESSURE.

Step 1. Check for open valves in the system.

Close all valves.

Step 2. Check for leaks in the system.

If leaks are found, notify unit maintenance.

15. WATER PUMP FAILS TO RUN.

Check and reset circuit breaker No. 14 located in Main Power Panel.

If motor still fails to run, notify unit maintenance.

16. WATER PUMP FAILS TO DELIVER WATER AT PROPER PRESSURE.

Step 1. Check level in water tank.

If level is low, fill water tank.

Step 2. Check for leaks in the system valves, piping and at the pump shaft seal.

If leaks are found, notify unit maintenance.

17. WATER PUMP, CONTINUALLY CYCLES ON AND OFF.

Step 1. Check system access valves for partially open valves(s).

Close all access valves.

Step 2. Check system piping for leaks.

If leaks are found, notify unit maintenance.

Step 3. Check operation of water system pressure switch.

a. Adjust pressure switch. (Refer to appropriate TM listed in Appendix A).

b. If pressure switch will not adjust properly, notify unit maintenance.

Table 3-1. Troubleshooting (cont.)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

18. WASTE WATER HEATER FAILS TO HEAT WASTE WATER.

Check and reset circuit breaker No. 3 located in Power Panel No. 2.

If heater still fails to produce hot water, notify unit maintenance.

19. FUME HOOD EXHAUST BLOWER(S) FAILS TO OPERATE.

Step 1. Check operation of blower switch (MS starter).

If inoperable, notify unit maintenance.

Step 2. Check and reset circuit breaker No. 10 located in Main Power Panel.

If exhaust blower(s) still does not operate, notify unit maintenance.

20. DRYING OVEN FAILS TO OPERATE (DOES NOT HEAT).

Check and reset circuit breaker No. 17 located in Main Power Panel.

If oven still fails to operate, notify unit maintenance.

21. REFRIGERATOR FAILS TO OPERATE.

Step 1. Ensure power cord is plugged into convenience outlet.

Step 2. Check position of temperature control knob.

Turn temperature control knob clockwise to maximum cold setting.

Step 3. Check and reset circuit breaker No. 6 located in Power Panel No. 2.

If refrigerator still fails to operate, notify unit maintenance.

Section III. OPERATOR MAINTENANCE PROCEDURES**ALPHABETICAL INDEX**

MAINTENANCE ITEM	PARAGRAPH
Introduction	3-3
Purge Intake Door Filter	3-4

3-3. Introduction. This section contains instructions covering maintenance functions for the operator on the AOAP Mobile laboratory. Personnel required are listed only if the task requires more than one. After completing each maintenance procedure, perform operational check to be sure that equipment is properly functioning.

MAINTENANCE OF PURGE DOOR FILTER (Refer to Figure 3- 1)

3-4. REMOVE/INSTALL PURGE DOOR FILTERS

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

<i>Tools</i>	<i>Materials and Parts</i>
Tool Kit, Item 1,	Lock washers Appendix B

REMOVAL

REMOVE PURGE DOOR FILTER.

- a. Unlatch and open purge door if required.
- b. Remove four screws, lock washers and washers from purge door screen. Remove screen and dirty filter.

INSTALLATION

INSTALL PURGE DOOR FILTER.

- a. Install a clean or new filter.
- b. Replace purge door screen and fasten in place with four screws. lock washers and washers.

