TECHNICAL MANUAL

# OPERATION AND MAINTENANCE INSTRUCTIONS

# FOR

# TESTER, PRESSURIZED CABIN LEAKAGE, AIRCRAFT

# USAF TYPE AF/M24T-3

# PART NUMBERS 10037-10 AND 10037-30

APS SYSTEMS (FSCM 60984)

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## SAFETY SUMMARY

The following are general safety precautions that personnel must understand and apply during many phases of operation and maintenance to ensure personnel safety and health and the protection of Air Force property. Portions of this information may be included in certain chapters of this publication for emphasis. Specific precautions will be included in the text for certain potentially hazardous operations in the form of WARNING or CAUTION statements.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe safety regulations. Do not replace components or make adjustments inside the equipment with the voltage supply turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position, due to charges retained by capacitors. To avoid injuries, always remove power from, discharge, and ground a circuit before touching it.

DO NOT WEAR JEWELRY

Remove rings, watches, and other metallic objects which may cause shock or burn hazards.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person capable of rendering aid and resuscitation is present.

RESUSCITATION

Personnel working with or near dangerous voltages shall be familiar with modern methods of resuscitation. Such information may be obtained from the Director of Base Medical Services.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the product in the presence of flammable gases or fumes.

**DO NOT OPERATE IN WET OR DAMP AREAS** Operating the product in wet or damp areas can be fatal or cause damage to the equipment.

GIVE CLEANERS SPECIAL CARE

Keep cleaners in approved safety containers and in minimum quantities. Observe manufacturers WARNING labels and current safety directives. Use only in authorized areas. Discard soiled cleaning cloths into safety can.

DANGEROUS PRESSURES

Pressure systems safety precautions apply to all ranges of pressure. Care must be taken during testing to ensure that all test connections are properly and tightly made prior to applying pressure to the last setup. Personnel must be protected by a safety shield or located at a distance sufficient to prevent injury.

**WARNING**

An operating or maintenance procedure, practice, condition, statement, etc, which, if not strictly observed, could result in injury to or death of personnel.

## SAFETY SUMMARY - Continued

**CAUTION**

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**NOTE**

An essential operating or maintenance procedure, condition, or statement, which must be highlighted.

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**NOTE**

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# SECTION I

# INTRODUCTION AND GENERAL INFORMATION

**1-1. INTRODUCTION.** This publication is the basic manual of Operation and Maintenance Instructions for the Aircraft Cabin Leakage Tester, type AF/M24T-3, Part Numbers 10037-10 and 10037-30. The Cabin Leakage Testers are manufactured by APS Systems, Port Hueneme, California 93041 (FSCM 60984).

Part Number 10037-10 works on 230/460VAC, 60 Hz, three phase electrical power and utilizes the tube type flowmeter. Part Number 10037-30 works on 220/380/440VAC, 50/60 Hz, three phase electrical power and uses a digital mass flowmeter. The Operation and Maintenance Instructions remain the same for both. User should check unit identification plate to confirm the Part Number of Cabin Leakage Tester being used. The Cabin Leakage Tester is wired for 220/230VAC and can be converted to 380/460VAC. Hereafter the Cabin Leakage Tester will simply be referred to as the tester.

**1-2. SCOPE OF MANUAL.** This manual is divided into eight sections as follows:

a. Section I, Introduction and General Information. Contains the information pertaining to the scope of the manual and a simplified description of the equipment.

b. Section II, Tools and Test Equipment. Contains the list of tools and test equipment required to operate and maintain the tester.

c. Section III, Preparation for Use and Shipment. Contains the instructions for set-up and check-out prior to operation and to prepare the unit for shipment.

d. Section IV, Operation Instructions. Contains the theory of operation and detailed instructions for operating the tester.

e. Section V, Maintenance Instructions. Contains inspection, maintenance, troubleshooting, repair, disassembly, cleaning, assembly and testing instructions.

f. Section VI, Diagrams. Contains the electrical and pneumatic diagrams required to operate and maintain the tester.

g. Section VII, Illustrated Parts Breakdown. Not applicable.

h. Section VIII, Difference Data Sheets. Contains information pertaining to the Tester, Pressurized Cabin Leakage, Aircraft-USAF Type AF/M24T-3, Part Number 10037-30.

**1-3. RELATED PUBLICATIONS.** T.O. 33D3-31-11-3 Overhaul and T.O. 33D3-31-11-4 Illustrated Parts Breakdown apply to this unit.

**1-4. PURPOSE OF EQUIPMENT.** The tester is a self-contained, portable, electric motor-driven unit designed to furnish an air supply under various combinations of pressure and flows to check pressurized aircraft cabins and canopy seals for leakage.

**1-5. GENERAL DESCRIPTION.**

**NOTE**

The terms "left side" and "right side" are defined as standing in the rear facing the unit.

1-6. The tester consists principally of: a cabinet and trailer assembly, an electric motor which drives a single stage positive displacement blower; intake and outlet silencers; aftercooler and fan, relief and rate control valves, flowmeter, canopy seal compressor and a control panel. An accessory kit consisting of hoses, adapters and a stethoscope, completes the tester.

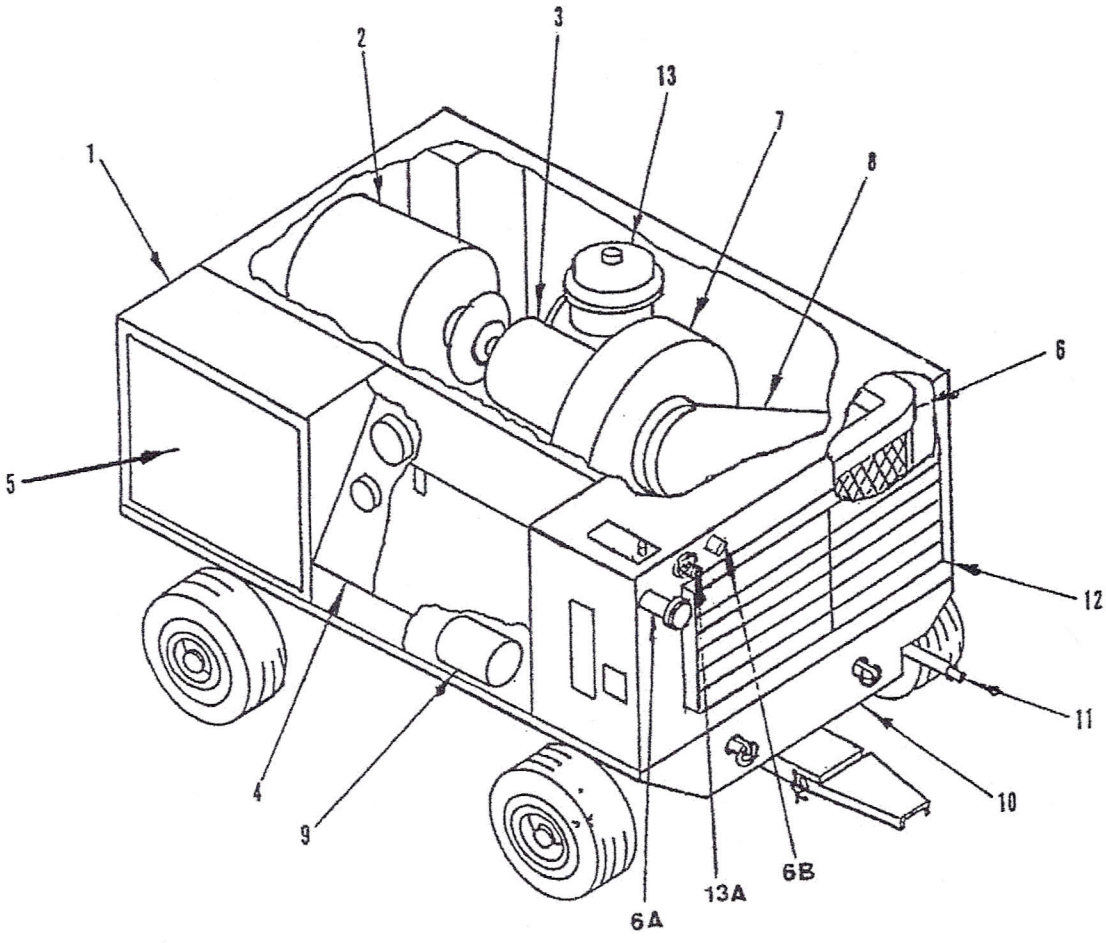
**1-7. DETAILED DESCRIPTION** (See Figure 1-1).

**1-8. CABINET.** The cabinet (1) is constructed of structural steel. There is one removable section and two fixed sections.

**1-9. ELECTRIC MOTOR (2).** Power for the tester is supplied by a 50 HP, 230/460 volt, 3 phase, 60 cycle, 3600 RPM, electric motor.

**1-10. BLOWER (3).** Single stage positive displacement type that provides the air for cabin pressure. It is driven by the electric motor and provides 400 cfm at 12.5 psi.

**1-11. AFTERCOOLER (HEAT EXCHANGER) (6).** Air to air type sized to maintain blower discharge air within 15°F of the ambient air at maximum flow and pressure.




KEY

1. Cabinet
2. Electric Motor
3. Blower
4. Control Panel
5. Electrical Panel
6. Aftercooler
6A. Cabin Pressure Air Outlet
6B. Cabin Pressure Gage Connection
7. Aftercooler Fan
8. Transition Flange
9. Canopy Seal Compressor
10. Trailer and Running Gear
11. Handbrake
12. Louvers
13. Relief Valve
13A. Canopy Seal Air Supply Outlet

*Figure 1-1. Pressurized Cabin Leakage Tester*

**1-12. CANOPY SEAL COMPRESSOR (9).** A small electric motor driven air compressor that provides air to the canopy seal at 1 cfm, 65 psig max.

**1-13. ELECTRICAL PANEL (5).** Houses the necessary electrical components required to start and run the tester. See Section IV for detailed information.

**1-14. CONTROL PANEL (4).** Houses the necessary switches and gages required to start, run and control the tester. See Section IV for detailed information.

**1-15. TRAILER AND RUNNING GEAR ASSEMBLY (10).** The trailer frame is of welded steel construction. The trailer rolls easily on four steel wheels equipped with 6.90 X 9.00 inch, 6 ply tires. Individual leaf springs for each wheel gives the tester good cushioning against road shocks and rough terrain, protecting the components of the tester. A hinged towbar permits ease of positioning of the tester and towing. The front wheel steering is of the conventional type with steering knuckles, tie rods and king pins. A hand lever sets the rear wheel brakes, holding the tester in a fixed position during test operation or in parking on a grade. Two tie-down rings are provided in both the front and rear of the trailer frame to permit tie-down of the test stand for storage or shipment.

**1-16. LOUVERS (12).** Allow ambient air to enter the cooling system. The amount of air flow is controlled by the louvers which are manually set at any desired position from full closed to full open.

**1-17. PROTECTIVE DEVICES AND INSTRUMENTATION.** Protective devices and instrumentation are provided as follows: (See Figure 4-5)

a. Fuse (5). A fuse is provided for overload protection of the control circuit (115 vac).

b. Circuit Breakers (1) (2). Are provided for overload protection of the various circuits.

c. Thermal Overloads (9) (10). The motor starters (contactors) are protected by thermal overloads (heaters) against overcurrents.

d. Reverse Current Relay (3). Continuously monitors the phase relationship between each of the three incoming power lines. If an abnormal relationship exists the relay will open and protect the motor from rotating in the wrong direction (See Section IV for source phase confirmation).

e. Complete instrumentation and controls are located on the control panel. Refer to Section IV for description of functions and location of all controls.

**1-18. ELECTRICAL SYSTEM.** The electrical system provides the circuits and controls for tester functioning of electrical components. The electrical system's controls are mounted on a panel on the left side of the tester with a hinged access door to permit facility of maintenance and inspection. The tester is designed to operate on 230 volts AC, 3 phase, 60 cycle. All contactors are furnished with overload heater coils and manual resets. A control transformer (T1) is used to provide 115 volts to the control circuits. A motor start pushbutton is mounted on the control panel along with an hourmeter to record tester operating hours. The tester can be converted to 460 VAC operation. Conversion instructions are on a nameplate located in the electrical panel.

The motor is designed for two-step part winding start. When starting the unit contactor M11 (Figure 4-5) energizes only part of the motor winding thereby preventing a high initial surge of current. After a one second time delay the timer (K2) allows contactor M12 to energize the remaining part of the motor winding and the motor comes up to full speed.

**1-19. LEADING PARTICULARS.** Table 1-1, Table of Leading Particulars, provides the listing of specifications for the tester.

**1-20. CONSUMABLE MATERIAL LIST.** Refer to Table 1-2 for the list of consumable materials required to operate, service and maintain the tester.

