KS-20336 L2 AIR DRYER
REQUIREMENTS
AND
ADJUSTING PROCEDURES

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1. GENERAL

1.01 This section covers requirements and adjusting procedures for the KS-20336 L2 Air Dryer. This dryer, through refrigeration and chemical adsorption, supplies dry compressed air to continuous feed pressure systems.

1.02 Section 161-308-802 covers the maintenance and replacement parts for the KS-20336 L2 Air Dryer.

1.03 The KS-20336 L2 Air Dryer (Fig. 1) is similar in design to the KS-20336 L1 Air Dryer (161-308-701), with the following modifications:

- Rearrangement of components in a slightly larger cabinet for improved accessibility.
- Addition of an isolation transformer for connection to a 3-wire 208/230V, single phase, 60Hz power supply (L1 requires 4-wire power supply).

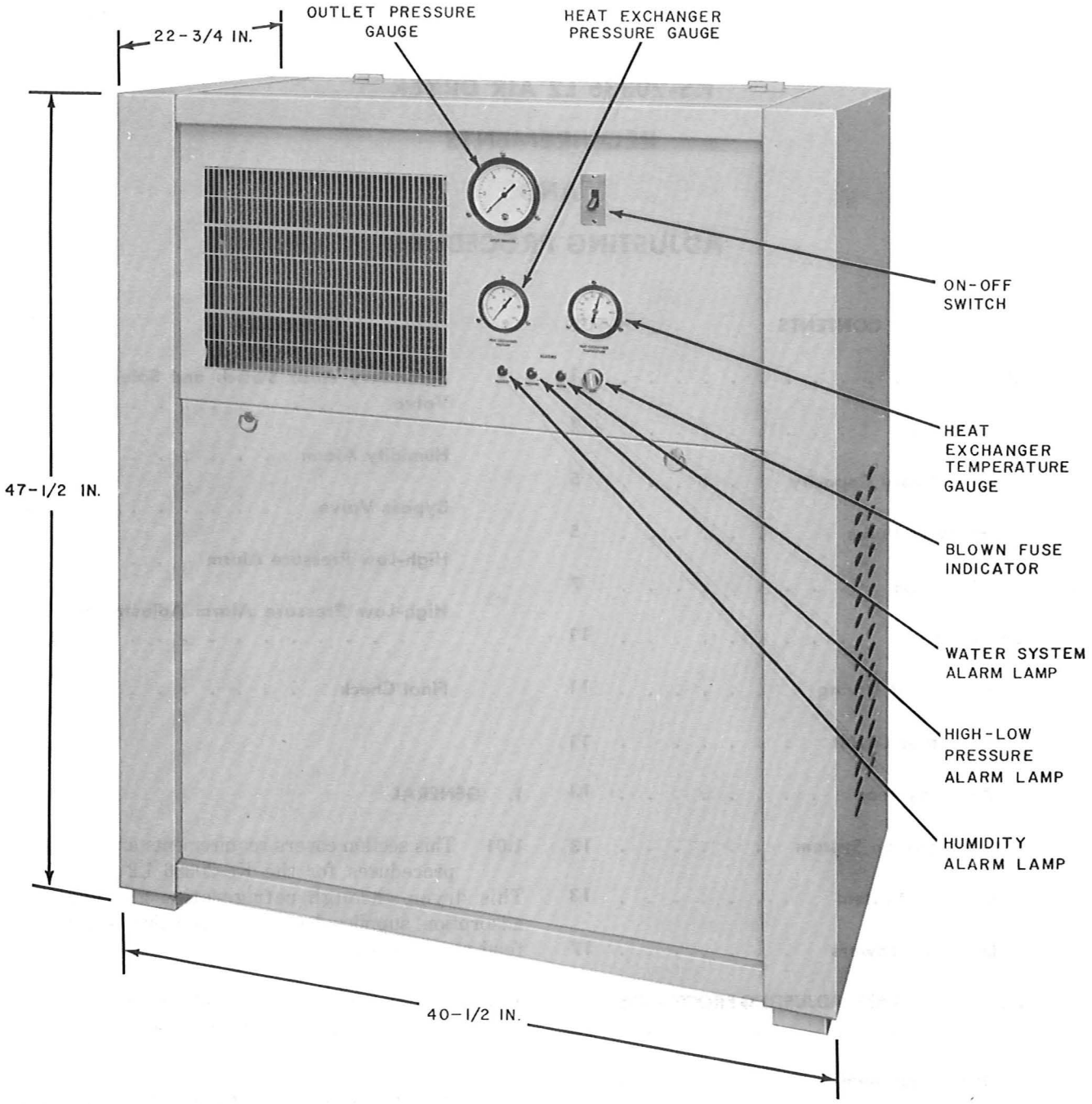


Fig. 1—KS-20336 L2 Air Dryer

- Maximum continuous dry air output increased to approximately 14,000 actual cubic feet per day (acfd).
- Larger desiccant towers.

Equipment

1.04 The air dryer cabinet is approximately 47 inches high, 40 inches wide, and 23 inches deep. The unit weighs approximately 600 pounds.

1.05 The dryer cabinet houses the following major components (Fig. 2, 3, and 4):

(a) ON-OFF power switch

(b) Water-lubricated air compressor and integral motor with associated intake air filter, silencer, and check valve

(c) Water flow control device, water strainer, and eductor

(d) Primary and secondary air-water separators

(e) Refrigeration system consisting of:

- Heat exchanger and heat exchanger temperature gauge
- Refrigeration compressor
- Refrigeration condenser
- Fan and fan motor