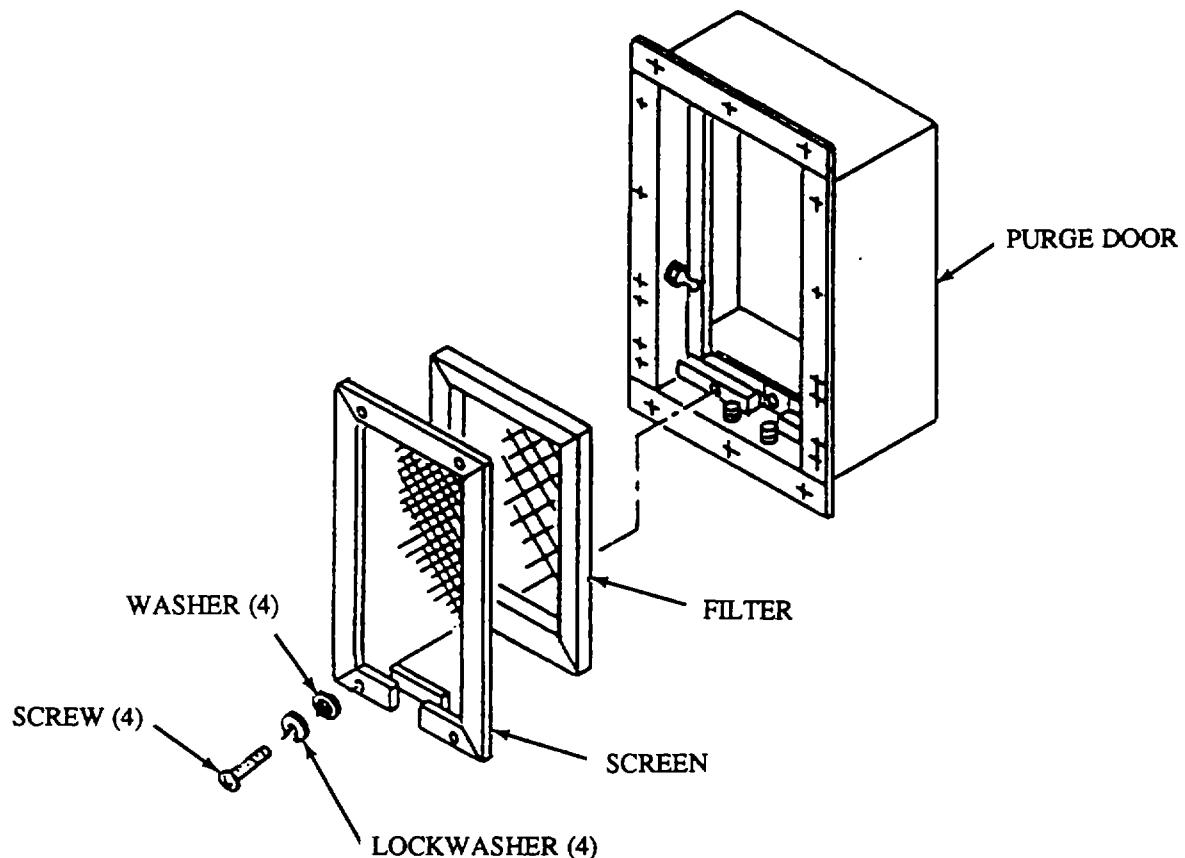


Figure 3-1. Remove/Install Purge Door Filter

APPENDIX A

REFERENCES

SCOPE

This appendix lists all forms, field manuals and technical manuals referenced in this manual and other necessary publications.

Regulations:

Joint Oil Analysis Program (JOAP) (AFR 400-68).....AR 700-132

Coal and Petroleum Product Supply and Management Activities.....AR 703-1

Army Materiel Maintenance Concepts and PoliciesAR 750-1

Pamphlets:

Consolidated Index of Army Publications and Blank FormsDA PAM 25-30

The Army Maintenance Management Systems (TAMMS)DA PAM 738-750

Functional Users Manual for the Army Maintenance Management SystemDA PAM 738-751
-Aviation (TAMMS-A)

Army Oil Analysis Laboratory Manual for LeadersDA PAM 750-5

Forms:

Equipment Inspection and Maintenance WorksheetDA Form 2404

Recommended Changes to PublicationsDA Form 2028

Recommended Changes to Equipment Technical ManualsDA Form 2028-2

Oil Analysis RequestDD Form 2026

Product Quality Deficiency Report.....SF 368

Technical Bulletins, Manuals and Orders

Aeronautical Equipment Army Oil Analysis Program (AOAP)TB 43-0106

Army Oil Analysis Program Guide for Leaders and Users.....TB 43-0211

Symbols for the Identification of Fuels and Lubricants.....TB 34-9-25
of and Allied Products NATO

Quantitative Ferrography-Its Meaning and ApplicationTI 612-120

Joint Oil Analysis Program Laboratory ManualTM 38-301 - 1 thru 4

Technical Bulletins, Manuals and Orders (cont)

Operator's Organizational Direct Support and General Support TM 5-4120-356-14
Maintenance Manual for Air Conditioner, Vertical Compact

Operator's and Unit Maintenance Manual for Generator Set TM 5-6115-545-12
Diesel Engine Driven, 60 KW

Operator's Organizational, Direct Support and General Support TM 9-2330-362-14&P
Maintenance Manual (including Repair Parts and Special Tools List)
for Semitrailer Van

Operator's Unit, Direct Support and General Support TM 9-6650-306-14
Maintenance Manual for Fluid Analysis Spectrometer, Model A/E35U-3A

Operator's Unit and Direct Support Maintenance Manual TM 10-4310-391 - 13&P
(including Repair Parts and Special Tools List) for Vacuum Pump

Operator's Unit and Direct Support Maintenance Manual TM 10-6665- 297-13&P
(including Repair Parts and Special Tools List) for Gas Alarm
and Calibration Data

Operator's and Organizational Maintenance Manual for Oscilloscope TM 11-6625-3135-12
Model AN/USM- 488

Miscellaneous Publications

First Aid for Soldiers FM 21 - 11

Quality Surveillance Handbook for Fuels and Lubricants MIL-HDBK- 200G
Reference List of Specifications and Standards for Petroleum
and Related Products

APPENDIX B

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

B-1. SCOPE

This appendix lists components of end item and basic issue items for the AOAP Mobile Laboratory to help you inventory items required for safe and efficient operation.