*Table 1-1. Leading Particulars*

| | |
|---|---|
| **Operating Characteristics:** | |
| Test Medium | Compressed air |
| Pressure, Cabin | 2 through 12.5 psig range |
| Flow | 10 through 400 scfm |
| Temperature | To within 15° of ambient temperature at maximum flow and pressure |
| Pressure, Canopy Seal | 0 through 65 psig |
| Flow, Canopy Seal | 1 scfm |
| Operating Ambient Temperature Range | 0°F to +120°F |
| Altitude Operating Range | Sea Level to 6,000 ft. |
| Storage Temperature Range | -80°F to +160°F |
| Operating Positions | 8-1/2 degree incline with true horizontal plane |
| Tow Speed | 20 mph improved roads, 10 mph unimproved roads |
| Cramping Angle | 40 degrees |
| Tire Inflation | 60 psig |
| Overall Dimensions | Height: 59.0 inches<br>Length: 98.0 inches<br>Width: 62.5 inches |
| Weight | 3200 pounds |
| Electrical Power Requirements | 230 +/- 23 volts AC, 60 Hz, three phase, convertible to 460 +/- 46, volt operation |
| Oil Requirements | See figure 5-1 and check every 24 hours of operation |

*Table 1-2. Consumable Materials*

| Nomenclature | Part Number |
|---|---|
| Adhesive (stud-lock) | Loctite Corp. # 242 |
| Deleted | |
| Compound, corrosion-preventative | MIL-C-6529A |
| Compound, silicone | MIL-S-8660 |
| Desiccant, activated | MIL-D-3464 |
| Glue, Epoxy | Devcon 5 Minute Epoxy<br>Devcon Corp., Danvers, MA 01923 |
| Grease | MIL-G018790 |
| Lubricant (Blower) | Non-Detergent 30 Weight<br>Class SB |
| Paper, emery | P-P-105 |
| Powder, lapping | MIL-L-17862 |
| Sealant | VC-3 |
| Solvent, cleaning | P-D-680, Type II or III |
| Solvent, mineral spirits | MIL-C-7024 Type II |
| Tape, water resistant, pressure sensitive | PPD-T-60 |
| Tape, teflon | MIL-T-27730 |
| Solder | QQ-S-571 |
| Paint, frame, cabinet | Green 24052 per FED-STD-595 |
| Paint, pre-treat | MIL-C-15328 |
| Paint, primer, epoxy<br>Paint, primer, water borne epoxy | MIL-P-23377, Type I, Class 2<br>MIL-P-85582, Type I, Class 2 |
| Element, air intake filter | 9803K35 (McMaster-Carr) |

# SECTION II

## SPECIAL TOOLS AND TEST EQUIPMENT

**2-1. SPECIAL TOOLS AND TEST EQUIPMENT.** There are no special tools or test equipment required.

# SECTION III

# PREPARATION FOR USE AND SHIPMENT

**3-1. INTRODUCTION.** The information contained in this section describes the installation, adjustments and procedures necessary to prepare the tester for use. Also, included, are procedures for removal of the test stand if required.

**3-2. PREPARATION FOR USE.**

**3-3. UNPACKING AND INSTALLATION.** The tester is shipped completely assembled on fully inflated tires and requires no major assembly of components prior to preparing the tester for use other than the following procedures:

a. Strip waterproof tape from seams, doors and other openings of cabinet, and strip masking tape from all glass gage faces.

b. Open all cabinet doors and thoroughly inspect interior of tester. Remove all extraneous packing or cushioning material used to protect internal components during shipment. Small areas of normally exposed metal surfaces may be wrapped with protective covering or tape during shipment. Be certain all such coverings are removed.

c. Remove bags of desiccant from cabinet interior.

d. Locate and unpack accessory equipment stored in accessory box and hose storage compartment.

e. The tester is shipped wired for 230 vac, 3 phase, 60 Hz operation. To convert to 460 vac operation refer to voltage conversion this section or nameplate in electrical box.

**3-4. INITIAL INSPECTION.** It is important to carefully inspect the complete tester for possible damage which may have occurred during shipment. The following initial inspection procedures are recommended:

a. Check data appearing on tester nameplates to verify it is the type of unit designated in paragraph 1-1 of this manual. If there is any doubt, do not attempt to operate the tester in accordance with the instructions contained in this manual.

b. Remove hose assemblies from inside of tester. Inspect hose assemblies carefully for evidence of damage, breaks, or loose fittings.

c. Open control and instrument panel access door. Inspect all gages, indicators, and controls for evidence of shipping damage. Check that all parts are securely mounted. Check that all manually operated switches and controls operate freely.

d. Open access doors. Inspect plumbing installation for damaged tube assemblies, fittings and hose assemblies. Check that all fittings are securely connected and hoses are not deteriorated.

e. Carefully inspect electrical wiring for broken wires or frayed insulation. Check that all electrical connections are secure.

f. Check tires for proper inflated pressure. Normal tire pressure should be 60 ±5 psi with tires cold. Inspect tire treads and casings for cuts or abrasions and remove any imbedded objects from treads.

g. Check tow and steering assemblies. Make certain that tie rods have not been bent or damaged and that the steering apparatus swings freely.

h. Check hand brake assembly by setting hand brake and testing rear wheels for braking action.

i. Inspect tester trailer and cabinet for any damage. Make certain that all bolts and screws are secured. Check doors and door latches for proper closing and locking.

**3-5. PRELIMINARY LUBRICATION.** Check all lubrication points and lubricate the tester as required (See Figure 5-1). The blower is properly lubricated prior to shipment; no preliminary lubrication is required except to verify oil level at both ends.

**3-6. START.**

a. See Section IV for starting procedures to check-out system.

b. Refer to the troubleshooting information given in Section V if an abnormal indication is obtained while testing the system for operation.

**3-7. PREPARATION FOR STORAGE.** When a blower is taken out of service it may require internal protection against rusting or corrosion. Prepare tester for storage as follows:

a. Disconnect input power cable from external power source.

b. Check all lubrication and lubricate the tester as required.

c. Fill both ends of blower completely full of oil (above normal situation).

d. Firmly attach a very prominent tag stating that the blower is completely full of oil and must be drained to the proper level prior to start-up.

e. Apply a rust preventative grease to the drive shafts.

f. If tester is to be stored at temperatures below -40°F, drain oil from blower.

g. Desiccant is to be placed in the interior of the tester to afford protection against moisture.

h. The accessory equipment is to be packaged individually and stored in the accessory compartment. To pack the tester, proceed as follows:

(1) Locate accessory part, wrap in moisture barrier paper and store in accessory box.

(2) Install barrier material over ventilation openings.

(3) Install tape over all openings, seams, doors and panels. Check underside of unit and install tape seals over vent of air intake openings.

**3-8. PREPARATION FOR SHIPMENT.** The tester does not require an external packing container. For shipment, prepare tester in the same way as for storage, paragraph 3-7 steps a through h.

**CAUTION**

When accomplishing electrical conversions for part number 10037-30 refer to section 8-2, difference data sheets.

**3-9. OPERATION AT 230 V OR 460 V.** The unit is designed for 230 V operation and can be converted to 460 V. Both conditions are explained below and shown in Figure 3-1. Prior to usage the user should check the electrical panel against Figure 3-1 to positively determine what state of operation (230 or 460) the unit is currently in. The entire conversion can be accomplished within the electrical panel Figure 4-5.

**CAUTION**

When accomplishing electrical conversions for part number 10037-30 refer to section 8-2, difference data sheets.

**3-10. CONVERSION TO 460 V (FROM 230 V).**

a. Main Electric Motor (Figure 3-1)

(1) Disconnect from overload OL11 the electric motor lines 7, 8, and 9. Reconnect line 7 to OL12 line 1 position, line 8 to OL12 line 2 position and line 9 to OL12 line 3 position.

(2) From timer (7, Figure 4-5) remove the top right jumper and store on TB2 (14) terminals 1 and 2 (bottom).

b. Air Compressor Motor

(1) From TB2 remove metal jumper tabs located at terminals 4, 5, 6 and store in terminals 1 and 2 (top).

(2) On motor starter M2 (11, Figure 4-5) disconnect (at starter end only) wires coming from TB2 terminal 9, terminal 8, and terminal 7. Connect loose end of terminal 9 wire to TB2 terminal 6, terminal 8 to terminal 5, and terminal 7 to terminal 4 respectively (See Figure 3-1).

c. Transformer (4, Figure 4-5)

(1) Disconnect at terminal H1 (Figure 3-1) jumper (J1) coming from H3 and reconnect to H2.

(2) Disconnect at terminal H4 jumper (J2) coming from H2 and reconnect at H3.

d. When completed, wiring should be as shown on Figure 3-1, 460 V operation.

**CAUTION**

When accomplishing electrical conversions for part number 10037-30 refer to section 8-2, difference data sheets.

**3-11. CONVERSION TO 230 V (FROM 460 V).**

a. Transformer (Figure 3-1)

(1) Disconnect at terminal H2 (Figure 3-1) jumper coming from H3 and reconnect at H1.

(2) Disconnect at H3 jumper coming from H2 and reconnect at H4.

b. Air Compressor

(1) On TB2 (14, Figure 4-5) disconnect wire on terminal 4 and reconnect at motor starter M2 line 1 position (Figure 3-1).

(2) On TB2 disconnect wire at terminal 5 and reconnect on motor starter M2 line 2 position.

(3) On TB2 disconnect wire at terminal 6 and reconnect on motor starter M2 line 3 position.

(4) On TB2 remove metal jumper tabs from terminals 1 and 2 and insert into terminals 4, 5 and 6.

c. Main Electric Motor (Figure 3-1)

(1) Disconnect from overload OL12 the electric motorlines 7, 8, and 9. Reconnect line 7 to OL11 line 1 position, line 8 to OL11 line 2 position, and line 9 to OL11 line 3 position.

(2) On timer (7, Figure 4-5) add jumper stored on TB2 terminals 1 and 2, to the top right position on timer.

d. When completed, wiring should be as shown on Figure 3-1, 230 V operation.

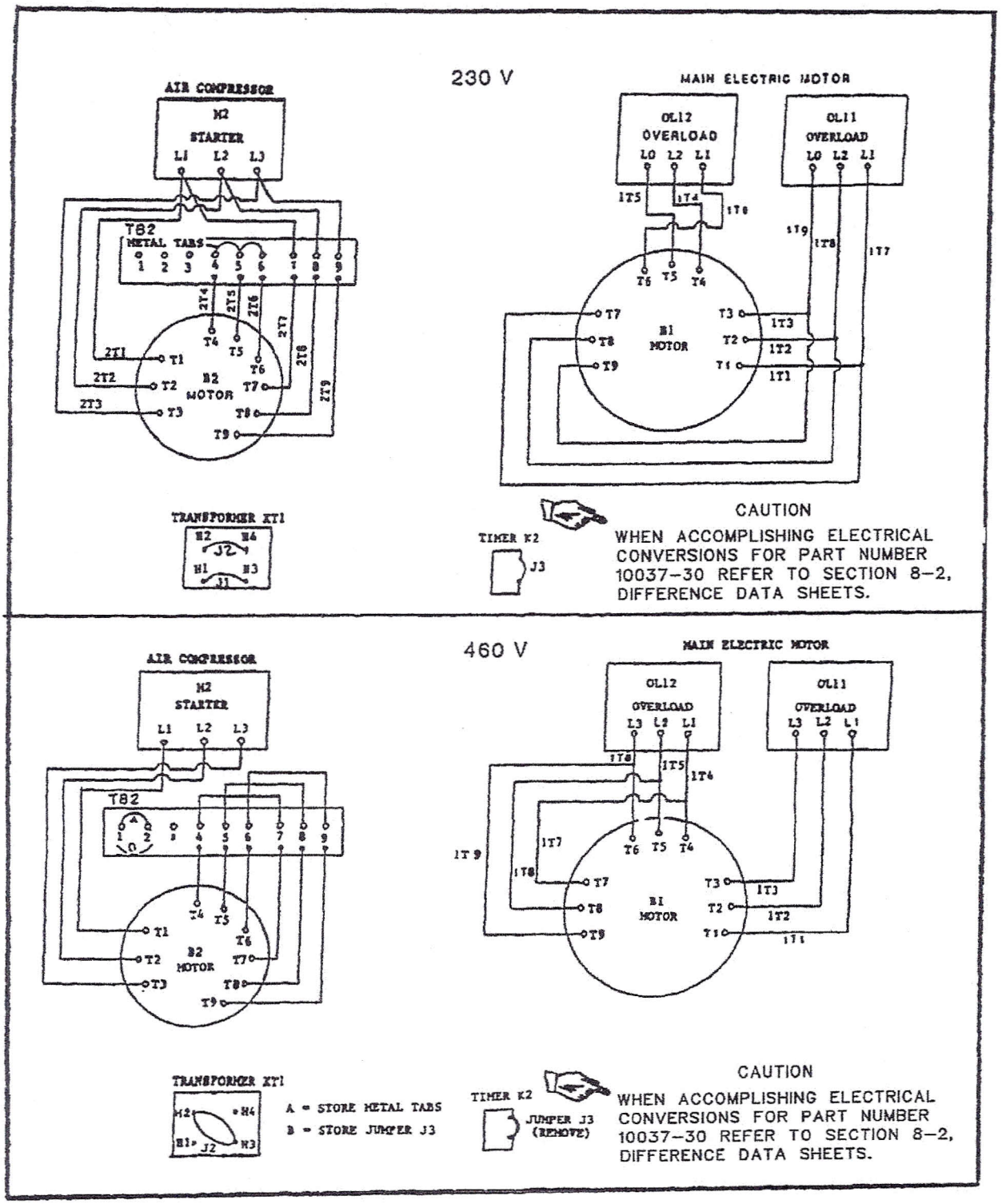



*Figure 3-1. Electrical Conversion*

# SECTION IV

# OPERATING INSTRUCTIONS

**4-1. GENERAL.** This section provides detailed description and the location of all operating controls and instruments, and step-by-step operating instructions for the tester. Operator should be familiar with all this section before attempting to operate the unit.

Personnel operating the tester must be familiar with the location and function of all controls and instruments and have a thorough knowledge of the principles of operation involved.