(f) Two desiccant towers with thermostatically-controlled heaters

(g) Timer-controlled four-way switching valve

(h) Adjustable bypass valve

(i) Outlet air pressure regulator

(j) Humidity alarm and alarm light

(k) High-low pressure alarm and alarm light

(l) Water system malfunction alarm and alarm light

(m) Blown fuse alarm light

(n) Alarm system lock-in relay

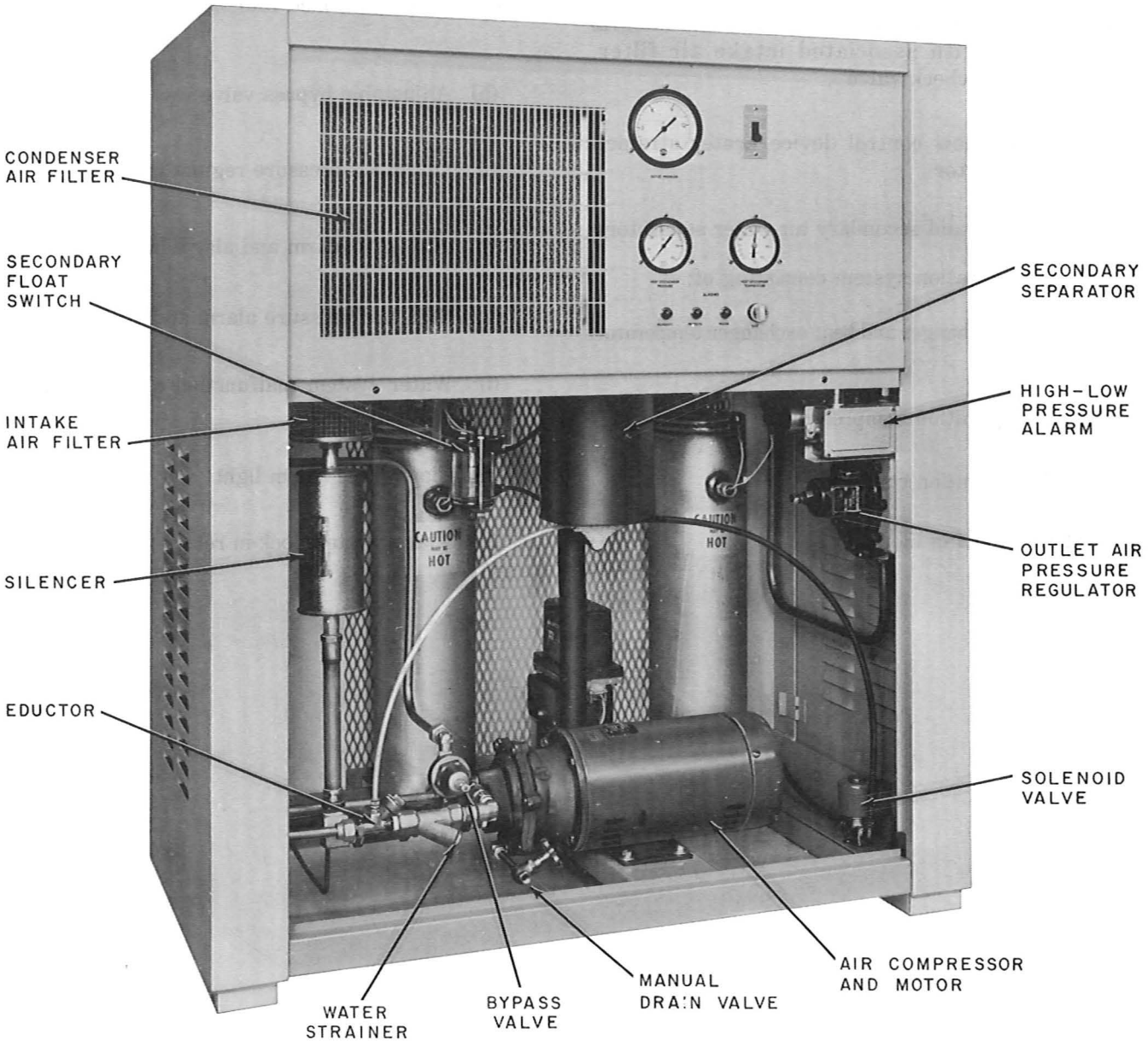


Fig. 2—KS-20336 L2 Air Dryer—Front Cover Removed

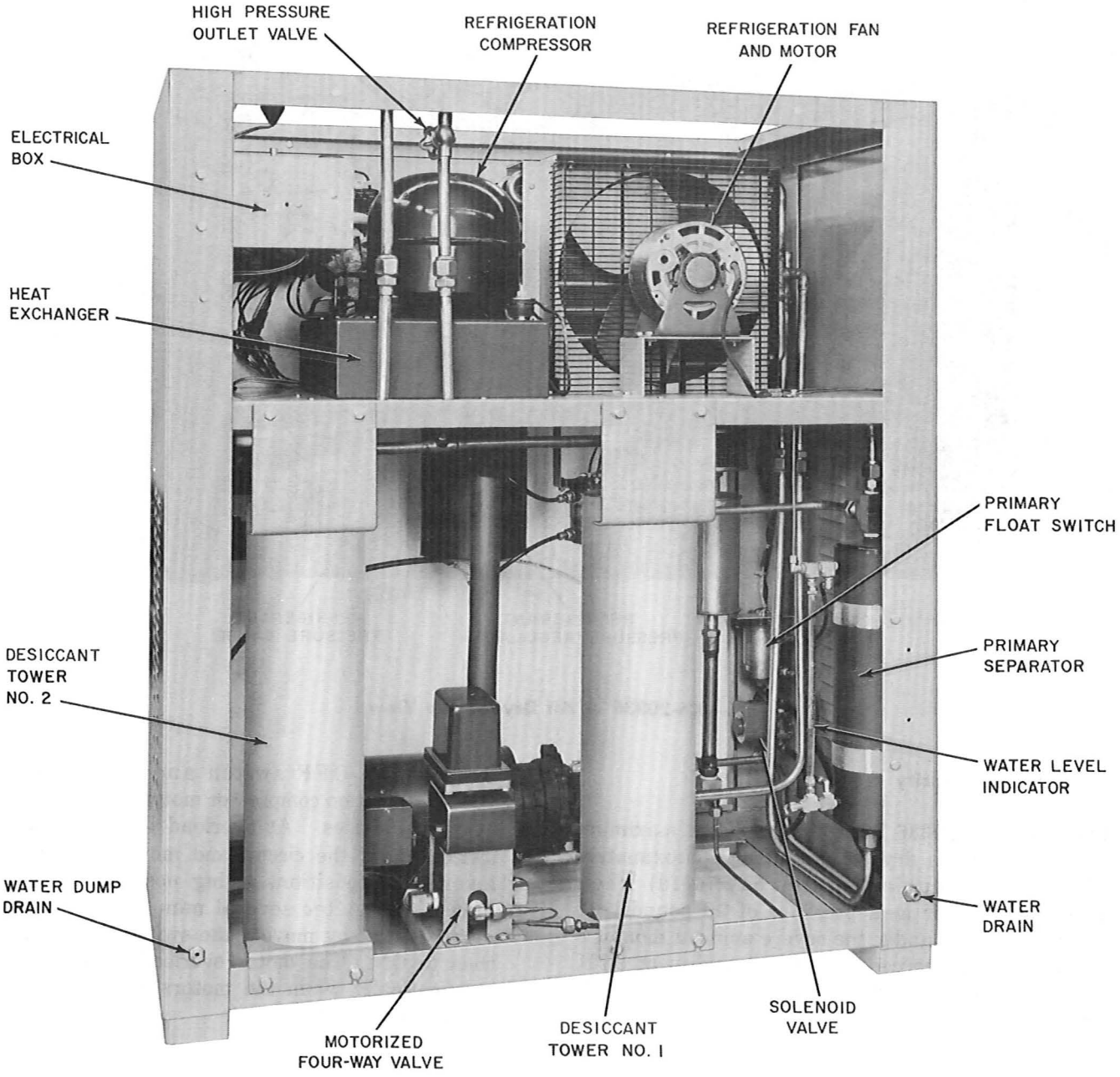
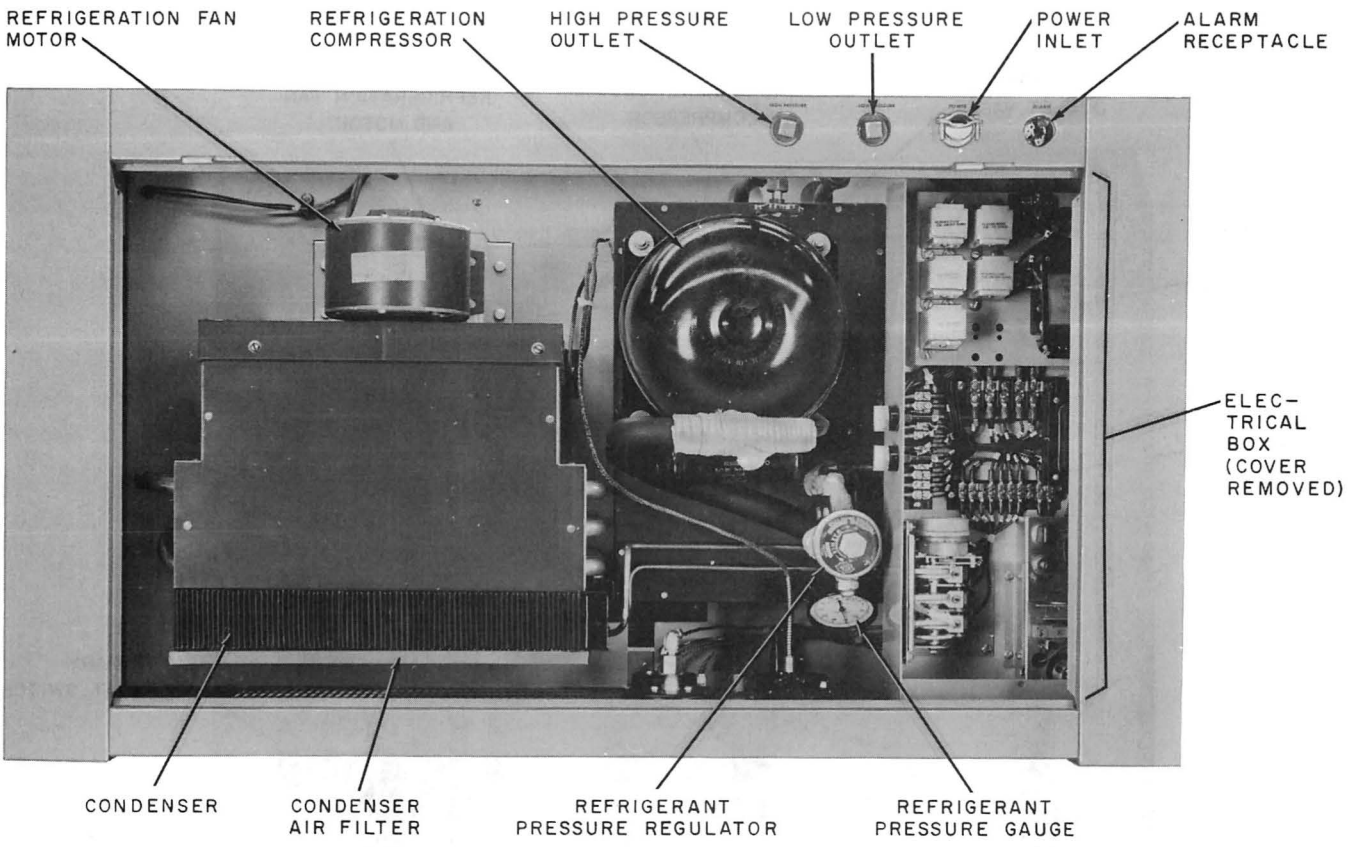