B-2. GENERAL

The Components of End Item and Basic Issue Lists are divided into the following sections:

a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts: Illustrations are furnished to assist you in identifying the items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the AOAP Mobile Laboratory in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the laboratory during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

B-3. EXPLANATION OF COLUMNS

The following provides an explanation of columns found in the tabular listings:

a. Column (1) - Illustration Number (Illus Number). This column indicates the number of the illustration in which the item is shown.

b. Column (2) - National Stock Number. Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3) - Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

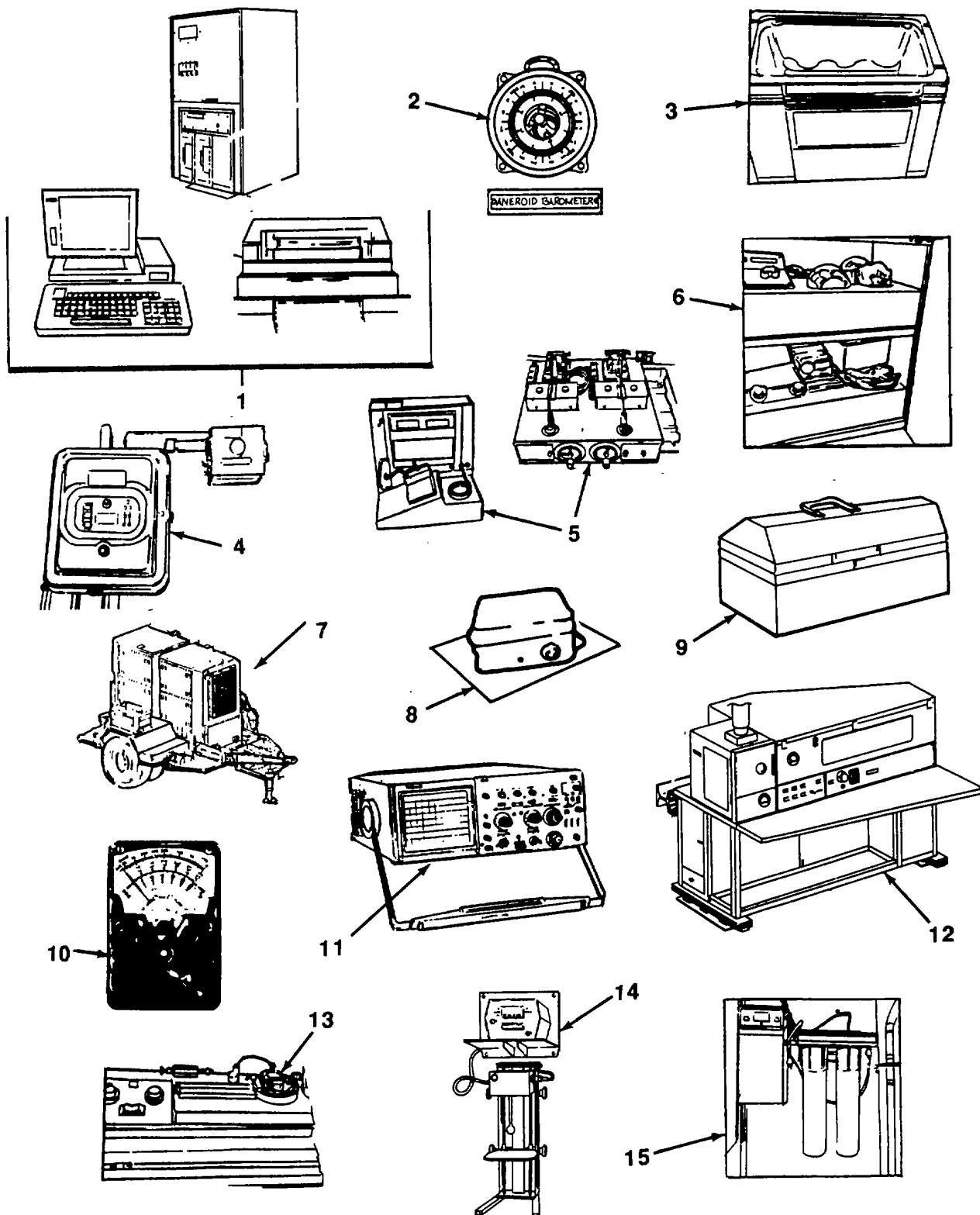
d. Column (4) - Unit of Measure (U/M). Indicates the measure used in performing the actual operation/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).

e. Column (5) - Quantity required (Qty rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