**4-2. THEORY OF OPERATION.**

**4-3. PRESSURIZATION SYSTEM.** (See Figure 6-1). The system consists of an electric motor-driven, lobe type single stage blower, an air-to-air aftercooler, a main relief valve, a rate valve and a direct reading flowmeter.

a. Cabin pressure on the aircraft is controlled by relief valve (6) which will open when the desired pressure is exceeded. This desired pressure (up to 12.5 psi) is established in the relief valve by the cabin pressure adjust valve (19). The speed at which a desired pressure is reached, either increasing or decreasing, is determined by the rate adjust valve (20).

b. Flowmeter (7) is a float-type, direct reading meter and indicates the air flow (leakage rate) to the aircraft cabin.

**4-4. CANOPY SEAL SYSTEM.** (See Figure 6-1). The system consists of an air compressor (18), driven by an electric motor, a pressure regulator (17), adjustable up to 65 psig and a panel mounted pressure gage (16).

**4-5. OPERATING CONTROLS AND INSTRUMENTS.**

4-6. All operating controls and instruments are conveniently grouped and clearly nameplated for ease of single operator operation. Operating controls and instruments are listed and described in Table 4-1 and their location shown in Figure 4-1.

**4-7. INTERPRETATION OF INSTRUMENTS.**

**4-8. BLOWER PRESSURE.** Gage (1, Figure 4-1) indicates air pressure in pounds per square inch being delivered by the blower. CABIN PRESSURE gage (4) indicates pressure in pounds per square inch in the aircraft cabin. RATE OF CLIMB indicator (2) indicates rate of increasing or decreasing air pressure in cabin of the aircraft being tested. Rate of pressure change is indicated in feet per minute altitude change. AIR TEMPERATURE gage (6) indicates the temperature of the air being supplied to the aircraft cabin. CANOPY SEAL PRESSURE gage (7) indicated air pressure applied to the canopy seal.

**4-9. READING THE FLOWMETER.**

4-10. Flowmeter (13, Figure 4-1) is used to determine the amount of air leaking from the aircraft. To interpret the flowmeter, reference must be made to BLOWER PRESSURE gage (1) and RATE OF CLIMB indicator (2). Flowmeter reading should be made when the CABIN PRESSURE gage (4) indicates required test pressure and the RATE OF CLIMB indicator (2) indicates no change. Find the point on the flowmeter scale (Figure 4-2) where the vertical line, representing BLOWER PRESSURE, intersects the top edge of the float (largest diameter) around the flowmeter float. The point of intersection will fall on/or near one of the diagonal lines, read the flow directly in cubic feet per minute.

**NOTE**

Intervals of 10 cubic feet per minute are represented by lines and numerals, intermediate points must be determined by estimating the distance above or below the nearest 10 cubic feet per minute division.

Air flow within the range of the flowmeter can be read directly from the flowmeter scale by using the proper pressure line as a reference.

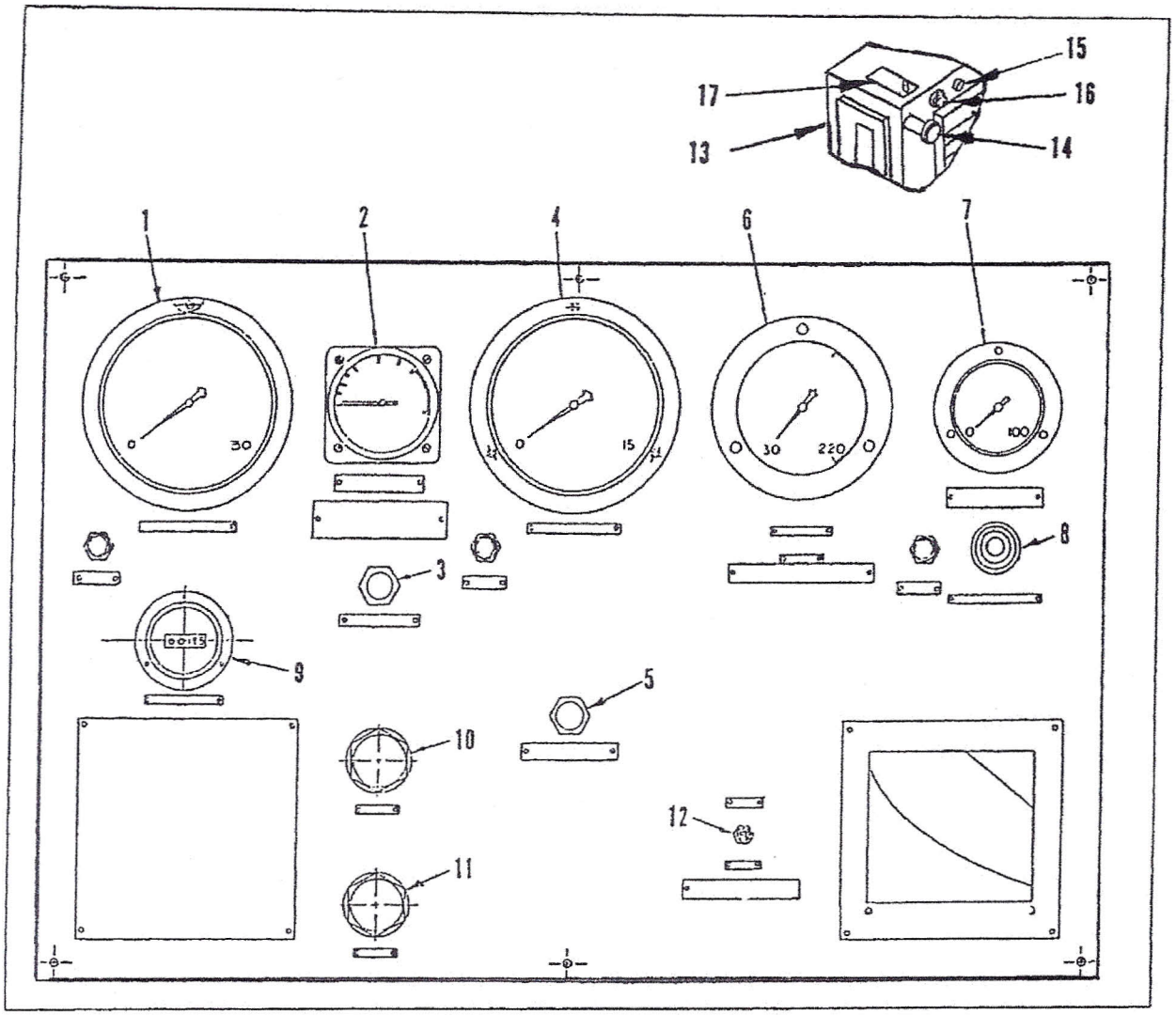



*Figure 4-1. Operating Controls and Instruments*

*Table 4-1. Operating Controls and Instruments*

| FIG. 4-1 INDEX NO. | CONTROL or INDICATOR | FUNCTION |
|---|---|---|
| 1 | BLOWER PRESSURE Gage | Indicates system output pressure, 0 to 30 psi range. |
| 2 | RATE OF CLIMB Indicator | Indicates rate of increasing or decreasing cabin pressure, 0 to 6000 feet per minute UP/DOWN. |
| 3 | RATE CONTROL VALVE | Sets and regulates rate of cabin pressure change, increasing or decreasing. |

*Table 4-1. Operating Controls and Instruments (Cont)*

| FIG. 4-1 INDEX NO. | CONTROL or INDICATOR | FUNCTION |
|---|---|---|
| 4 | CABIN PRESSURE Gage | Indicates cabin pressure, 0 to 15 psi range. |
| 5 | CABIN PRESSURE ADJUSTMENT | Manual adjustment for setting cabin pressure, 2 through 12.5 psi adjustable range. |
| 6 | AIR TEMPERATURE Gage | Indicates temperature of discharge air, +30 to +220. Red lined from +120 to +220. |
| 7 | CANOPY SEAL PRESSURE | Indicates canopy seal pressure, 0 to 100 psi range. |
| 8 | CANOPY SEAL AIR REGULATOR | Manual adjustment for regulating canopy seal pressure. |
| 9 | Hourmeter | Totalizes operational hours. |
| 10 | START Button | Energize blower drive motor power circuit. |
| 11 | STOP Button | De-engergize blower drive motor power circuit. |
| 12 | CANOPY SEAL COMPRESSOR START-STOP SWITCH | Energizes canopy seal compressor motor. |
| 13 | Flowmeter | Indicates flow rate to aircraft cabin, 10 to 400 scfm. |
| 14 | Air outlet connection | Air outlet connection, tester to aircraft cabin. |
| 15 | CABIN PRESSURE | Pressure connection, aircraft cabin to tester CABIN PRESSURE gauge (4). |
| 16 | CANOPY SEAL Connection | Pressure outlet, tester to aircraft canopy seal. |
| 17 | BYPASS VALVE | Bypasses air flow during start-up and shutdown. |

**4-11. TEMPERATURE CORRECTION.** The flowmeter is calibrated for standard cfm air at 70°F; therefore, when the temperature of the air flowing through the flowmeter varies from 70°F, a temperature correction factor must be applied to the indicated air temperature. Example: When indicated air temperature is 90°F, refer to Temperature-Correction Chart on the flowmeter panel or to Figure 4-3 and locate the vertical line that represents 90°F. Follow this line up until it intersects the diagonal line on the chart. Refer to the left-hand margin of the chart and note the number; the number is 0.98. This is the temperature correction factor for 90°F. Multiplying the indicated flow, 110 cfm, by the correction factor, 0.98, gives the corrected flow 107.8 cfm. Indicated airflows at any temperature readings within the limits of the flowmeter Temperature-Correction Chart may be corrected to 70°F by mploying this method.

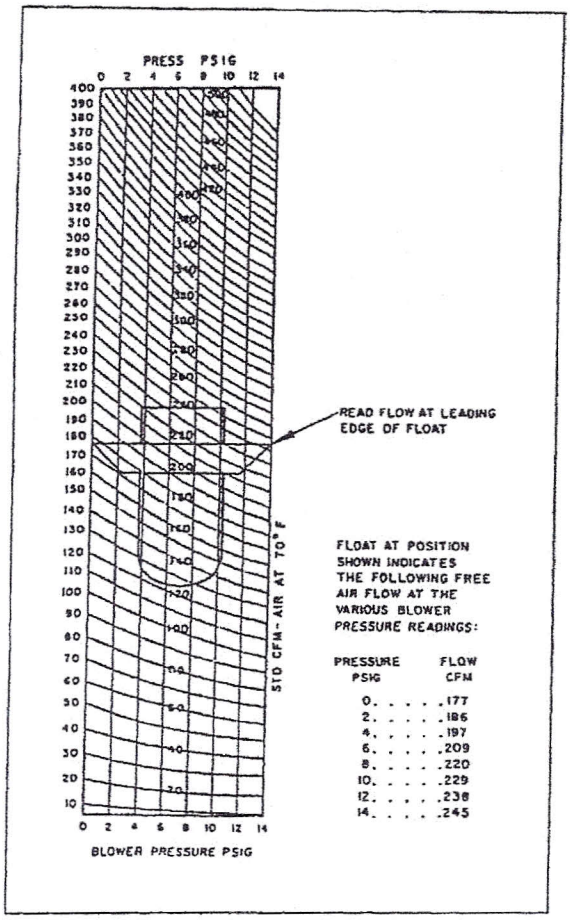



*Figure 4-2. Flowmeter Scale*

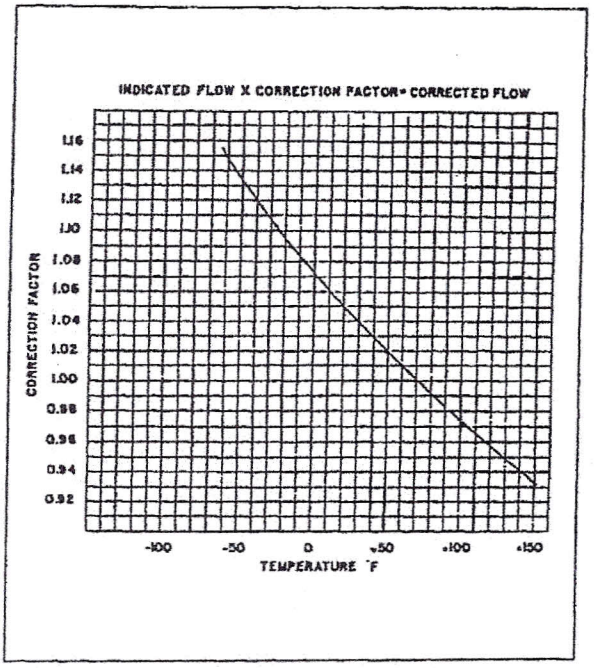
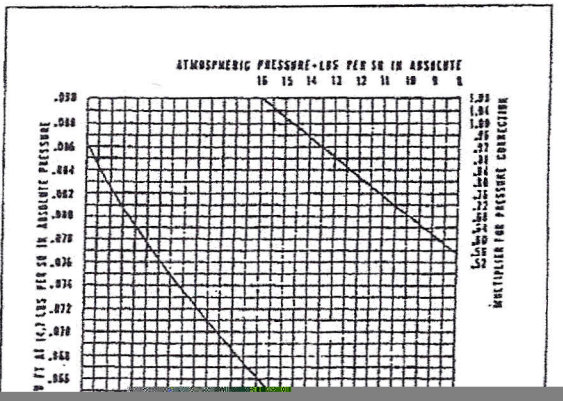



*Figure 4-3. Flow Temperature Correction Chart*




**4-12. CONVERTION OF CFM TO POUNDS PER MINUTE.** (See Figure 4-4.) To convert corrected flow from cubic feet per minute to pounds per minute, multiply corrected flow by 0.75 lbs. (This is approximate weight of one cubic foot of air at 70°F and 14.7 psia). For conversions at other temperature and barometric pressures, see the chart on instru-