Fig. 3—KS-20336 L2 Air Dryer—Rear View



4—KS-20336 L2 Air Dryer—Top View

Air Delivery Capacity

1.06 The KS-20336 L2 Air Dryer has a maximum continuous dry air output of approximately 14,000 actual cubic feet per day (acfd) when delivering dry air at a pressure of 10 pounds per square inch (psi) under the severe ambient moisture condition of 52 percent relative humidity at 95°F. Continuous air supply is approximately 8,400 cfd when metered at 10 psi.

Safety Features

1.07 Safety features are provided in the dryer as follows:

(a) The dryer cabinet and all metallic parts of the assembly are connected to a common ground system terminating on a binding post.

(b) The ON-OFF switch and the air and refrigeration compressor motors have thermal overload devices. At overload the unit power switch opens the circuit and moves the switch lever to midposition, giving positive overload indication. After several minutes the switch may be reset by moving the switch to OFF and then to ON. The motor overload devices reset automatically when the motors cool to normal operating temperature.

(c) Two 10-ampere fuses in the terminal box provide circuit protection for the apparatus.

(d) Refrigeration fan guard.

(e) Adjustable high-low pressure alarm which operates when delivered air pressure is outside the required limits.

(f) Humidity alarm which operates if the delivered air humidity is in excess of 4 percent at 70°F, or if power is shut off.

(g) Secondary float switch, solenoid valve, and water system alarm which will eject excess water and operate the alarm if the water level control malfunctions.

(h) Blown fuse alarm.

(i) In addition to registering a major central office alarm, each alarm condition is identified by a lamp on the front panel of the air dryer.

2. INSTALLATION

2.01 Locate the dryer at least 6 inches from the wall to allow sufficient air circulation.

2.02 Install a length of 3/8-1 C Plastic Tubing between the air dryer water drain outlet and an open drain. Since up to three gallons of water a day may be discharged, a receptacle having not less than this capacity should be used if a floor drain is not available.

2.03 The air dryer is designed to operate from a 208/230 volt, single-phase, 3-wire, 60 Hz power source, fused for 30 amperes.

2.04 A conduit opening has been provided at the top right rear of the dryer cabinet. Connect the electrical conductors to the L1, L2, and GND terminals in the dryer electrical box (Fig. 5).