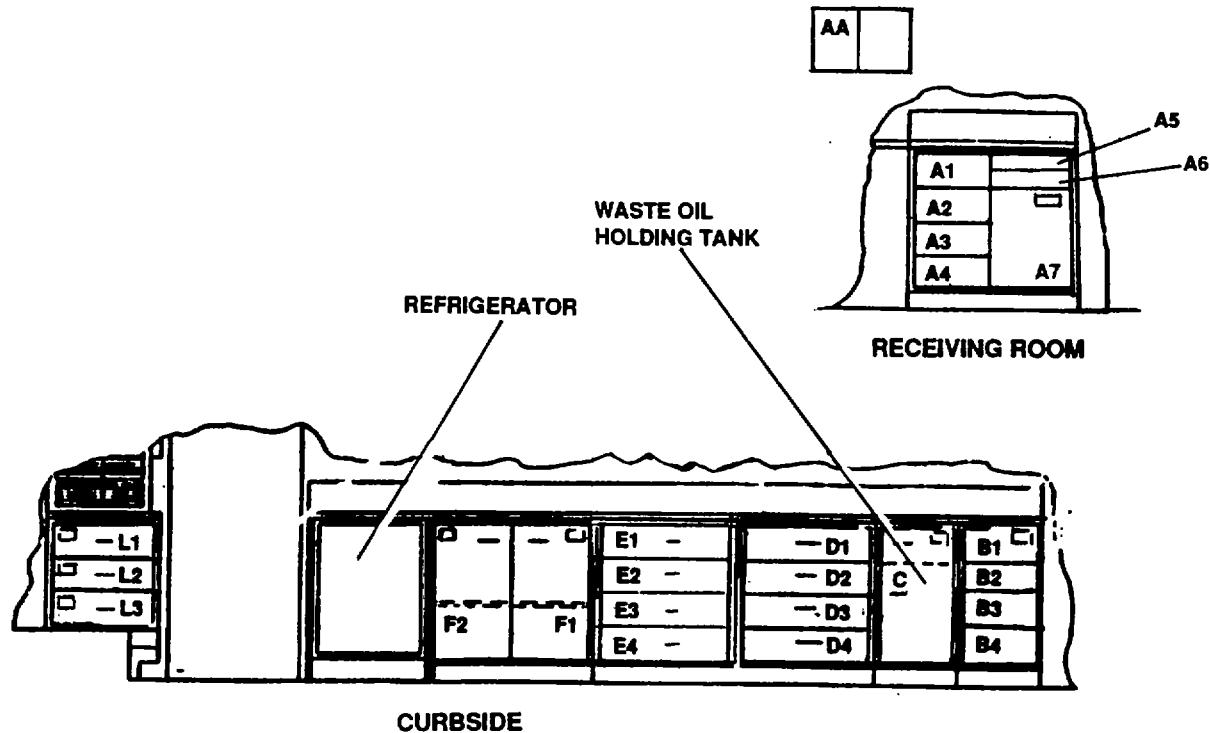
Section II. COMPONENTS OF END ITEM

(1) Illus Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable on Code	(4) U/I	(5) Qty Rqr
1		AOAP Standard Data System (7U1 64) MICROVP-2		EA	1
2		Barometer, Aneroid, Wall-Mounting (22527) 02-404		EA	1
3	4940-01-208-9819	Cleaner, Ultrasonic (located in cabinet C) (22527) 15-337-15		EA	1
4		Detector, Vapor w/ Remote (Gas Alarm) (mounted on wall) (22527) 10-030-40		EA	1
5	6630-0 - 158-7638	Duplex Ferrograph (located in H5, H6 & overpack storage) (62478) 695578CH-1		EA	1
6	6630-01-037-5149	Fluids Contamination Set (located in cabinet K7) (19204)5911204		EA	1
7	6115-00-118-1243	Generator Set, DED, Tactical 60 KW Model MEP006A		EA	1
8		Hot Plate (located in cabinet K2) (22527) 11-496-3		EA	1
9	5180-00-209-6225	Kit, Tool w/Case (located in overpack storage) (19204) SC4940-95CLA68		EA	1
10	6625-01-139-2512	Multimeter, Digital, Model AN/PSM-45 (55026) T00377		EA	1
11	6625-01-187-7847	Oscilloscope Model AN/USM-488 (located in Drawer G2) (80009) TEK 2235		EA	1
12	6650-01-149-8430	Spectrometer (05234) A/E354-3A		EA	1
13		Tester, Flashpoint (01579) 035F		EA	1
14	6630-01-037-5147	Viscometer Set (partially mounted on curbside wall and located in G7) (19204)5911199		EA	1
15		Water Purification System (mounted on wall) (22527) 09-034-107		EA	1