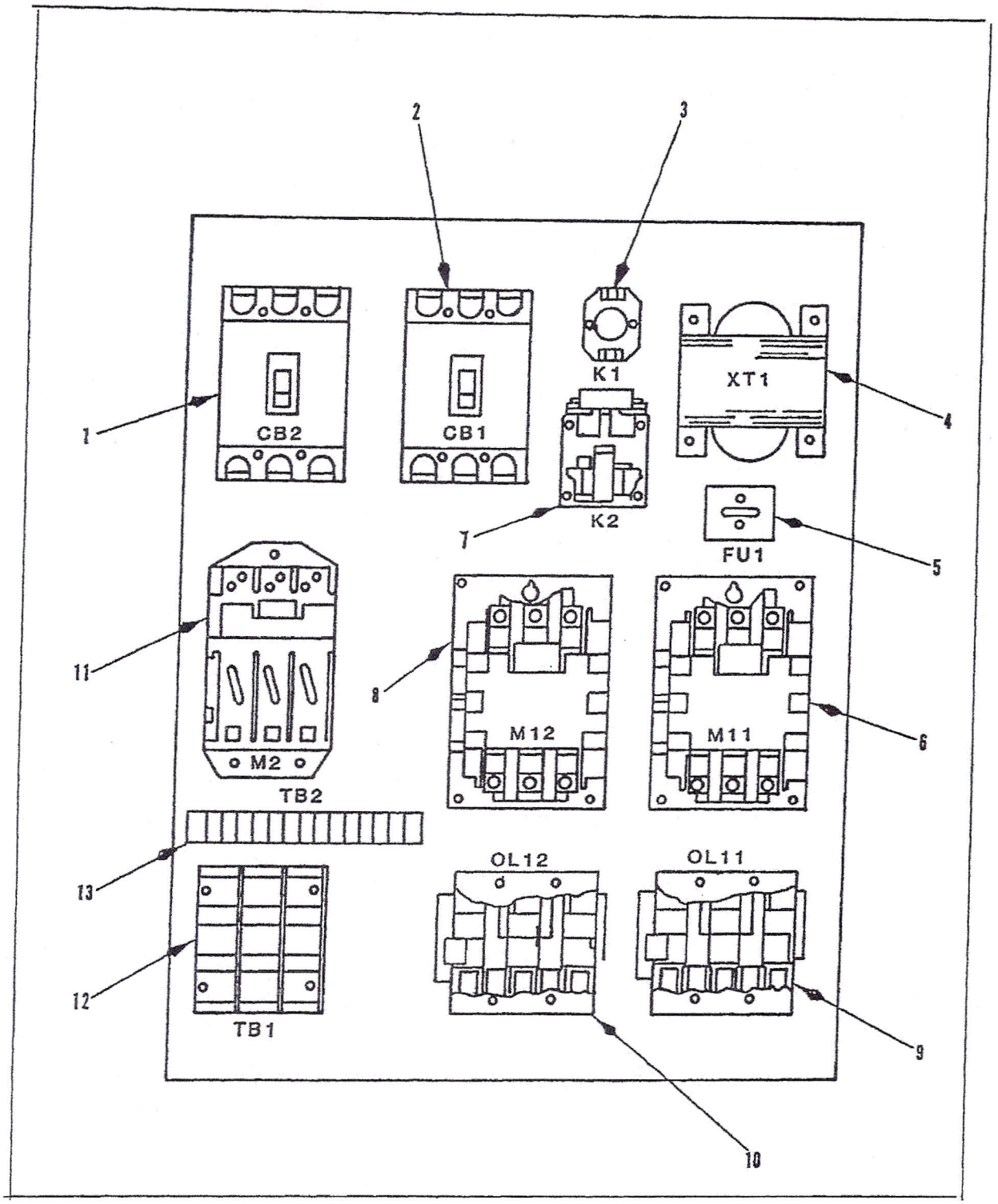



*Figure 4-5. Electrical Panel Controls*

*Table 4-2. Electrical Panel Controls*

| FIG. 4-5 INDEX NO. | PANEL ITEM | FUNCTION or OPERATION |
|---|---|---|
| 1 | CIRCUIT BREAKER (CB2) | Overload protection for compressor starter. |
| 2 | CIRCUIT BREAKER (CB1) | Overload protection for main motor starters. |
| 3 | PHASE REVERSAL RELAY (K1) | Disables power to motor when phase rotation is incorrect. |
| 4 | TRANSFORMER (XT1) | Provides 115 vac control power. |
| 5 | FUSE (FU1) | Circuit protection for transformer. |
| 6 | MOTOR STARTER (M11) | Starter for first portion of main motor winding. |
| 7 | TIMER RELAY (K2) | Delays start of second portion of main motor winding for 1 second. |
| 8 | MOTOR STARTER (M12) | Starter for second portion of main motor winding. |
| 9 | OVERLOAD RELAY (OL11) | Provides overload protection to first portion of main motor winding. |
| 10 | OVERLOAD RELAY (OL12) | Provides overload protection for second portion of main motor winding. |
| 11 | MOTOR STARTER (M2) | Starter for air compressor motor. |
| 12 | DISTRIBUTION BLOCK (TB1) | Distributes power from main power cable to the various circuits. |
| 13 | TERMINAL BOARD (TB2) | Board for control wires distribution to panel items |

**4-13. OPERATING INSTRUCTIONS.**

**4-14. POWER SOURCE OUTLET CONFIRMATION.** This procedure will be used for confirmation of the power source outlet to ensure proper phase rotation. It will be used if a change of outlets occurs and the phase for the new outlet is unknown (e.g., different line). Once an outlet has been confirmed this procedure no longer applies.

**CAUTION**

Improper phase will cause the motor to spin in reverse causing serious damage to equipment.

a. Remove removable section of cabinet to observe motor.

b. Momentarily push in the starter button for motor (to jog it) and check for proper rotation. The proper rotation is indicated by arrows on the motor or blower.

c. If rotation is reversed.

(1) Disconnect power cable.

(2) Have electrician interchange any two power cable leads at distribution block (12, Figure 4-5).

**4-15. CONNECTING TESTER TO AIRCRAFT.** (See Figure 4-6). The tester is connected to the aircraft by three 25 foot hoses. One hose is a three-inch diameter hose (7) and the other two are small diameter rubber covered flexible hoses (1 and 4). The hoses are stowed on hose racks located in front of the tester. Make sure the three-inch hose is properly installed over outlet fitting before securing with clamp. Connect the tester to aircraft as follows:

a. Uncoil and assemble the three-inch hose (7) to the tester air outlet connection.

b. Select the appropriate aircraft adapter (9 or 11).

c. Connect hose (7) to the aircraft adapter.

d. Use the hose clamps (8) to secure the hose at tester and aircraft adapter.

**CAUTION**

Check all hose and tubing connections, leakage in the hose or instrument lines will cause inaccurate gage indications. Serious damage to aircraft structure could result. Do not remove caps from CANOPY SEAL or CABIN PRESSURE fittings prior to verifying that systems are at zero pressure. Remove caps slowly.

e. Connect hose (4) between the tester CANOPY SEAL fitting (if applicable) and hose (1) to the CABIN PRESSURE fitting and the corresponding test connections on the aircraft. Check the applicable Technical Manual for the aircraft being tested for location of test connections on the aircraft.

**4-16. GENERAL OPERATING INSTRUCTIONS.** When operating the tester, the operator should not leave the instrument panel unattended and should constantly observe the BLOWER PRESSURE, CABIN PRESSURE, RATE OF CLIMB indicator, CANOPY SEAL PRESSURE, AIR TEMPERATURE gage and flowmeter. Do not operate tester with hoses (1, 4, 7) installed unless free ends are secured or installed on aircraft. If mechanics are to be inside the aircraft during the pressure test, personnel intercommunication should be provided between the tester operator and personnel inside the aircraft.

**WARNING**

When reducing cabin pressure with personnel inside the aircraft, reduction of pressure must be slow and gradual to prevent injury.

4-17. When resetting tester for new test pressure requirements, always follow procedure outlined in paragraph 4-21 or 4-22.

**4-18. TEST OPERATION.**

**4-19. PRE-START PROCEDURES.** (See Figure 4-1).

a. Preliminary

(1) Set parking brakes.

(2) Tow-bar to up position.

b. Inspection

(1) Check to see that louvers are open in front of tester.

(2) Check blower oil level through access door (flashlight may be required).

(3) Check electrical panel door is secure.

(4) Check blower air inlet on top of tester is clear and filter in place.

(5) Open control panel door and check canopy air compressor switch is in off position.

(6) Connect power cable to power source.

(7) Properly connect tester to aircraft with tester air hoses and adapters.

c. Turn pressure adjustment (5) clockwise until the dial indicator is set on the desired cabin test pressure.

d. Turn RATE CONTROL VALVE (3) clockwise to the fully closed position and then back off one full turn.

e. Back out CANOPY PRESSURE REGULATOR (8) counterclockwise until control turns freely.

f. Open Bypass Valve.

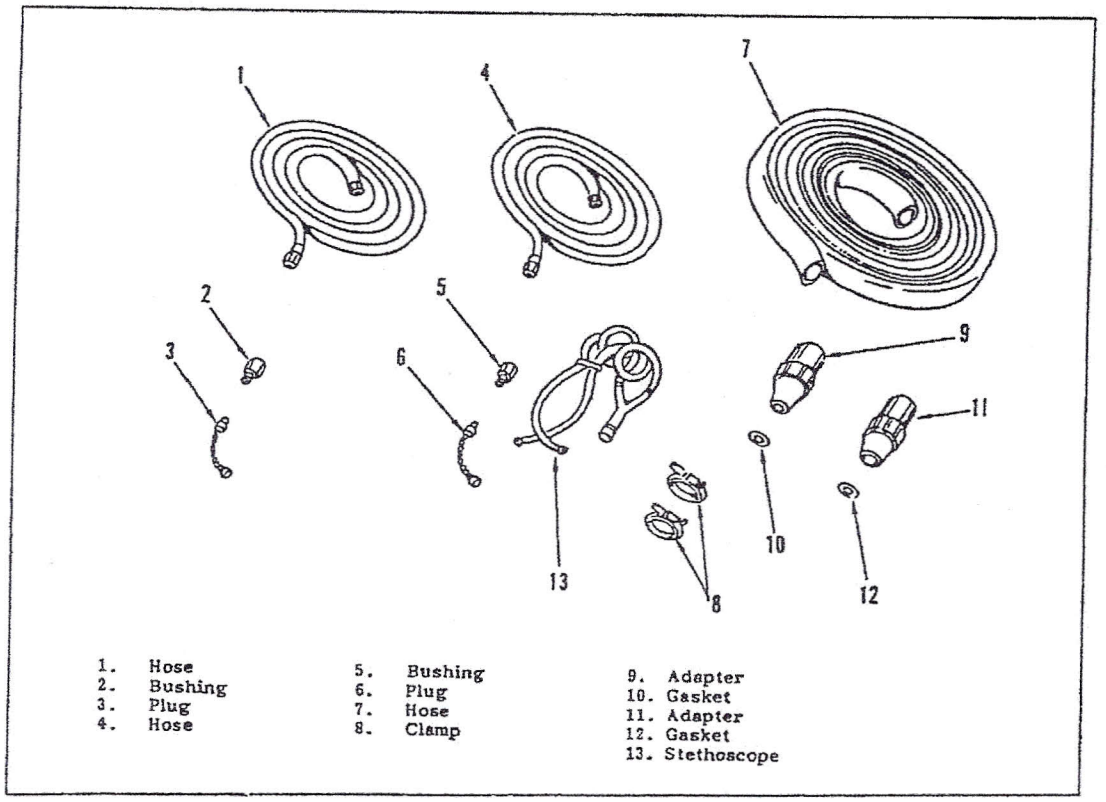



*Figure 4-6. Accessory Equipment*

**4-20. NORMAL START.** (See Figure 4-1)

a. Press START button (10).

b. If canopy seal pressure is required, set CANOPY SEAL COMPRESSOR START-STOP SWITCH (12) to ON. Adjust pressure by turning the CANOPY SEAL AIR REGULATOR (8) clockwise until the CANOPY SEAL PRESSURE gage (7) indicates the required pressure, 65 psig maximum.

c. Turn RATE CONTROL VALVE (3) counterclockwise one-half turn and allow approximately two minutes for control pressure to build up in the relief valve. Observe RATE OF CLIMB indicator (2) closely during this operation and when the gage needle starts to indicate rising cabin pressure, proceed immediately to step (d) and watch that air temperature does not exceed 120°F.

**CAUTION**

Cabin pressure should not be increased or decreased at rates above 250 feet per minute at flows from 50 to 400 cfm, or above 500 feet per minute at flows from 10 to 50 cfm.

d. Adjust tester for desired rate pressure increase by turning RATE CONTROL VALVE (3) clockwise (to decrease) or counterclockwise (to increase) slowly in 1/16 of a turn increments, allow system time to stabilize between adjustments to avoid exceeding desired rate, until desired rate of increase is indicated on RATE OF CLIMB indicator (2). As the cabin pressure increases, indicated on CABIN PRESSURE gage (4), it may be necessary to re-adjust the RATE CONTROL VALVE (3) from time to time to maintain desired rate of increase.

e. Slowly close Bypass Valve (17).

f. When the cabin is pressurized to test pressure requirements, as indicated on CABIN PRESSURE gage (4), and the RATE OF CLIMB indicator (2) reads approximately zero ±200 feet, determine rate of cabin leakage by reading flowmeter (13). (Refer to paragraph 4-9)

(1) If the cabin test pressure is above test requirements, make adjustments in accordance with paragraph 4-21 (re-adjusting tester for lower test pressure).