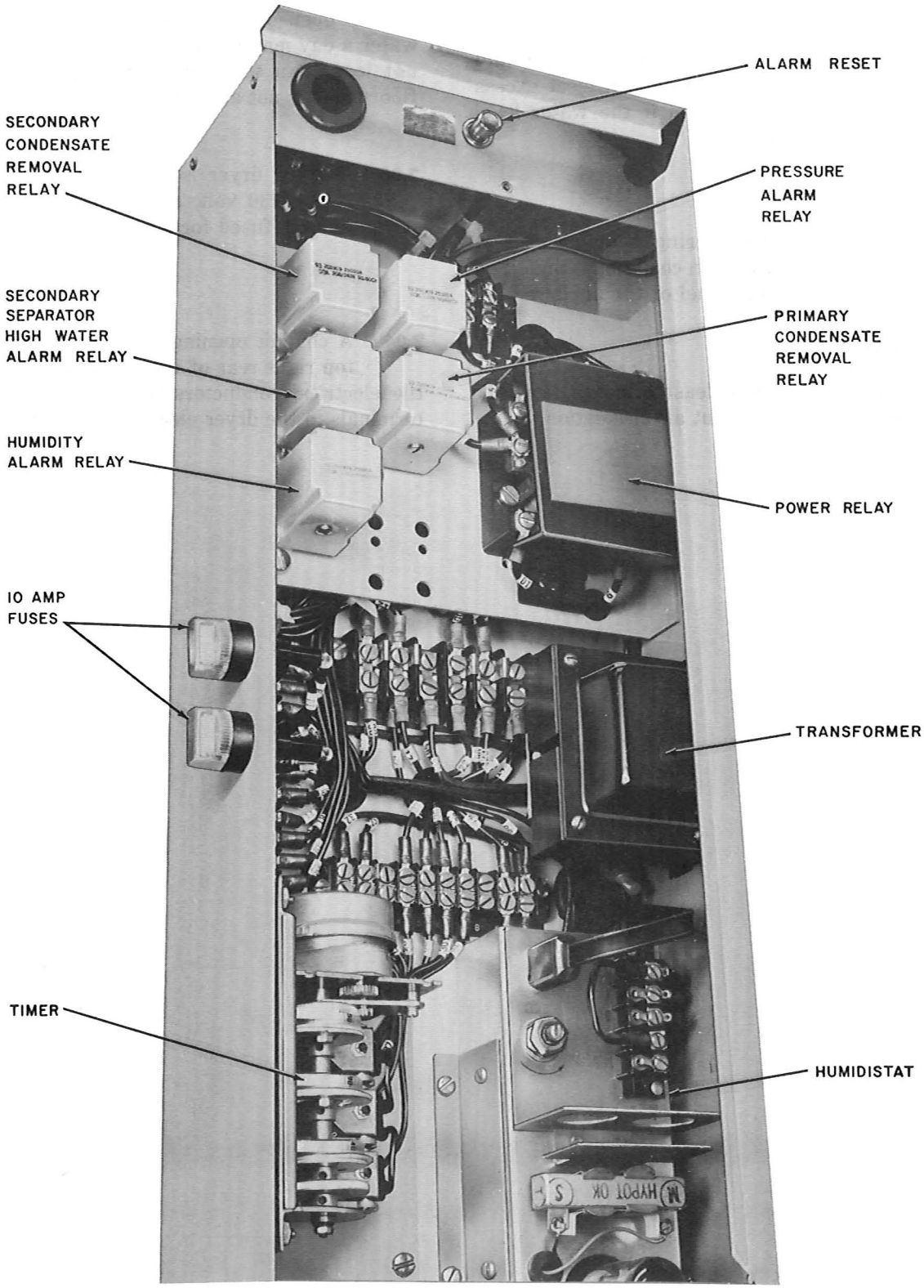


Fig. 5—Electrical Box—Cover Removed

2.05 Detailed instructions for wiring the isolation transformer for either a 208V power supply or a 230V power supply are contained on a decal affixed to the electrical box cover (Fig. 6).

2.06 With the alarm connector furnished with the air dryer, connect the office alarm pair to the alarm receptacle located near the top right rear of the dryer cabinet.

2.07 ***The air compressor is water lubricated and the water system must be filled before operating the dryer.*** The capacity of the system is approximately 2 quarts. The water system is filled as follows:

(1) Remove the intake air silencer assembly.

(2) Turn the outlet air pressure regulator counterclockwise to the closed position.

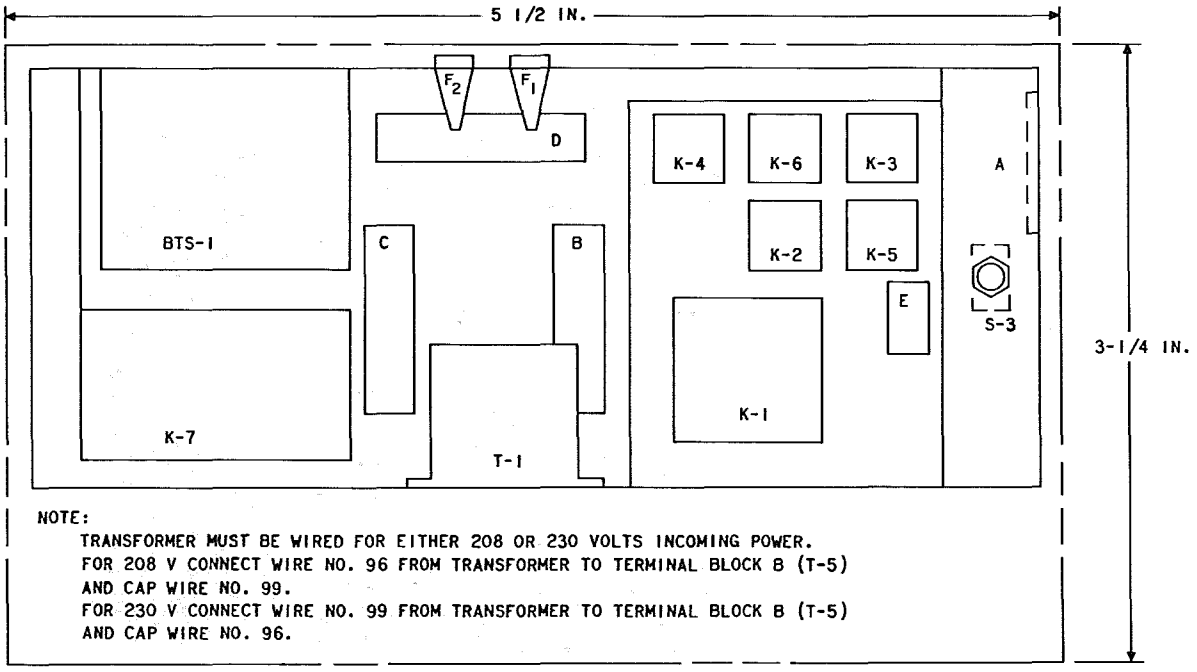


Fig. 6—Parts Layout Decal for Electrical Box

(3) Using a funnel or beaker-type container, fill the air inlet pipe assembly with water (Fig. 7).

(4) Turn the ON-OFF switch to ON and immediately resume pouring water into the inlet pipe until excess water is discharged through the water drain. Water discharging from the drain indicates that the water system is full and the water control system is operating properly.

(5) Place the intake air silencer assembly back on the silencer.