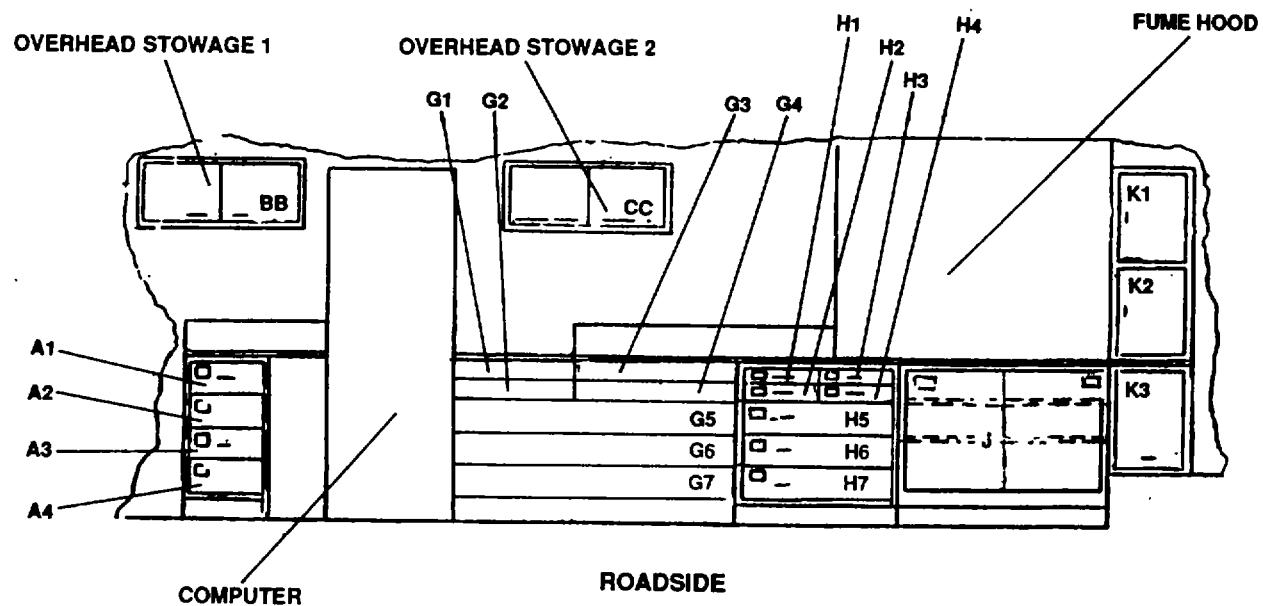
SECTION II. COMPONENTS OF END ITEM



SECTION III. BASIC ISSUE ITEMS



CURBSIDE



ROADSIDE

Section III. BASIC ISSUE ITEMS

(1) Illus Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable on Code	(4) Qty U/I	(5) Rqr
1(G5)	5999-01-262-3705	Analysis & Measurement Control Logic Board (05234)660404	EA	1	
2(G5)	5999-01-282-2988	Analysis & Measurement Offset Multiplexer (05234)661606	EA	1	
3	6650-00-001-2337	Attenuator, 16/1 (located in Tray 1 overpack) (05234)659599	EA	1	
4	6650-00-001-2334	Attenuator, 2/1 (located in Tray I overpack) (05234)659596	EA	1	
5	6650-00-001-2335	Attenuator, 4/1 (located in Tray I overpack) (05234) 659597	EA	1	
6	6650-00-001-2336	Attenuator, 8/I (located in Tray I overpack) (05234)659598	EA	1	
7(A6)		Calculator, 8-Digit Logic (22527) 12-099	EA	1	
8		Can, Waste Disposal, Safety Liquid (22527) 04-664-30	EA	2	
9		Can, Waste, Disposal, Safety, Solid (22527) 04-664-50	EA	2	
10(C)	7910-00-720-5535	Cleaner, Vacuum, Electric (81348) W-C-425	EA	1	
11	6645-00-410-2395	Clock, Panel,4.125 DIA (80063) SC-C-68141 1	EA	1	
12(G5)		Computer Interface 11/05 (05234)660076	EA	1	
13(G2)		Delta Start I (05234) 659077	EA	1	
14(G2)		Delta Start II (05234)659159	EA	1	
15(D3)		Dispenser (62478) AP005BC	EA	1	
16(H4)		Dispenser, Repipet (22527) 13-687-62B	EA	1	
17(G2)		Entrance Slit, 0032 inch (05234)650437	EA	1	

Section III. BASIC ISSUE ITEMS

(1) Illus Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable on Code	(4) Qty U/I	(5) Rqr
18(G5)		Extender Board, Electronic Processing (05234)661784	EA	1	
19(G5)		Extender Board, Integration Assembly (05234)66	EA	1	
20		Extinguisher, Fire (2.5 LB) (22527) 10-013	EA	3	
21		Extinguisher, Fire (5 LB) (22527) 10-013-1	EA	1	
22		Extinguisher, Fume Hood Fire (22527) 16-050	EA	1	
23(G5)	5999-01-282-2986	Fire Element Integrator (05234)664810	EA	1	
24(D4)	8230-00-269-3034	Flashlight, Dry Cell (81349) MIL-F-3747	EA	2	
25(G4)	6650-01-111-6825	Form Tool (59522) SM 1501	EA	1	
26(G4)	5920-00-284-9455	Fuse, 0.12 AMP (05234)651265	EA	5	
27(G4)	Fuse, 0.15 AMP	BX (05234) 651266		5	
28(G4)	5920-00-199-9498	Fuse, 0.5 AMP (05234)651267	BX	5	
29(G4)	5920-00-280-8342	Fuse, 1 AMP (81349) F02A25OV IA	EA	10	
30(G4)	5920-00-089-3858	Fuse, 1 AMP (05234)651264	EA	10	
31(G4)	5920-00-010-6652	Fuse, 3 AMP (05234)651264	EA	10	
32(G4)	5920-00-284-6787	Fuse, 5 AMP (05234) 657654	EA	10	
33	6650-00-238-1183	Holder, Rotary Electrode (located in Tray I overpack) (05234)659023	EA	1	
34	6685-01-279-1812	Hygrometer (22527) 11-657	EA	1	