(2) If cabin test pressure is below test requirements make adjustments in accordance with paragraph 4-22 (re-adjusting tester for higher test pressure).

g. Use the stethoscope, furnished as an accessory, to detect leakage along the seams, joints and points where lines pass through the skin of the aircraft.

**4-21. READJUST TESTER FOR LOWER TEST PRESSURES.** Always decrease the cabin pressure to a point below the new test pressure, before resetting pressure. Readjust tester as follows: (See Figure 4-1)

a. Set PRESSURE ADJUSTMENT (5) to 2 psig below former test pressure. Cabin pressure will decrease at preset rate.

b. When CABIN PRESSURE gage (4) reads approximately 2 psig below former test pressure turn PRESSURE ADJUSTMENT (5) clockwise until dial indicator is set on the desired new test pressure, cabin pressure will increase to new setting at preset rate.

c. Proceed with test operations.

**4-22. READJUSTING TESTER FOR HIGHER TEST PRESSURES.** Always decrease the cabin pressure to a point below the former test pressure before resetting pressure. Readjust tester as follows: (See Figure 4-1)

a. Set PRESSURE ADJUSTMENT (5) to 2 psig below former test pressure. Cabin pressure will decrease at present rate.

b. When CABIN PRESSURE gage (4) reads approximately 2 psig below former test pressure turn PRESSURE ADJUSTMENT (5) clockwise until the dial indicator is set on the desired new test pressure, cabin pressure will increase to new setting at present rate.

c. Proceed with test operations, in accordance with paragraph 4-20, steps c and g.

**4-23. COLD WEATHER OPERATION.** Conditioning the tester consists mainly of replacing lubricants with cold weather types. To accomplish the following operations, the tester must be exposed to an ambient temperature not lower than +65°F to insure complete drainage. To prepare tester, proceed as follows:

a. Drain blower gear case and refill with oil, in accordance with Figure 5-1.

b. Verify that blower intake filter is free of ice or any other restriction.

**4-24. NORMAL STOP.**

a. As the cabin pressure decreases, indicated on CABIN PRESSURE gage (4), it may be necessary to readjust the RATE CONTROL VALVE (5) from time to time to maintain the desired rate of decrease.

**NOTE**

If safety conditions permit, i.e., no personnel inside the aircraft, cabin pressure may be dumped quickly by turning the air bypass (dump) valve (8, Figure 6-1).

b. When RATE OF CLIMB indicator (2) reads zero, and RATE CONTROL VALVE (5) is open two full turns, turn CANOPY SEAL AIR REGULATOR (8) counterclockwise until it turns freely, and set CANOPY SEAL COMPRESSOR START-STOP SWITCH (12) at OFF.

c. Open Bypass Valve (17).

d. Press STOP switch (11).

e. Close louvers and the air intake door, also the instrument panel doors.

f. Disconnect tester from aircraft and tester input power cable from source and place the power cable and hoses on the hooks provided.

**4-25. EMERGENCY STOP.** Push STOP button.

# SECTION V

# MAINTENANCE INSTRUCTIONS

**5-1. GENERAL.** Maintenance of the tester consists of periodic inspection, cleaning, service adjustment, minor repairs or replacement of parts and components, and lubrication of main motor. The procedures described in this section must be performed regularly and thoroughly, even though the tester is operating satisfactorily. Through proper inspection, maintenance and lubrication, equipment that is not in continous use is kept ready for operation when necessary, and the unit is maintained at peak performance levels for the maximum life of the equipment.

**5-2. COMPONENT REMOVAL.** When it is necessary to remove any components from the tester observe the following precautions and general practices.

**WARNING**

Release all system pressure prior to removal of components and ensure the input power is disconnected to avoid possible injury to personnel.

**CAUTION**

Do not use adjustable jaw-type wrenches on tube fittings. Slippage may result in damage to hexagonal fitting surfaces.

a. Make certain all air pressure is completely relieved before removing air system components.

b. Do not attempt to remove or repair any electrical component unless input power is disconnected.

c. If it is necessary to remove system lines connected to air components, loosen fitting at end of each line, and remove attaching parts securing component to structure. Do not bend system lines on removal, as thread damage or misalignment may result. Cap or plug open lines or ports with protective closures.

d. When removing electrical components, disconnect electrical leads from terminals and tag each for ease of identification during reassembly.

**5-3. SERVICE/PERIODIC INSPECTION.** Refer to Table 5-1 for requirements. The following precautions should be observed when servicing the tester in accordance with Periodic Inspection Workcards T.O. 33A4-4-116WC-1.

a. Always disconnect input power, power cable from power source prior to performing any inspection or maintenance procedure.

**WARNING**

Blower casing and associated piping may become hot enough to cause major burns on contact.

b. Do not perform any inspection or maintenance procedures on any internal components immediately after operation due to high heat build-up.

c. Do not remove caps from CABIN PRESSURE or CANOPY PRESSURE fittings prior to verifying zero system pressure, always remove caps slowly.

d. One person should not attempt to remove the removable cabinet section.

e. Do not operate tester with either cabinet section open or removed due to exposure to rotating components and high noise levels.

**WARNING**

Internal and external rotating parts of blower and driving equipment can produce serious physical injuries. Do not reach into any opening in blower while it is operating.

f. Do not operate tester with free end of hoses (1, 4, or 7, Figure 4-6) free. Always remove hoses or secure free ends to prevent whipping.

**5-4. PREVENTATIVE MAINTENANCE.** Maintenance is generally limited to cleaning, service adjustments, and minor repair or replacement of parts and components that require attention through normal service use. Generally, the instructions consist of carefully noting method of installation when removing defective parts, performing the

necessary minor repair, or adjustment, and installing parts in reverse order of removal.

**5-5. LUBRICATION.** Perform in accordance with Periodic Inspection Workcards T.O. 33A4-4-1-166WC-1, Figure 5-1., and Table 5-1.

**5-6. OPERATIONAL CHECKOUT.**

5-7. The following checkout procedures will be performed as required and after overhaul of a component or complete tester to verify operational performance. Position tester, set parking brakes and proceed as follows (See Figure 4-1 and Table 4-1):

**WARNING**

Unless absolutely necessary, do not operate tester with cabinet sections open because of exposure to rotating equipment and high noise levels.

**CAUTION**

No attempt should ever be made to control the blower air capacity by means of a throttle valve in the air intake or exhaust. This will increase the power load on the drive system, increase operating temperatures, and can overload and/or seriously damage the blower.

a. Install a throttling valve, with a pressure tap on the inlet side of the valve, to the outlet of the three-inch cabin pressure hose (14).

b. Connect cabin pressure gage hose (15) to throttling valve pressure tap. Open valve.

c. Install a throttling valve at outlet of canopy seal pressure hose (16), open throttling valve.

d. Open heat exchanger louvers, the air intake doors and the instrument panel doors.

e. Turn PRESSURE ADJUSTMENT (5) knob counterclockwise until pressure (2 psi) is indicated on dial.

f. Turn RATE CONTROL VALVE (3) clockwise to the fully closed position.

g. Connect input power cable to power source.

h. Back out CANOPY AIR REGULATOR (8) counterclockwise until control turns freely.

i. Press START button (10).

j. Adjust external throttling valve to restrict air flow. Turn RATE CONTROL VALVE (3) counterclockwise one and one-half turns and allow approximately two minutes for control pressure to build up in the rate valve. Observe RATE OF CLIMB indicator (2) closely during this operation and when the gage needle starts to indicate rising cabin pressure, proceed to step k. Maximum tester output will exceed 400 cfm at 12.5 psig at sea level.

k. Adjust tester for desired rate of pressure increase by turning RATE CONTROL VALVE (3) clockwise slowly in 1/16 of a turn increments, allowing time for system to stabilize between adjustments to avoid exceeding desired rate, until desired rate of increase is indicated on the RATE OF CLIMB indicator (2).

l. As the cabin pressure increases, indicated on CABIN PRESSURE GAGE (4), it may be necessary to readjust RATE CONTROL VALVE (3) from time to time to maintain the desired rate of increase.

m. Set CANOPY SEAL COMPRESSOR START-STOP SWITCH (12) at ON. Check canopy seal pressure; increased pressure adjustment is made by turning the CANOPY SEAL AIR REGULATOR (8) clockwise and throttling output with external throttling valve until the CANOPY SEAL PRESSURE gage (7) indicates the desired pressure. Maximum external throttling valve until the CANOPY SEAL PRESSURE gage (7) indicates the desired pressure. Maximum output is 65 psig. Set CANOPY SEAL COMPRESSOR START-STOP SWITCH at OFF.

5-8. Stop test operation as follows:

a. Position RATE CONTROL VALVE (3) to DECREASE.

b. Rate of decrease is indicated on RATE OF CLIMB indicator (2).

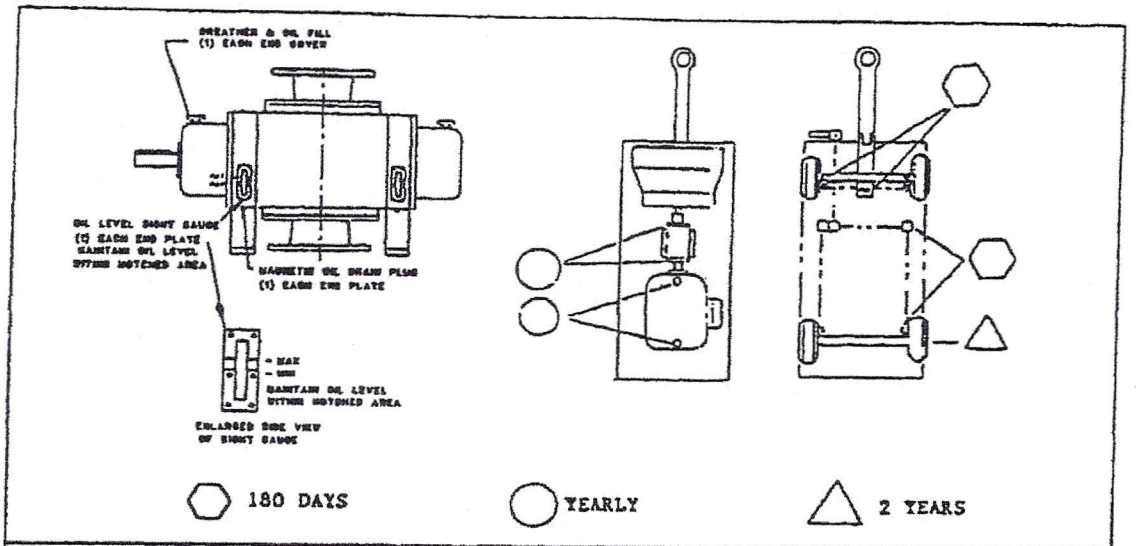
c. When RATE OF CLIMB indicator reads zero, and RATE CONTROL VALVE is open two full turns, turn CANOPY SEAL AIR REGULATOR (8) counterclockwise until it turns freely.

d. Press STOP button (11).

e. Disconnect the cable and hoses and place on hooks, close all doors and louvers.

**5-9. TROUBLESHOOTING.**

5-10. When tester operates in a faulty or erratic manner, check item listed in Table 5-2, Troubleshooting Chart for the trouble, probable cause, and remedy.




| ITEM | LUBRICANT (SPECIFICATION) | PROCEDURE |
|---|---|---|
| Blower Gear and Bearing Housing (250-1000 hours depending on conditions) | MIL-L-2104 below 30 Degrees F. Grade 20 WT.<br>MIL-L-2104 30-90 Degrees F. Grade 30 WT.<br>Above 90° MIL-L-2104 Grade 40 WT.<br><br>MIL-G-81322B (Grease) | Open rear cabinet section. Remove BLOWER DRAIN plugs, replace when case is drained. Remove breathers and slowly fill each end until oil comes up to proper level on sight gage. Replace breathers when complete.<br>Apply grease with gun until a small amount of grease appears at relief fittings located immediately below fitting.<br><br>NOTE: Protect foam below blower from oil during this operation. |
| Trailer Assembly (180 days) | MIL-G-10924 | Apply with grease gun to zert fittings on steering tie rod ends, front wheel king pins. |
| Miscellaneous (180 days) | MIL-L-15016 | Door hinges and latches.<br>Towbar pin.<br>Parking brake linkage. |
| Wheel Bearing (2 years) | MIL-G-10924 | Hand pack wheel bearings. |
| Electric Motor (Yearly) | MIL-G-18709 | Relubricate with motor warm. Remove relief hole plugs from both ends of motor. Using a low pressure hand operated grease gun, pump grease until new grease appears at the relief holes. Operate motor 10 minutes before replacing relief plugs. |
| Compressor Motor | None | Motor requires no lubrication. |
| Relief Valve Actuator | MIL-G-18709 | Grease O'Ring annually (See paragraph 5-17) |