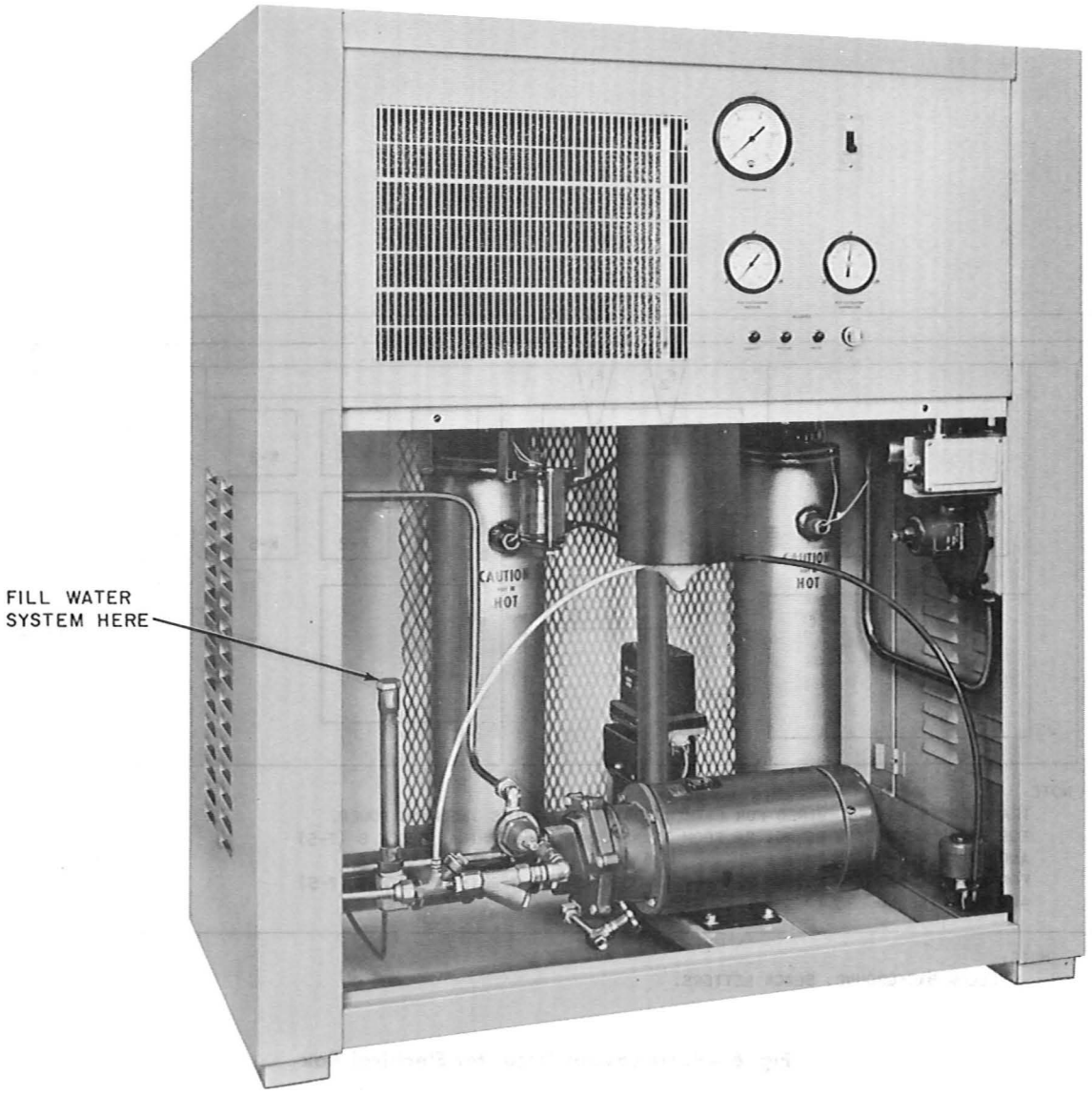


Fig. 7—Silencer Removed for Filling Water System

2.08 Observe that the heat exchanger pressure gauge indicates a pressure of approximately 26 psi (Fig. 8). If the pressure varies by more than $\pm$1.5 psi, adjust the bypass valve as covered in 4.16.

2.09 The refrigeration compressor operates continuously and maintains the heat exchanger temperature at approximately 40°F under maximum flow (Fig. 9). For flow less than maximum, adjust the refrigeration pressure regulator (Fig. 4) to maintain the 40°F temperature.

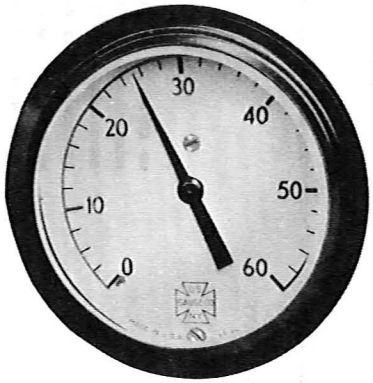


Fig. 8—Heat Exchanger Pressure Gauge

Fig. 9—Heat Exchanger Temperature Gauge

2.10 Slightly open the outlet air pressure regulator to obtain a small amount of air flow.

2.11 Using E Pressure Testing Solution, check the air fittings for leaks.

2.12 A humidity alarm condition will exist temporarily. Depress the alarm reset button at approximately one minute intervals until the humidity alarm lamp is extinguished.

2.13 When the alarm is clear the dryer may be connected to the cable system. The connection can be made either from the low pressure outlet, or from the high pressure outlet through either a KS-16648 Dual Pressure Kit or a Pipe Alarm Meter Panel. Use tubing not less than 1/2 inches od for these connections.

2.14 Readjust the outlet air pressure regulator to obtain the desired cable pressure and tighten the locknut on the regulator adjusting screw.

2.15 Adjust the high-low pressure alarm to operate at approximately 1.5 psi above and below the desired delivery pressure as covered in 4.19.

2.16 After 24 hours of operation, inspect the dryer to ensure that it is operating properly.

3. OPERATION

Principle of Drying

3.01 Water and compressed air together are discharged from the air compressor into the air-water coil and are then routed through the primary separator where most of the moisture is separated from the air.

3.02 From the top of the separator the air flows into the refrigerated heat exchanger. Additional moisture is removed as the air is cooled to approximately 35 to 40°F in the heat exchanger.

3.03 The cooled air leaves the heat exchanger and enters the secondary separator where the condensate is separated from the partially dried air by way of the eductor valve. The partially dried air is then routed by a four-way motorized valve to one of the two desiccant towers where virtually all of the remaining moisture is adsorbed.

3.04 The desiccant tower is the final stage of drying. The total drying process lowers the relative humidity of the outlet air to less than 1 percent at 70°F.