Section III. BASIC ISSUE ITEMS

(1) Illus Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable on Code	(4) Qty U/I	(5) Rqr
35	5999-01-282-2987	Interface, FAS2-11/05 (05234) 660076	EA	1	
36	5999-01-282-3706	Interface, RS-232 (05234)66160	EA	1	
32(G5)	5999-01-282-3706	Interface, RS-232C (05234)661610	EA	1	
37		Kit, First Aid (Burn) (22527) 10-021-10	EA	1	
38	6545-01-190-9166	Kit, First Aid(General) (89337) 10-020	EA	1	
39(G4)	6240-00-014-2870	Lamp, 117V (05234)656313	EA	5	
40(GI)	6240-00-001-5353	Lamp, Mercury (05234)659384	EA	5	
41(G4)	6240-00-155-7836	Lamp, Type 327 (05234)658260	EA	10	
42	6210-00-019-5599	Light, Indicator (located in Tray 1) (96182) 80EAI	EA	1	
43	6650-00-001-5386	Low Voltage Relay Control (located in Tray I overpack) (05234)651062	EA	1	
44(H6)		Mixer, Test Tube (22527) 12-812	EA	2	
45	6650-00-119-9412	Optical Alignment Fixture (located in Tray 2 Overpack) (05234) 659966	EA	1	
46	6650-00-420-3593	Plate, ADJ, Electric Holder (05234)659175	EA	1	
	6650-00-001-2322	Plate, Mounting (Mercury) (Tray 1) (05234)659186	EA	1	
47(G4)	5935-00-823-5322	Plug, Protective (96906) MS25251-16	EA	10	
48		Power Supply, 1000 Vdc (located in Tray 1 Overpack) (05234) 660050	EA	1	

Section III. BASIC ISSUE ITEMS

(1) Illus Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable on Code	(4) Qty U/I	(5) Rqr
49(G4)	5905-00-267-9259	Resistor, 25 OHMS (05234)651214	EA	2	
50(G4)		Resistor, 250K OHMS (MVZI6-250K) (05234)651920	EA	1	
51(G4)	5905-00-429-3003	Resistor, 5 OHMS (81349) RER7QF4R99R	EA	2	
52(G4)	6650-00-119-9413	Sample Excitation Plate (05234) 658942	EA	1	
53(G4)		Screw, Sample Stand Backplate (05234)651223	EA	10	
54	6650-01-109-7725	Shaft (located in Tray 1 overpack) (05234) 661464	EA	2	
55	6650-01-109-7724	Shaft, Electrode (Shaft Adapter) (located in Tray 1 overpack)	EA	2	
56	6650-00-161-4122	Socket Assembly (located in Tray 1) (05234)659041	EA	2	
57(G1)	6250-00-299-5962	Starter (05234) 651309	EA	2	
58(G1)		Switch (Auto/Manual) (05234)656301	EA	2	
59(G1)		Switch (Calibrate) (05234)651275	EA	2	
60	5930-00-892-9246	Switch, Interlock (Tray I) (05234) 658070	EA	2	
61(G1)		Switch (PPM NORM/OFF) (05234)651279	EA	2	
62	5930-00-240-7721	Switch Readout (located in Tray I overpack) (05234)651187	EA	1	
63(G4)	5930-00-919-0132	Switch, Readout/Burn (05234)651273	EA	2	
64(G1)	5930-00-225-2013	Switch, Rotary (05234)654505	EA	1	
65(G1)	5930-00-919-0133	Switch (Start) (05234)651320	EA	2	