*Figure 5-1. Lubrication Chart*

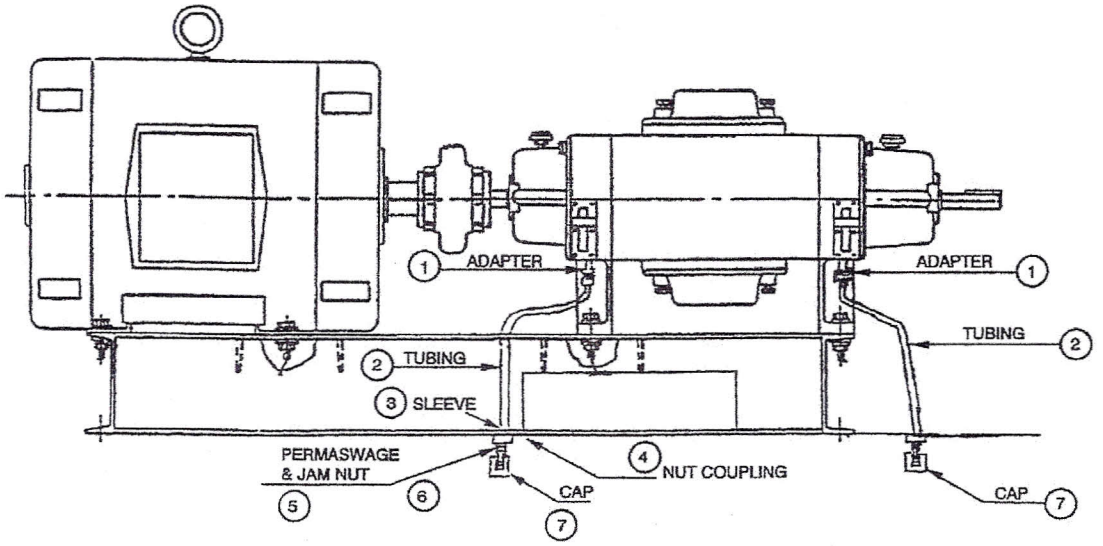
*Table 5-1. Inspection and Maintenance Chart*

1. Service checks are to be performed only when tester is used. If used intermittently, check before use.
2. If visual inspection indicates dirt and dust buildup on noise suppression foam, remove by light vacuum action. Do not wash interior of unit.

| ITEM | INSPECTION PERIOD | INSPECTION |
|---|---|---|
| Cabinet Interior | Service | Check all plumbing and hoses for obvious air leakage. While making this check, operate the tester with controls set as in paragraph 4-19 and 4-20. |
| Blower Chart and Bearing Housings | 180 days | Check oil level. Remove blower oil level plugs, one in each housing, oil should drip from port. Fill until oil drips from ports, replace plugs. Refer to Figure 5-1. |
| Air Intake Filter | 180 days | Remove filter, located on top of tester, wash in mild detergent solution, dry with oil-free compressed air. |
| Heat Exchanger | 180 days | Inspect for accumulation of dirt, insects, etc., that would obstruct flow of cooling air. Clean as necessary. |
| Gages | 180 days | Calibrate. (Refer to paragraph 5-13) |
| Blower and Motor Shafts | 180 days | Apply a light coat of grease, MIL-G-10924, to both shafts to prevent corrosion. |
| Blower Gear and Bearing Housings | Yearly | Drain and refill gear case with non-detergent oil. Refer to Figure 5-1. |
| Electric Motor | Yearly | Lubricate. Refer to Figure 5-1. |
| Filter, Compressor | 30 days | Check for cleanliness (See paragraph 5-16) |

NOTE

IF USERS FIND IT DIFFICULT TO CHANGE OIL IN THE BLOWER. USERS ARE AUTHORIZED TO INSTALL DRAIN TUBES (SEE FIGS 5-1A AND 5-1B FOR A REPRESENTATIVE INSTALLATION).




| ITEM | PART NO. | NSN | QUANTITY |
|---|---|---|---|
| 1. ADAPTER | AN816-4-4D | 4730-00-187-0087 | 2 EA |
| 2. TUBE | 8837-194 | 4710-00-278-3294 | 2 EA |
| 3. SLEEVE | MS20819-4 | 4730-00-278-0678 | AS REQUIRED |
| 4. NUT COUPLING | AN818-4 | 4730-00-222-1912 | AS REQUIRED |
| 5. PERMASWAGE TUBE | AC1035C04 | 4730-00-432-1137 | 2 EA |
| 6. NUT | MS24400D4 | 5310-00-282-7823 | 2 EA |
| 7. CAP, TUBE | MS21914-4 | 4730-00-640-0632 | 2 EA |

*Figure 5-1A. Motor and Blower Assembly*

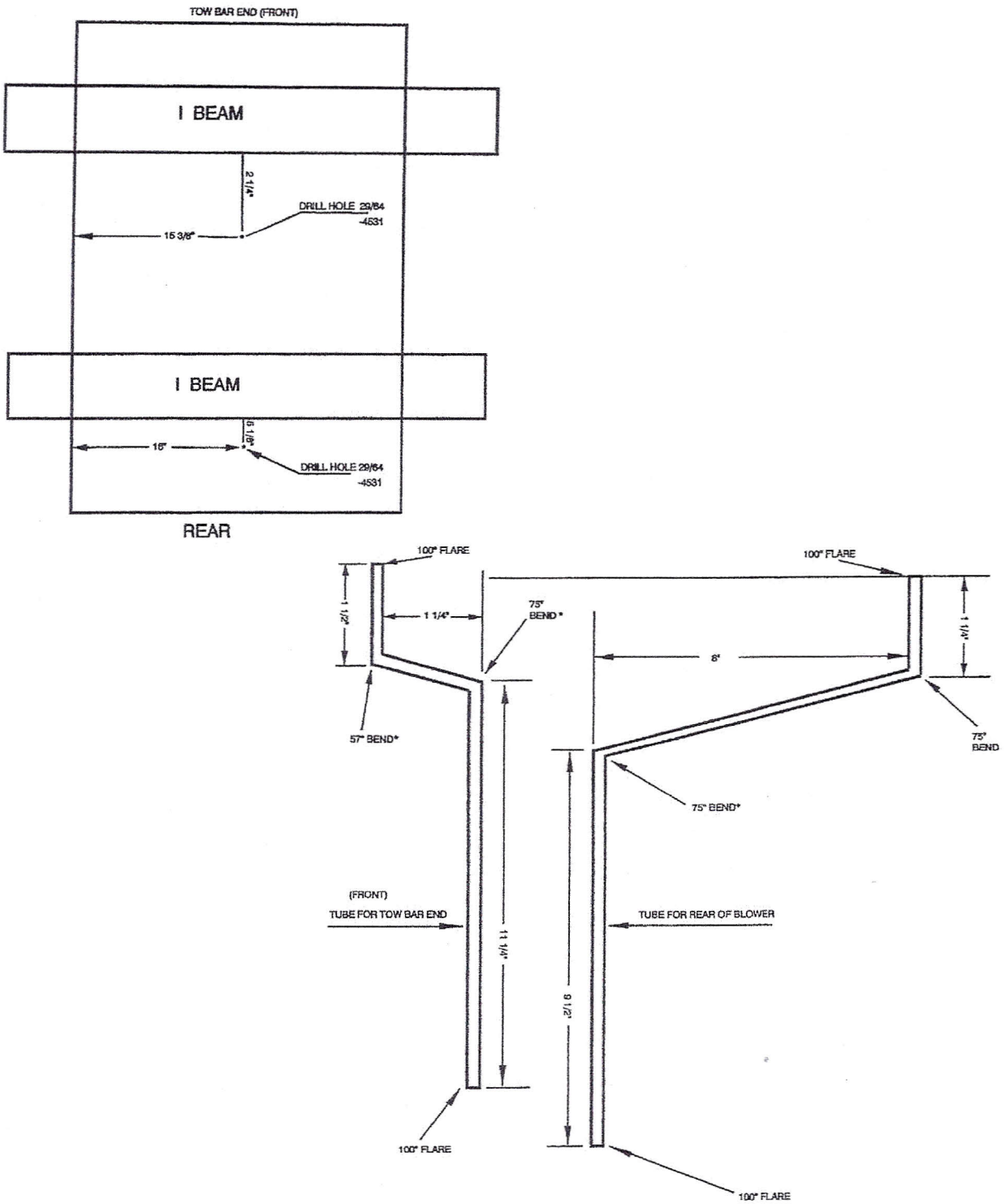



*Figure 5-1B. Tow Bar End and Stainless Tube*

*Table 5-2. Troubleshooting Chart*

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Blower output low | Restriction or foreign material in blower intake system. | Check blower intake port on top of tester for obstructions. Check for clogged intake filter. Clean filter in a mild detergent solution. |
| | Restriction or foreign material in blower output system. | Check and clean blower silencer. Check and clean flowmeter. |
| | Defective relief valve. | Repair relief valve. |
| | Pilot valve (cabin PRESSURE ADJUSTMENT). | Repair or replace pilot valve. |
| | Defective blower. | Remove and replace. |
| | Oil forced from breathers. | Replace shaft seals. |
| Excessive temperature rise in output air | Air inlet louvers closed. | Open louvers. |
| | Restriction or foreign material in fan intake. | Check and clean fan intake and wheel. |
| | Flow of cooling air through heat exchanger impeded. | Direct blasts of air through the heat exchanger, from air output side, with an air hose. Clean foreign material off the heat exchanger louver assembly and check for adjustability |
| | Heat exchanger defective. | Remove and replace. |
| Unit fails to develop canopy seal pressure | CANOPY SEAL AIR REGULATOR (relief valve) set improperly | Readjust. |
| | Loose fittings or defective tubing in canopy pressurization system. | Tighten loose fittings, replace defective tubing. |
| | Compressor malfunctioning. | Repair or replace. |
| | CANOPY SEAL AIR REGULATOR (relief valve) defective. | Replace or replace. |
| Unit fails to pressurize cabin | Main relief valve stuck open or defective. | Repair relief valve. |
| | RATE SELECTOR VALVE on START. | Set valve to INCREASE. |
| | Cabin PRESSURE ADJUSTMENT improperly adjusted. | Set PRESSURE ADJUSTMENT to required test pressure. |

*Table 5-2. Troubleshooting Chart (Cont)*

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Unit fails to pressurize cabin (Cont) | Defective CONTROL VALVE. | Repair or replace. |
| | RATE CONTROL VALVE closed. | Adjust. |
| | RATE VALVE defective. | Repair valve. |
| | Loose fittings or defective tubing. | Tighten loose fittings. Replace defective tubing. |
| Unusual noises | Roters making contact with case, end plates, or each other. | Check bearings and gears for wear. Replace as necessary. |
| | | Possible excessive Pressure Ratio. |
| Failing bearings and/or gears | Incorrect oil. | See Figure 5-1 for correct oil. |
| | Low or high oil levels. | Check levels as required. |
| | Oil temperature too high. | Reduce pressure ratio and RPM. |
| | Infrequent oil changes. | See Figure 5-1. |
| Leaking oil | Seals failing. | Reduce pressure ratio and temperatures. |
| | Oil foaming. | Improper oil type or overfilling. |

**5-11. REPAIR.** Component repair consists of performing any repair or part replacement necessary to restore the component to a serviceable condition. The operator shall limit repair to only the procedures detailed herein.

**5-12. CLEANING.** The tester should be cleaned whenever there is an accumulation of dust or dirt on the exterior of the cabinet or control panel or whenever grease, oil or similar foreign matter is inadvertently spilled within the stand.

a. Clean all disassembled components except electrical parts and prelubricated bearings, with solvent, Federal Specification P-D-680 Type II or III. Use a stiff-bristle non-metallic brush to ensure that all orifices, packing grooves and ports are clean.

b. Dry all cleaned parts using compressed air at approximately 15 psig, or a clean, lint-free cloth.

c. After cleaning, inspect all parts for wear and defects, such as nick, burrs, scoring, cracks, corrosion, or similar defects. Inspect all threaded areas for stripped, crossed, or broken threads. Inspect mounting holes for elongation which would effect component performance.

d. Replace all preformed packings, back-up rings, gaskets, and seals, regardless of condition, each time a component is replaced.

**5-13. CALIBRATION.** Calibration of entire test stand as a unit is not possible. However, when functionally testing the unit, gages and instruments shall be checked for operation. Gages or instruments appearing inaccurate or erratic during operations shall be individually verified with an instrument of known accuracy.

**5-14. FLOWMETER.** Calibration of flowmeter is not required as it is used for indication only. However, the accuracy of the volume indicated on the flowmeter may be confirmed by connecting a calibrated test flowmeter to the cabin pressure air discharge nozzle.

**5-15. REPAIR OF MOTOR STARTERS.** Repair of motor starters and contactors should be generally limited to replacement of contact coils, overload relays, and heaters. Coils should be replaced if they show evidence of overheating or other defects that may cause eventual failure during operation. Contacts are silver plated and are still serviceable even though discolored or pitted. Replacement of contacts

is necessary only when silver contact surface has worn thin. Contacts are supplied in kits. Replace all contacts contained in kit at one time. Observe the following during starter repair and do not file contacts as contact material and correct alignment will be destroyed.

a. Remove coils by removing coil leads and magnet screws, then remove magnet assembly and slip out coil; replace in reverse order.

b. Remove heaters by removing attaching screws and withdrawing from starter; replace in reverse order.

c. Remove contacts by first removing arc box and cross bar, then twisting out moving contacts and unscrewing stationary contacts. Replace in reverse order.

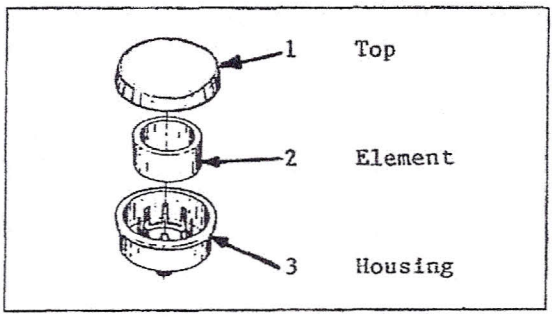



*Figure 5-2. Compressor Filter*

**5-16. FILTER, COMPRESSOR.** A compressor motor should never be operated without a filter. To clean filter, proceed as follows:

a. Lift top (1, Figure 5-2) from filter housing.

b. Remove filter element (2) and blow away dirt particles with compressed air.

c. Replace element after several cleanings.

d. Return element and top to housing.