Air-Water Circuit

3.05 A flow diagram of the air and water circuits is shown in Fig. 10.

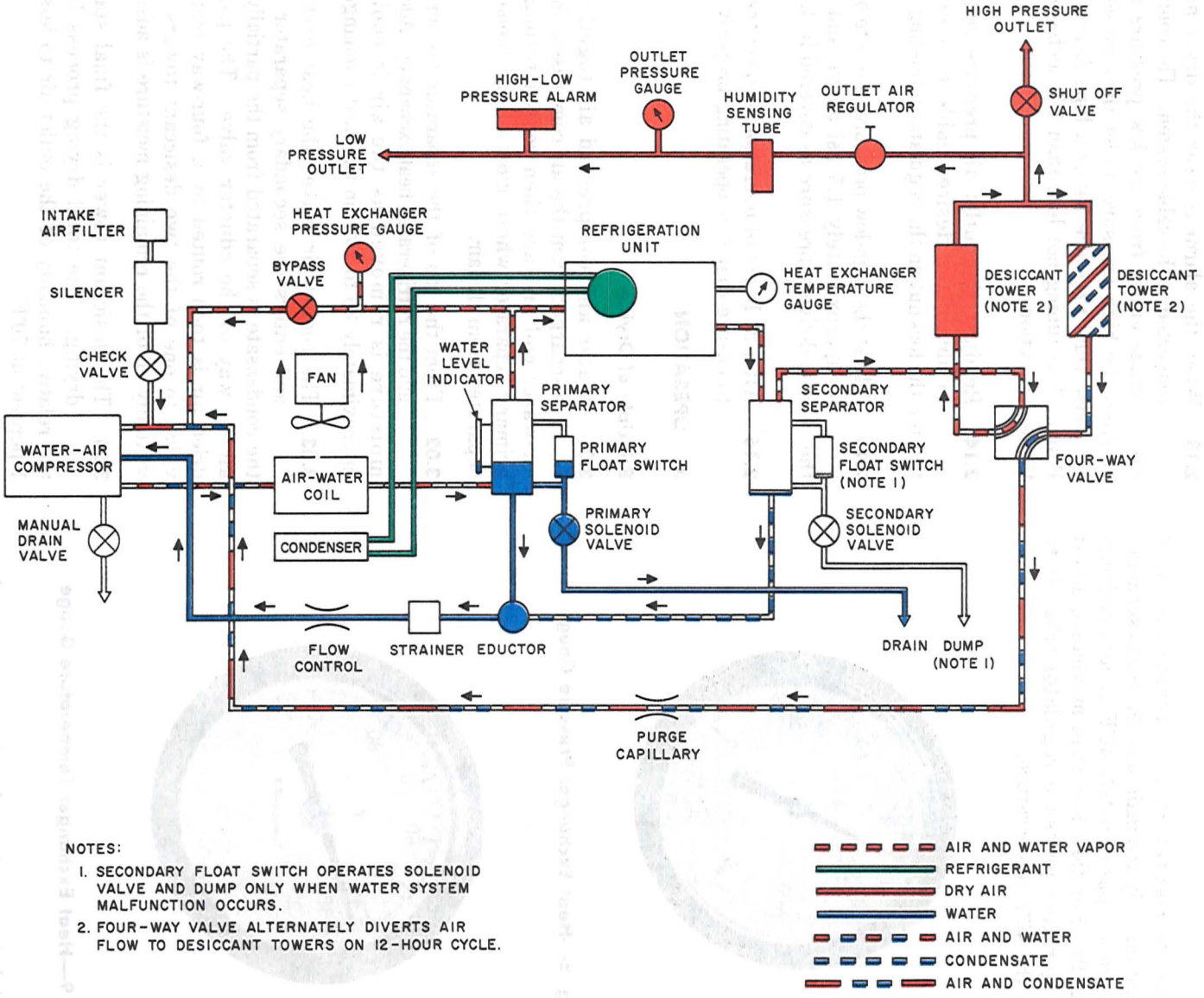


Fig. 10—Air and Water Flow Diagram

3.06 Ambient air is drawn through a felt filter into the air compressor inlet. The air compressor operates continuously to maintain an internal air system pressure of approximately 14 to 26 psi. This pressure range is maintained by a bypass valve which returns excess air to the air compressor inlet.

3.07 The air compressor and air compressor motor are an integral component. The motor shaft is coupled directly to the compressor rotor. The rotor has radial blades which rotate within an elliptical housing. Incoming water is centrifugally forced to the housing wall by the rotor, thus forming a liquid ring. Incoming air is compressed between the rotor blades and the water ring. The compressed air along with a portion of the water is discharged through the compressor discharge port.

3.08 Water and compressed air are discharged from the compressor into the air-water coil which is cooled by an air circulating fan.

3.09 The water and air flow from the cooling coil to the primary separator. There the water flows into the water return line and the moist air is routed to the refrigerated heat exchanger.

3.10 The refrigerated heat exchanger cools the air to approximately 35 to 40°F thereby removing additional moisture. From the heat exchanger the cooled air and condensate flow to the secondary separator where condensate is routed through the eductor to the water return line.

3.11 Air flows from the secondary separator through a timer-controlled four-way valve which directs the flow through one of the desiccant towers for final drying.

3.12 Dry air is expanded through the outlet pressure regulator, monitored by the humidity and high-low pressure alarms, and flows to the low pressure outlet. A high pressure outlet is tapped off the air line ahead of the outlet pressure regulator.

Water System

3.13 Water from the primary separator flows into the water return line. The eductor in the water return line causes water from the secondary separator to flow into the return line. Under normal operating conditions the secondary separator holds no appreciable amount of water. Should excess water accumulate, as might occur with either high air flow or a dirty strainer, the secondary float valve will operate the secondary solenoid valve and dump the excess water, simultaneously operating the water system malfunction alarm.

3.14 Water in the return line is routed through a strainer and flow control device to the air compressor. Some of the water extracted from the air in the drying process is returned to the air compressor to maintain the system water level. A water level indicator, which is connected to the primary separator provides a visual indication of sufficient water in the system. If 2 or 3 inches of water are visible, the system has sufficient water.

3.15 A float switch and solenoid valve assembly connected to the primary separator automatically discharges any water in excess of the system requirement.

Refrigeration System

3.16 The refrigeration compressor and the fan motor operate continuously. The fan blades pull cooling air through a dust filter and across both the refrigeration condenser and the air/water cooling coil. The refrigeration unit maintains the heat exchanger temperature at between 35 and 40°F.