Section III. BASIC ISSUE ITEMS

(1) Illus Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable on Code	(4) Qty U/I	(5) Rqr
66(G1)	5930-00-919-0132	Switch (System/Electric) (05234)651277	EA	2	
67(H2)		Thermometer, Surface (22527) 15-170D	EA	1	
68	5950-00-032-6368	Transformer, ARC (located in Tray 2 overpack) (05234)659089	EA	1	
69	5950-00-032-6369	Transformer, Ignition (located in Tray 2 overpack) (05234)659083	EA	1	
70(G4)	5962-00-917-1636	Transistor (04713) 2N3790	EA	2	
71	5960-00-038-5430	Tube, Photomultiplier, 1 (located in Tray 1 overpack) (05234)659056-1	EA	2	
72	5960-00-038-5431	Tube, Photomultiplier, 2 (located in Tray 1 Overpack) (05234) 659056-2	EA	2	
73	5960-00-038-5432	Tube, Photomultiplier, 3 (located in Tray 1 Overpack) (05234) 659056-3	EA	2	
74	5960-00-038-5433	Tube, Photomultiplier, 4 (located in Tray 1 Overpack) (05234) 659056-4	EA	2	
75	5960-00-038-5428	Tube, Photomultiplier, 5 (located in Tray 1 Overpack) (05234) 659056-5	EA	1	
76(G1)	5977-00-048-2913	Tungsten Electrodes (05234)659182	EA	3	
77(A7)	7430-00-461-9495	Typewriter (30874)725	EA	1	
78(G4)	6650-00-011-0774	Window, Quartz (05234) 6500344	EA	1	
79(G5)	5999-01-282-3704	KI-KIOAMP,CV Reference (05234) 664811	EA	1	

APPENDIX C
EXPENDABLE AND DURABLE ITEMS LIST

Section I. INTRODUCTION

C-1. SCOPE

This appendix lists expendable and durable items that you will need to operate and maintain the AOAP Mobile Laboratory. This listing is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-790, Expendable/Durable Items (except medical, class V repair parts, and heraldic items), or CTA 8-100, Army Medical Department Expendable/ Durable Items.

C-2. EXPLANATION OF COLUMNS.

- a. Column 1. Item number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the item (e.g. "Use cleaning compound, item 5, Appendix D".)
- b. Column 2. Level. This column identifies the lowest level of maintenance that requires the item.
- c. Column 3. National stock number. This is the national stock number assigned to the item which you can use to requisition it.
- d. Column 4. Item name, description, Commercial and Government Entity Code (CAGEC), and part number. This provides the other information you need to identify the item.
- e. Column 5. Unit of measure. This code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

Section II. EXPENDABLE AND DURABLE ITEMS

(1) Item Number	(2) Level	(3) National Stock Number	(4) Item Name, Description CAGEC, Part Number	(5) U/M
1	C		Adapter, LPG Supply (01579) ISF-2010	EA
2	C	8415-00-715-0450	Apron, Laboratory (58536) A-A-50068	EA
3	C	8415-00-082-6108	Apron, Reusable (81349) MIL-A-41829	EA
4	C		Battery, Dry Cell, D Size (22527) 02-432	BX
5	C	6640-00-899-2784	Beaker 2000 ML (81348) A-A-51 101	EA
6	C	6640-00-942-4393	Beaker, 250 ML (22527) 02-540K	EA
7	C	8125-01-082-9697	Bottle, Oil Sample (81996) PD8125-1	CS

Section II. EXPENDABLE AND DURABLE ITEMS

(1) Item Number	(2) Level	(3) National Stock Number	(4) Item Name, Description CAGEC, Part Number	(5) U/M
8	C		Block, Cooling (metal) (01579) ISF-5500	EA
9	C		Bottle, Squeeze, 250ML (22527) 03-409-IOD	BX
10	C		Brushes, Cleaning (22527) 03-608	PK
11	C		Brushes, Cleaning (22527) 03-621 A	EA
12	C	7920-01-124-4184	Brushes, Cleaning (22527) 03-625	EA
13	C		Brushes, Cleaning (22527) 03-536	EA
14	C		Brushes, Cleaning (22527) 03-570A	EA
15	C	6640-01-042-6583	Cap, Bottle (34573) 24-400	BX
16	C	6810-00-470-4631	Chemical, Heptane (81346) GRADE N HEPTANE	CN
17	C		Chemical, N-Butyl Diethanolamine (4W981) 780C-P21	CN
18	C		Chemical, Propanol, 4liter (22527) A-416SK-4	BT
19	C	8520-00-782-2183	Cleaner, Hand (58536) A-A-279	CN
20	C	6850-00-227-1887	Cleaner, Lens, Liquid (81349) MIC-43454	BT
21	C	6850-00-984-5853	Compound, Cleaning (81349) MIL-C-81302	CN
22	C	7350-00-290-0578	Cup, Paper, 4 oz (81348) UU-C-806	BX
23	C		Cylinder, Butane Charging (01579) ISF-5540	EA
24	C	6640-00-889-1698	Cylinder, Graduated, 10 ML (81348) A-A-50807	EA