**5-17. RELIEF VALVE.** Relief valve parts are subject to wear and tear and must be inspected and replaced as necessary. For the relief valve see T.O. 33D3-31-11-3 Overhaul for repair and replacement. The relief valve actuator (Figure 5-3) has an O'ring that can be lubricated via the grease fitting and this should be done annually. The O'ring can be checked for damage during normal operation by line pressure leakage or unexpected grease extension from the actuator vent.

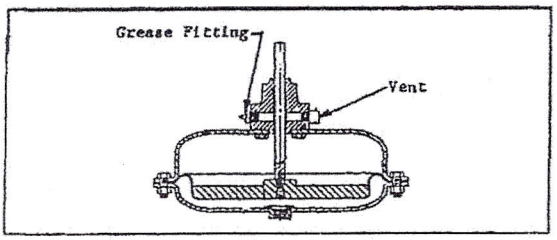



*Figure 5-3. Relief Valve Actuator*

**WARNING**

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled gas.

Before starting disassembly;

a. Isolate the relief valve from system pressure.

b. Release all internal pressure.

c. Vent the pilot(s) and main valve diaphragm loading pressure.

# SECTION VI

# DIAGRAMS

**6-1. GENERAL.** This section provides the diagrams and wire lists necessary for troubleshooting, maintenance and repair of the test stand. The diagrams for the test stand are as follows:

| | |
|---|---|
| Pneumatic Schematic | Figure 6-1 |
| Electrical Schematic | Figure 6-2 |

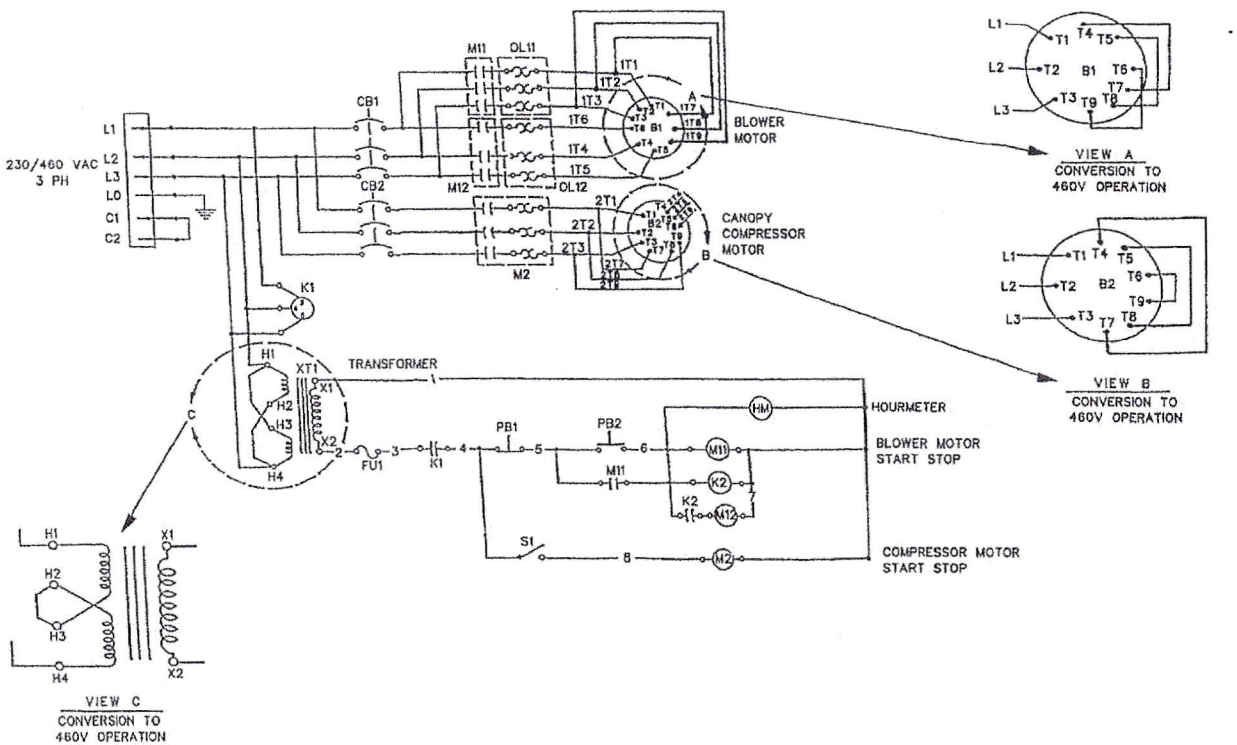



*Figure 6-2. Electrical Schematic*

# SECTION VII

## ILLUSTRATED PARTS BREAKDOWN

Refer to separate Illustrated Parts Breakdown T.O. 33D3-31-11-4 for the repair parts.

# SECTION VIII

# DIFFERENCE DATA SHEETS

**8-1. INTRODUCTION.** Operation and Maintenance Instructions for the part numbers included in this section are the same as those for the Tester, Pressurized Cabin Leakage, Aircraft - USAF Type AF/M24T-3, Part Number 10037-10, except for the specific differences noted by the applicable Difference Data Sheet. Section 1 through 7 contain complete Operation and Maintenance instructions for Tester, Pressurized Cabin Leakage, Aircraft - USAF Type AF/M24T-3, Part Number 10037-10.

**8-2. INDEX OF DIFFERENCE DATA SHEETS.** Part numbers covered by Difference Data Sheets are as follows:



*DIFFERENCE DATA SHEET*

PRESSURIZED CABIN LEAKAGE TESTER — PART NO. 10037-30

THE INSTRUCTIONS CONTAINED IN THE PRECEDING SECTIONS OF THIS TECHNICAL MANUAL ARE APPLICABLE TO THIS PART NUMBER EXCEPT FOR THE DIFFERENCES CITED IN THIS DIFFERENCE DATA SHEET.

**8-3. INTRODUCTION AND GENERAL INFORMATION.** Same as Part Number 10037-10, except this can be operated on 220/380/440V, 50/60 Hz, 3-Phase power. The tester is designed to operate on 220 volts AC, 3 phase, 50/60 cycles. The tester can be converted to 380/440VAC operation. This model uses the digital flowmeter which could be set to read the air flow in standard cubic feet per minute (scfm) or pounds per minute (ppm).

The Leading Particulars are also the same, except for:

a. Operating Ambient Temperature Range ---------- -25°F to +125°F.

b. Electrical Power Requirements: 220 +/- 22 volts AC, 50/60 Hz, three phase, convertible to 380/440 +/- 38/44 volts AC, 50/60 Hz, three phase operation.

**8-4. SPECIAL TOOLS AND TEST EQUIPMENT.** Same as Part Number 10037-10.

**8-5. PREPARATION FOR USE AND SHIPMENT.** The tester is shipped wired for 220VAC, 3 phase, 50/60 Hz operation. To convert to 380/440VAC operation, see below or nameplate in electrical box.

a. **Operation At 220V or 380/440V.** The unit is designed for 220V operation and can be converted to 380 or 440V operation. All conditions are explained below and shown in Figure 8-1. Prior to usage, the user should check the electrical panel against Figure 8-1 to positively determine what state of operation (220, 380 or 440) the unit is currently in. The entire conversion can be accomplished within the electrical panel (Figure 8-2).

b. **Conversion To 380/440V (From 220V).**

(1) Main electric motor B1 (Figure 8-1).

(a) Disconnect from overload OL12 the electric motor lines 4, 5, and 6. Reconnect line 4 to OL12 line 1 position, line 5 to OL12 line 2 position and line 6 to OL12 line 3 position.

(b) Disconnect from overload OL11 the electric motor lines 7, 8, and 9. Reconnect line 7 to OL12 line 1 position, line 8 to OL12 line 2 position and line 9 to OL12 line 3 position.

(c) From timer K2 (7, Figure 8-2) remove wire 7 from the bottom terminal C3 and connect to the wire nut supplied, or tape the end with electrical insulation tape.

(2) Air compressor motor B2 (Figure 8-1).

(a) From TB2 remove metal jumper tabs located at terminals 4, 5, 6 and store in terminals 1 and 2 (top).

(b) On motor starter M2 (11, Figure 8-2) disconnect (at starter end only) wires coming from TB2 terminal 9, terminal 8, and terminal 7. Connect loose end of terminal 9 wire to TB2 terminal 6, terminal 8 to terminal 5, and terminal 7 to terminal 4 respectively (See Figure 8-1).