Electrical System

3.17 The wiring schematic of the dryer is shown in Fig. 11.

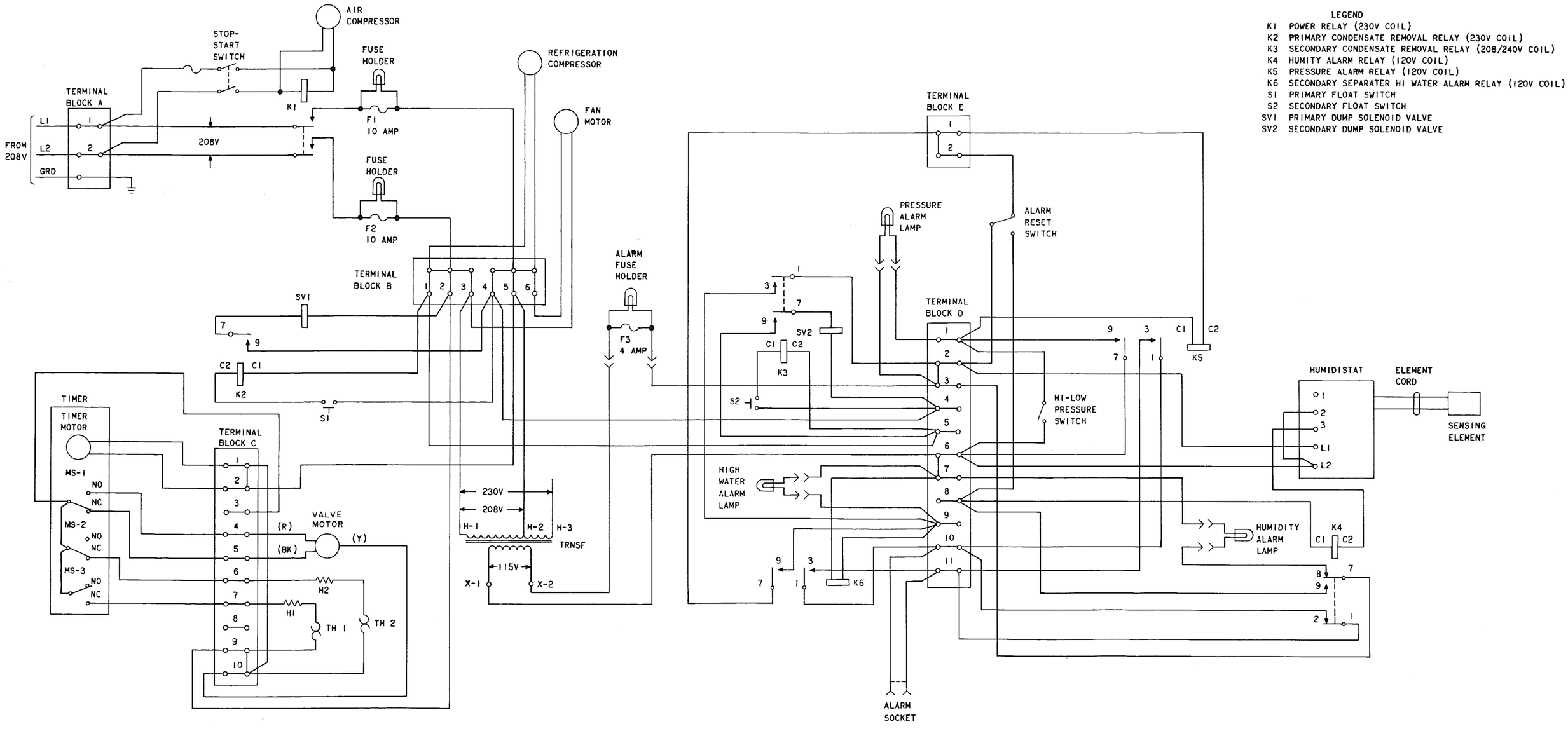


Fig. 11—Wiring Schematic

Desiccant Towers

3.18 Air flow to the desiccant towers is automatically routed from one tower to the other every twelve hours by the four-way motorized valve. The valve is controlled by a timer.

3.19 When the air is rerouted, the timer automatically energizes the heater in the tower to be reactivated. The desiccant is reactivated by a combination of heating and purging by a portion of the dry air from the output of the other tower.

3.20 The heater remains energized for a period of four hours. The reactivated tower then cools, with the aid of a continuous purge air flow, for the remaining eight hours of the cycle.

> ***Warning: Avoid contact with the tower during the four hour heating period. The outer surface of the tower reaches temperatures over 250°F during this period.***

4. REQUIREMENTS AND ADJUSTING PROCEDURES

Dryer Shutdown

4.01 When removing a dryer from service, follow local instructions regarding the need for providing a substitute air source.

Disabling the Alarm

4.02 Before either moving the ON-OFF switch to the OFF position or making adjustments that might cause an undesired alarm operation, remove the central office alarm circuit plug from the receptacle in the cabinet. Also, if a dual pressure kit is connected to the dryer, remove the alarm from it.

Interval for Checking Requirements

4.03 For continuous good operation and long service life, the requirement checks covered in this section should be scheduled at three month intervals (quarterly).

Cleaning

4.04 ***General:*** Failure to keep the equipment clean will result in excessive maintenance.

> ***Caution: Before starting to clean the dryer, move the ON-OFF switch to the OFF position. If either tower is in the heating portion of the reactivation cycle, delay requirement checks until the tower has cooled.***

4.05 ***Cabinet:*** Clean the cabinet with a clean, dry KS-14666 Cloth. Clean the cabinet louvers with a No. 8 Sash Brush.

4.06 ***Refrigeration System:*** Clean the refrigeration fan blades and condenser using clean, dry cloths, a sash brush, and a vacuum cleaner. Clean the fan blades first using a cloth moistened with either petroleum spirits, B Cleaning Fluid, or a good detergent cleaner, then wipe with a dry cloth. Replace the dust filter located in front of the condenser every three months or sooner, if warranted by local conditions.

> ***Note:*** If dryer parts are cleaned with petroleum spirits near dc machinery, provide adequate ventilation beforehand. Use the least amount of petroleum spirits necessary and keep the container closed when not in use. These precautions will prevent the fumes from damaging the dc machinery.

4.07 ***Equipment:*** Using a clean, dry cloth, clean the external surfaces of the components inside the cabinet.

Intake Air Filter

4.08 Replace the felt of the intake air filter (Fig. 12) every three months or sooner, if warranted by local conditions, as follows:

(1) Unscrew the air intake filter and separate the filter assembly from the mounting cap by removing the screw in the center of the cap.

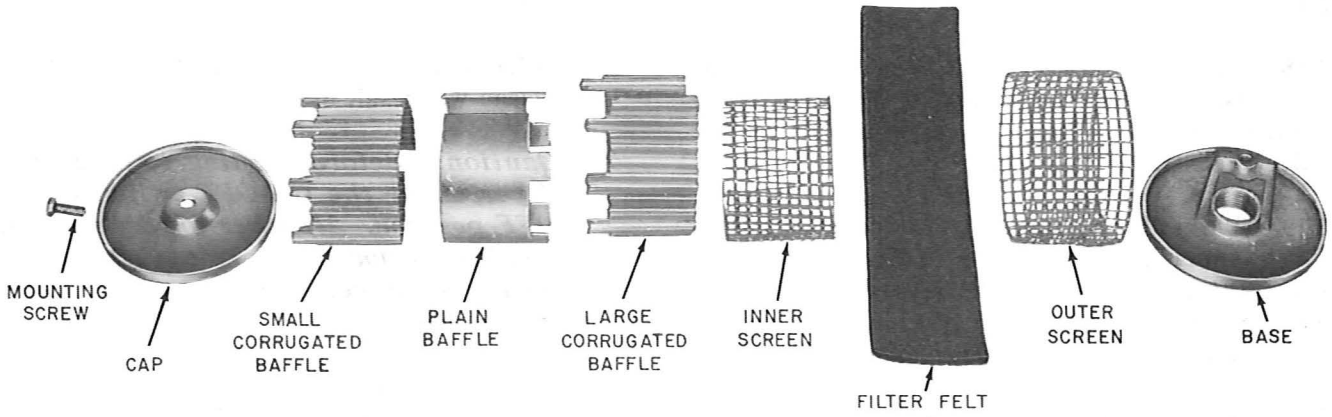


Fig. 12—Intake Air Filter—Dismantled

(2) Using long-nose pliers, pull the baffles from the outer screen.

(3) Remove the inner screen and filter felt with the pliers.

(4) Discard the felt and separate the baffles.

(5) Clean the screens, baffles, cap, and base of the filter, first using a cloth moistened with petroleum spirits, B Cleaning Fluid, or a good detergent cleaner, and then with a clean, dry cloth.

(6) Place the new filter felt inside the outer screen with the felt ends butting against each other.

(7) Mount the inner screen with the screen ends overlapping.

(8) Place the larger corrugated baffle against the inner screen.

(9) Place the plain baffle inside the corrugated baffle with the cutout portion opposite the cutout portion of the corrugated baffle.