Section II. EXPENDABLE AND DURABLE ITEMS

(1) Item Number	(2) Level	(3) National Stock Number	(4) Item Name, Description CAGEC, Part Number	(5) U/M
25	C	6640-00-420-6000	Cylinder, Graduated 100 ML (81348) A-A-50807	EA
26	C	6640-00-857-2243	Dish, Culture Petri (81348) NNN-D- 1478	EA
27	C	7045-01-173-0524	Disk, 13.4 MegaByte (06763) 725-0711	EA
28	C	7045-01-149-4719	Diskette, 8-inch, SS/SD	BX
29	C		Dispenser, Slide (22527) 12-592-5	EA
30	C		Filter Paper (5.5 Diameter) (22527) 09-795A	PK
31	C		Gloves, Disposable, LT WGT (22527)	PK
32	C	7510-00-161-4237	Ink, Black, Stamp Pad (58536) A-A-209	BT
33	C	7510-00-161-4240	Ink, Red (58536) A-A-209	BT
34	C	3455-01-108-8676	Insert, Carbide (85597) TP40GROUP-K68	EA
35	C		Lid/Shutter Locking (01579) 3SF-5023A	EA
36	C		Magnifier, Thermometer (01579) ISF-5530	EA
37	C		Oxford Disposable Plastic Tips (01579) PK-500	EA
38	C	7510-00-526-1741	Pad, Stamp (81348) TT-1-600	EA
39	C	6640-00-435-7650	Paper, Filter (81348) NNN-P- 14751	PG
40	C	7530-00-145-0418	Paper, Printer, Five Part (81348) UU-P-546	BX
41	C	7530-00-145-0414	Paper, Printer, Single Part (81348) UU-P-546	BX

Section II. EXPENDABLE AND DURABLE ITEMS

(1) Item Number	(2) Level	(3) National Stock Number	(4) Item Name, Description CAGEC, Part Number	(5) U/M
42	C	7520-00-223-6672	Pencil, Black, Grease, Mechanical (81348) SS-P- 186	BX
43	C	7520-00-223-6675	Pencil, Red, Grease, Mechanical (81348) SS-P-I 86	BX
44	C		Pipette Tips (62478) AP005BF	BX
45	C		Pipetter (62478) AP005BU	EA
46	C		Precipitator Tubes (62478) AP005CJ	BX
47	C	7430-01-207-4020	Printwheel, Typewriter (67317) SWS PS 1245	BX
48	C	7510-01-186-9867	Ribbon,BondPrinter (06763) 725-2540-6	BX
49	C		Sample Vials, Culture Tubes (62478) AP005AR	PK
50	C		Seal, O-Ring (01579) 3SF-5025	EA
51	C	6640-00-494-3893	Slide, Microscope (81348) NNN-S-450	PG
52	C		Slide, Petri (16863)7231	BX
53	C	6650-00-179-5137	Standard, Spectrometer (89771) OPPM CONC	BT
54	C	6650-00-179-5141	Standard, Spectrometer (89771) 300 PPM CONC	BT
55	C	6650-00-179-5142	Standard, Spectrometer (89771) 100 PPM CONC	BT
56	C	6650-00-179-5154	Standard, Spectrometer (89771) IO PPM CONC	BT
57	C	6650-00-179-5144	Standard, Spectrometer (89771) 30 PPM CONC	BT
58	C	6650-00-179-5143	Standard, Spectrometer (89771) 50 PPM CONC	BT

Section II. EXPENDABLE AND DURABLE ITEMS

(1) Item Number	(2) Level	(3) National Stock Number	(4) Item Name, Description CAGEC, Part Number	(5) U/M
59	C		Substrates (62478) AP005CK	BX
60	C		Syringe (5 ML) (01579) 3SF-5520	EA
61	C	7510-00-551-9823	Tape, Masking (58536) A-A-1 13	EA
62	C	7510-01-094-8418	Tape, Typewriter Correction (67317) SWS 422	BX
63	C		Thermometer, ASTM (01579) 3SF-5532	EA
64	C		Thermometer, Wall (22527) 15-091	EA
65	C	6640-01 - 189-3993	Tips, nonsterile (22527) 21-195-3	PK
66	C	6645-00-880-8045	Timer, Interval (58536) A-A-726	EA
67	C	7920-00-928-1203	Tissues, Large (81348) UU-T-595	BX
68	C	6640-01-276-4587	Transfer Pipe fitting System (22527) 21-195	EA
69	C		Tray, Relgene, Polypropylene (22527) MOD 13-361-10	EA
70	C	7420-00-964-1433	Tubing, Plastic, 1/4 inch Dia. (25602) 800020	EA
71	C		Tubing, Silicone Gas (01579) 15F-5012A	FT
72	C		Turret Tubes (01579) AP005CL	BX
73	C		Viscosity Standard (94481) CANNON S-6	BT
74	C		Viscosity Standard (94481) CANNON S-60	BT
75	C		Viscosity Standard (94481) CANNON S-200	EA
76	C		1.1.I-Trichlorethane, Reagent Grade C-5/(C6 blank)	BT

Appendix D
Additional Authorization List (AAL)
(Not Applicable)

D-1/(D-2 blank)

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

THOMAS F. SIKORA
Brigadier General, United States Army
The Adjutant General

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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 decagram = 10 grams = .35 ounce
 acres
 1 hectogram = 10 decagrams = 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 milliters = .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

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

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
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	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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