DIFFERENCE DATA SHEET

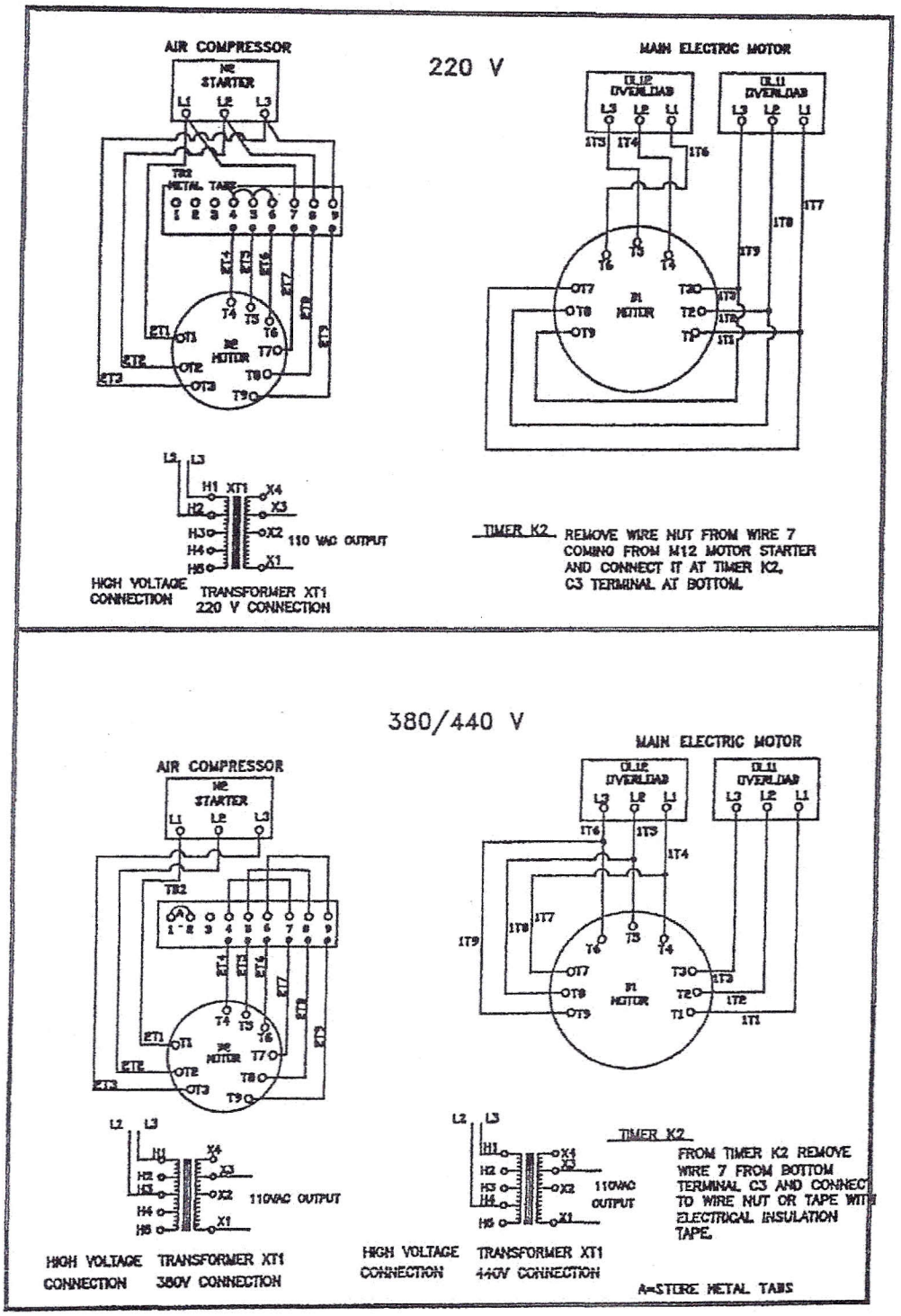



*Figure 8-1. Electrical Conversion*

DIFFERENCE DATA SHEET

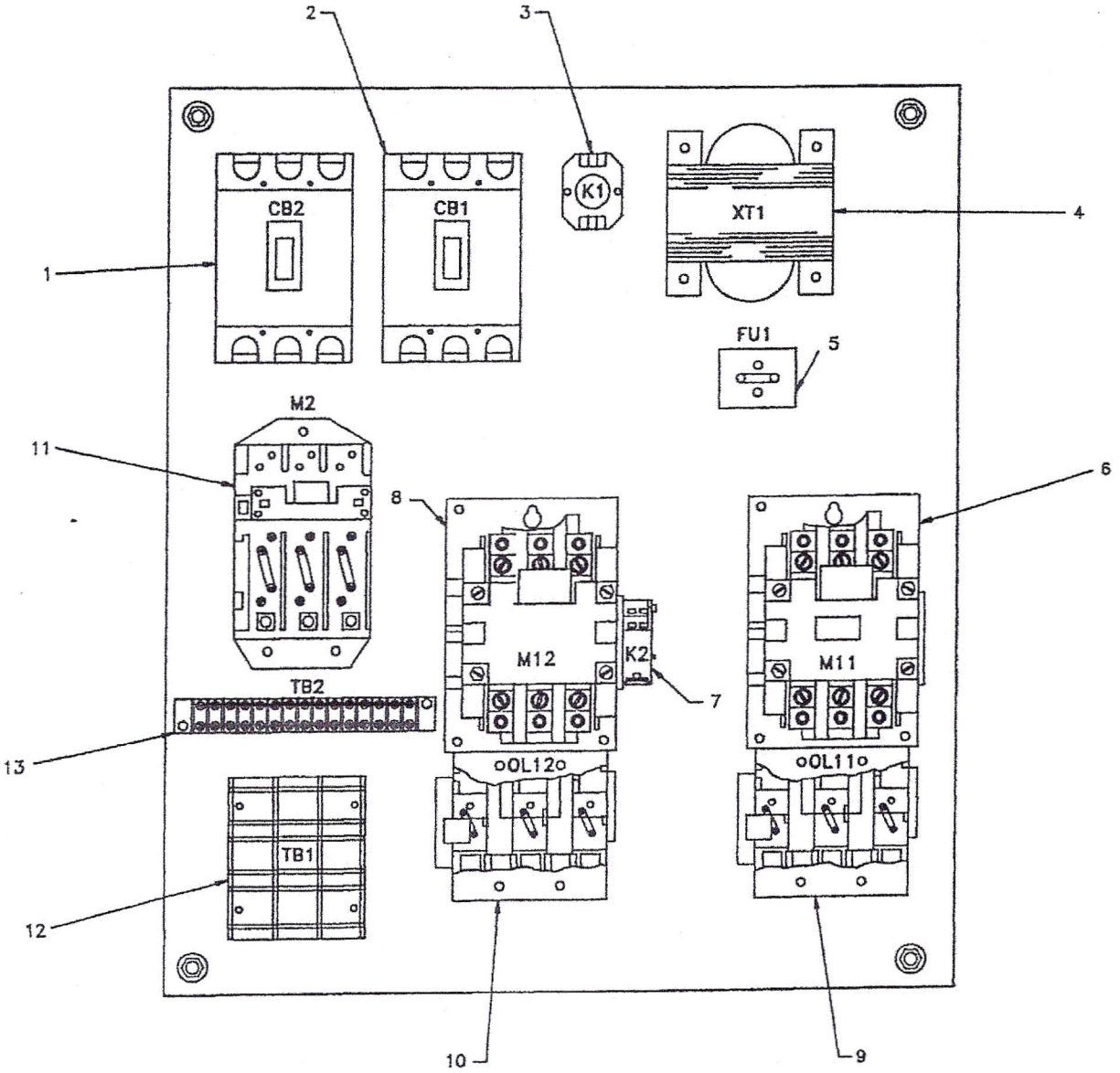



*Figure 8-2. Electrical Panel Controls*

(3) Transformer XT1 (4, Figure 8-2).

(a) For 380V operation, remove L2 wire at terminal H2 and connect at terminal H3.

(b) For 440V operation, remove L2 wire at terminal H2 and connect at terminal H4.

(4) When completed, wiring should be as shown on Figure 8-1, 380/440V operation.

c. **Conversion To 220V (From 380/440V).**

(1) Transformer XT1, (4, Figure 8-2).

(a) From 440V operation, remove L2 wire at terminal H4 and connect at terminal H2.

(b) From 380V operation, remove L2 wire at terminal H3 and connect at terminal H2.

(2) Air Compressor Motor B2 (Figure 8-1).

(a) On TB2, (13, Figure 8-2) disconnect wire on terminal 4 and reconnect at motor starter M2 line 1 position (Figure 8-1).

(b) On TB2, disconnect wire at terminal 5 and reconnect on motor starter M2 line 2 position.

(c) On TB2, disconnect wire at terminal 6 and reconnect on motor starter M2 line 3 position.

(d) On TB2 remove metal jumper tabs from terminals 1 and 2 and insert into terminals 4, 5, and 6.

(3) Main Electric Motor B1 (Figure 8-1).

(a) Disconnect from overload OL12 the electric motor lines 7, 8, and 9. Reconnect line 7 to OL11 line 1 position, line 8 to OL11 line 2 position, and line 9 to OL11 line 3 position.

(b) At overload OL12, disconnect lines 4, 5, and 6. Reconnect line 4 to OL12 line 2 position, line 5 to OL12 line 3 position and line 6 to OL12 line 1 position.

(c) Remove wire nut from wire 7 coming from M12 motor starter and connect it at timer K2 (7, Figure 8-2) C3 terminal at the bottom.

(4) When completed, wiring should be as shown on Figure 8-1, 220V operation.

**8-6. OPERATING INSTRUCTIONS.** The flowmeter used is an insertion mass digital flowmeter which automatically computes temperature and pressure corrections and reads the air flow of air leaking from the aircraft in standard cubic feet per minute (scfm) or pounds per minute (ppm). The operating controls and instruments are same as Part Number 10037-10 as given in Table 4-1 and Table 8-1 and as shown in Figure 8-3.

Electrical Panel controls (shown in Figure 8-2) description is the same as given in Table 4-2.

Operating instructions are the same as Part Number 10037-10, except the digital flowmeter can read in scfm or ppm by turning the switch (19, Figure 8-3) in the desired position.

**8-7. MAINTENANCE INSTRUCTIONS.** Digital flowmeter should be removed and sent to Calibration Laboratory for calibration at least once a year.

**8-8. DIAGRAMS.** Pneumatic Schematic is same as Part Number 10037-10. For new electrical schematic see Figure 8-4.

**8-9. ILLUSTRATED PARTS BREAKDOWN.** Same as Part Number 10037-10.

DIFFERENCE DATA SHEET

*Table 8-1. Operating Controls and Instruments*

| FIG 8-3 INDEX NO. | CONTROL OR INDICATOR | FUNCTION |
|---|---|---|
| 1-17 | Same as given in Table 4-1 | |
| 18 | Fuse | Protects digital flowmeter power supply circuit. |
| 19 | SCFM/PPM Indicator Switch | In upper position, flowmeter reads air flow in scfm and in lower position flowmeter reads air flow in ppm. |

DIFFERENCE DATA SHEET

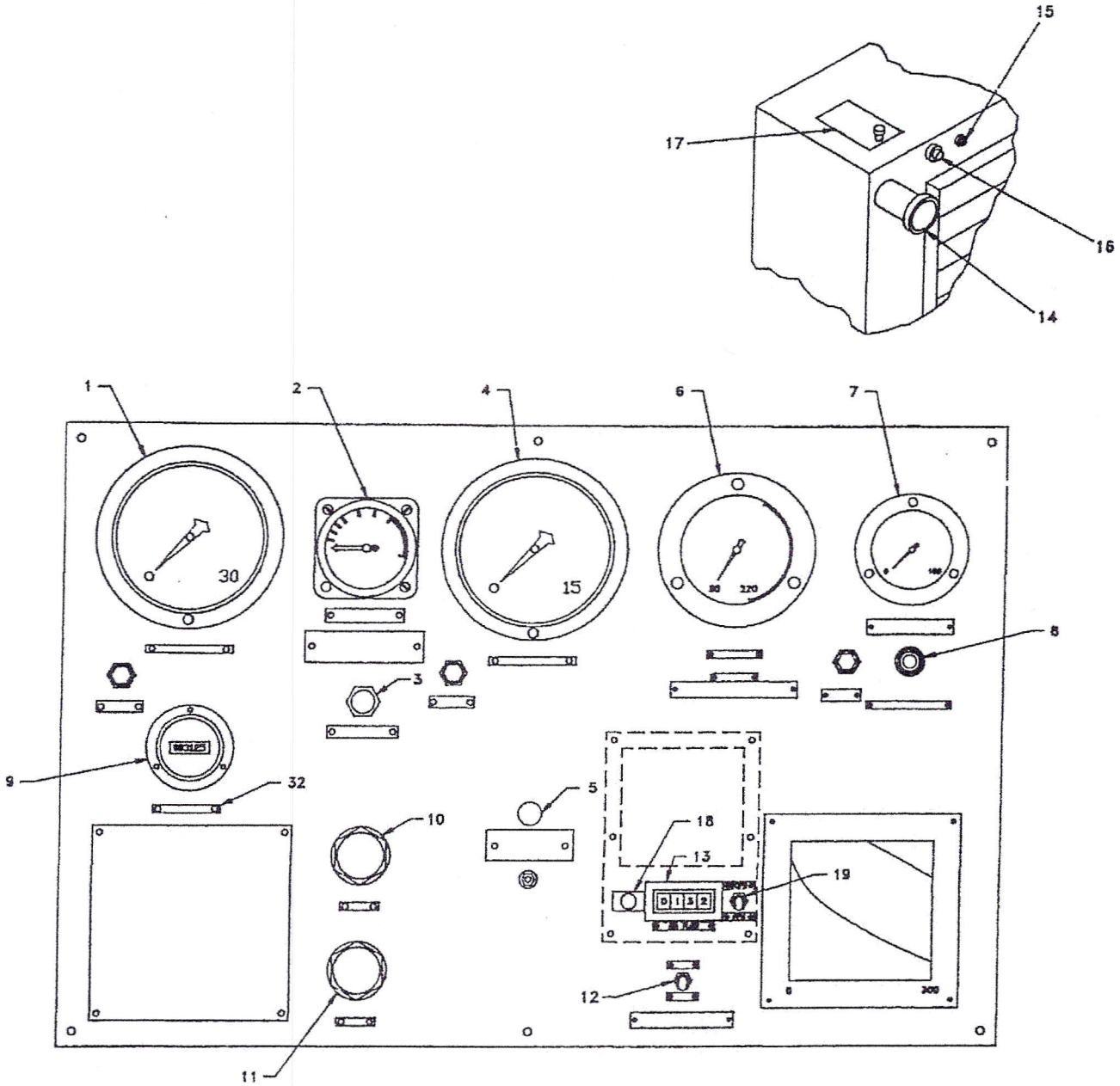



*Figure 8-3. Operating Controls and Instruments*

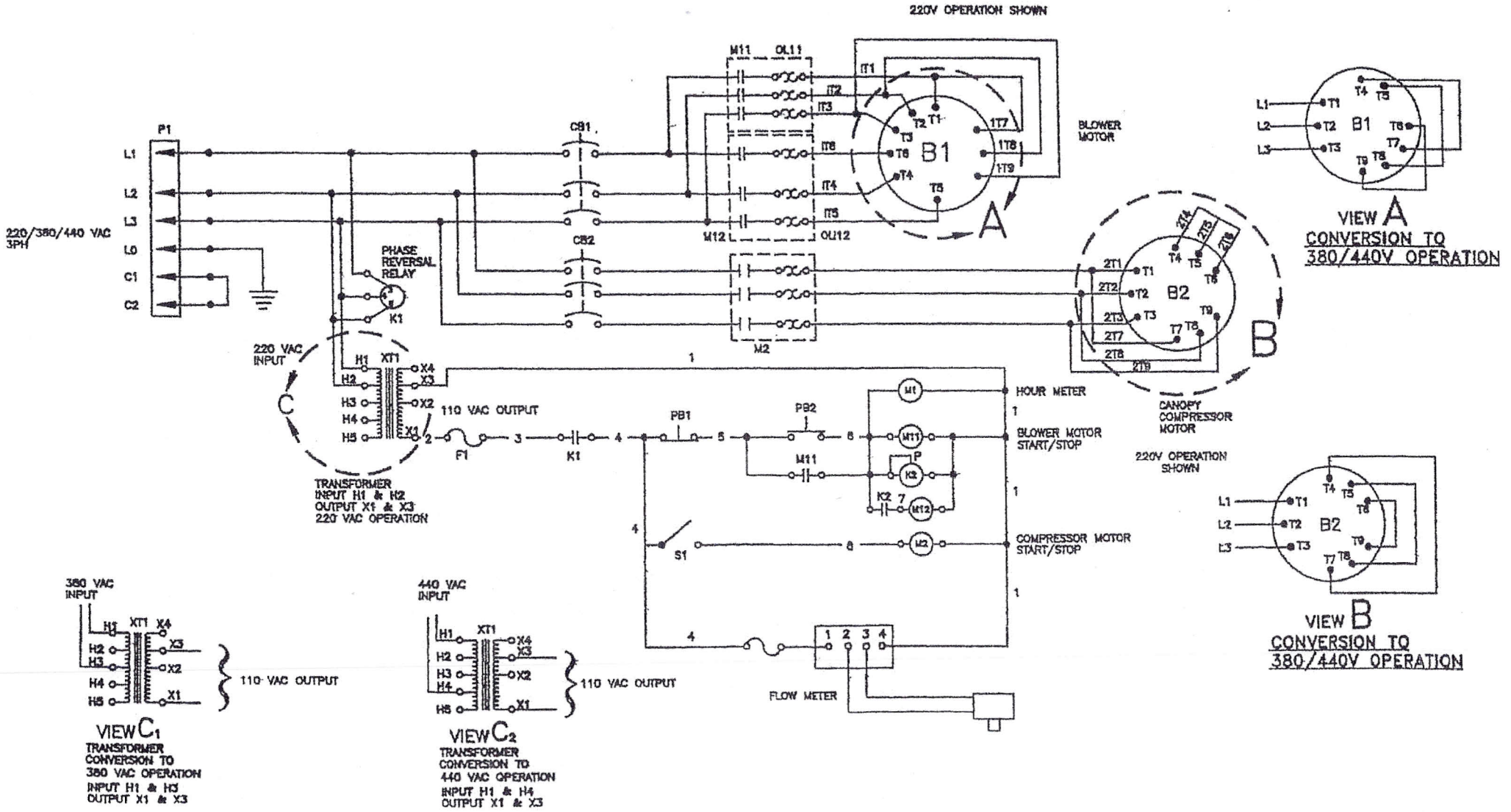



*Figure 8-4. Electrical Schematic*