(10) Mount the remaining corrugated baffle with the cutout portion opposite the cutout portion of the plain baffle.

(11) Place the assembly and the cap on the filter base, and insert and tighten the screw in the cap.

(12) Remount the filter.

Water Strainer, Primary Float Switch, and Solenoid Valve

4.09 Replace the water strainer every three months. At the same time also check the operation of the primary float switch and solenoid valve as follows:

(1) Disconnect the alarm plug and move the ON-OFF switch to the OFF position.

(2) Open the drain valve and drain the water system.

(3) Using a 1-inch wrench, remove the strainer nut.

(4) Remove the strainer.

(5) Install the new strainer and tighten the nut.

(6) Tighten all water line connections.

(7) Remove the intake air silencer assembly.

(8) Close the water drain valve.

(9) Fill the air inlet pipe assembly with clean water.

(10) Move the ON-OFF switch to the ON position and continue adding water to the system.

(11) Observe the water in the primary float switch as the water is being added. The water levels of float switch and primary separator sight tube should be the same.

(14) As the water level rises, the float switch should operate the primary solenoid and expel the excess water. If this does not occur, check the operation of the float switch and the solenoid valve and replace if defective.

(15) Place the intake air silencer back on the inlet pipe assembly.

Secondary Float Switch and Solenoid Valve

4.10 Check the operation of the secondary float switch and solenoid valve every three months, as follows:

(1) Move the ON-OFF switch to the OFF position.

(2) Disconnect the humidity alarm and the pressure alarm.

(3) Attach a hose equipped with a suitable fitting to the bottom of the secondary float switch bowl and add water to the bowl until the float rises.

(4) Connect an ohmmeter across the alarm terminals.

(5) Move the ON-OFF switch to the ON position.

(6) The water should be discharged and the ohmmeter should read zero. If this does not occur, check the operation of the float switch and the operation of the solenoid valve and replace if defective.

(7) Move the ON-OFF switch to the OFF position.

(8) Reconnect the pressure alarm and the humidity alarm.

(9) Move the ON-OFF switch to the ON position.

Humidity Alarm

4.11 The humidity alarm consists of a humidity sensing element connected by cable to the humidistat. The sensing element is mounted in the dry air outlet line. If the relative humidity of delivered air exceeds 4 percent at 70°F the alarm will operate.

4.12 The humidity alarm lamp has a lock-in arrangement, whereby the lamp will remain energized although the alarm condition has cleared. Depress the alarm reset button and if the alarm condition is clear the lamp will be extinguished.

4.13 Check the operation of the humidity alarm at 3-month intervals, as follows:

(1) Connect an ohmmeter across the alarm terminals.

(2) Remove the humidity sensing element from the receptacle, exposing the sensing element to the ambient air. Either disable the pressure alarm or temporarily seal the open housing to prevent loss of air.

(3) The ohmmeter should read zero and the humidity alarm lamp should begin flashing.

(4) If the action described in (3) does not occur, breathe on the sensing element. If after breathing on the element the alarm still does not operate, examine the sensing element cable connection at the humidistat and examine the cable for a broken conductor. If the cable is satisfactory, replace the sensing element and repeat the check.

Caution: Do not use an ohmmeter to measure the resistance of the sensing element. Any voltage applied to the sensing element will make it inoperative.

(5) Return the sensing element to its housing and in a short while the ohmmeter should read full scale.

(6) Depress the alarm reset button to extinguish the lamp.

Bypass Valve

4.14 The bypass valve limits the discharge pressure of the air compressor to approximately 26 psi at no flow. The bypass valve diverts excess air to the air compressor air inlet during periods of low dryer output.

4.15 Check the bypass valve every three months by closing the outlet air pressure regulator valve and observing that the heat exchanger pressure gauge indicates a pressure of approximately 26 psi. Readjust the bypass relief valve, if required.

4.16 To adjust the bypass valve, loosen the locknut and turn the valve adjusting screw clockwise to increase and counterclockwise to decrease the heat exchanger pressure.

High-Low Pressure Alarm

4.17 The pressure alarm (Fig. 13) is factory set to operate at approximately 10.5 $\pm$1.5 psi for the high pressure alarm and at approximately 6.5 $\pm$1.5 psi for the low pressure alarm as measured at the dryer outlet.

> ***Note:*** If local conditions require high-low alarm pressure settings other than the factory settings, adjust the alarm as described in 4.25.

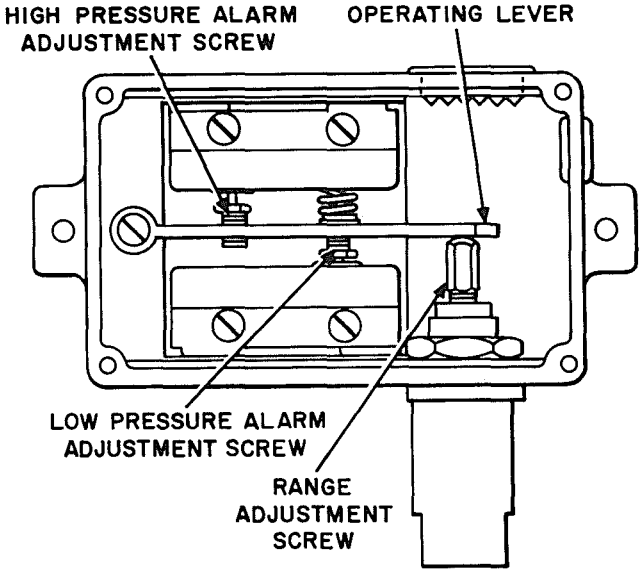


Fig. 13—High-Low Pressure Alarm

4.18 Check the operation of the alarm every three months by turning the outlet air pressure regulator adjusting screw to increase and decrease the outlet pressure until the high and low pressure alarms operate. If the alarms do not operate within $\pm$0.5 psi of the desired operating pressure, readjust alarm as described in 4.19.

> ***Note:*** The alarm reset button must be depressed to reset the alarm after each alarm operation.

High-Low Pressure Alarm Adjustment

4.19 The high-low pressure alarm (Fig. 13) is adjusted as follows:

(1) Remove the cover of the pressure alarm switch.

(2) Adjust the outlet air pressure regulator to the high outlet pressure at which the alarm should operate.

(3) Turn the left adjusting screw clockwise to raise, and counterclockwise to lower the alarm operate point.

(4) Adjust the outlet air pressure regulator to the low outlet pressure at which the alarm should operate.

(5) Turn the right adjusting screw clockwise to raise and counterclockwise to lower the alarm operate point.

(6) The adjusting screws should be turned no farther than is necessary to operate the alarm at the required high and low outlet pressures.

(7) Replace the alarm switch cover.

Final Check

4.20 Make sure cabinet doors are closed and latched. Move the ON-OFF switch to the ON position. When the heat exchanger temperature and pressure gauges and the outlet pressure gauge indicate proper operating temperature and pressure, reconnect the central office alarm circuit to the dryer (and KS-16648 Dual Pressure Kit, if present). Resume supplying air to the cable system.