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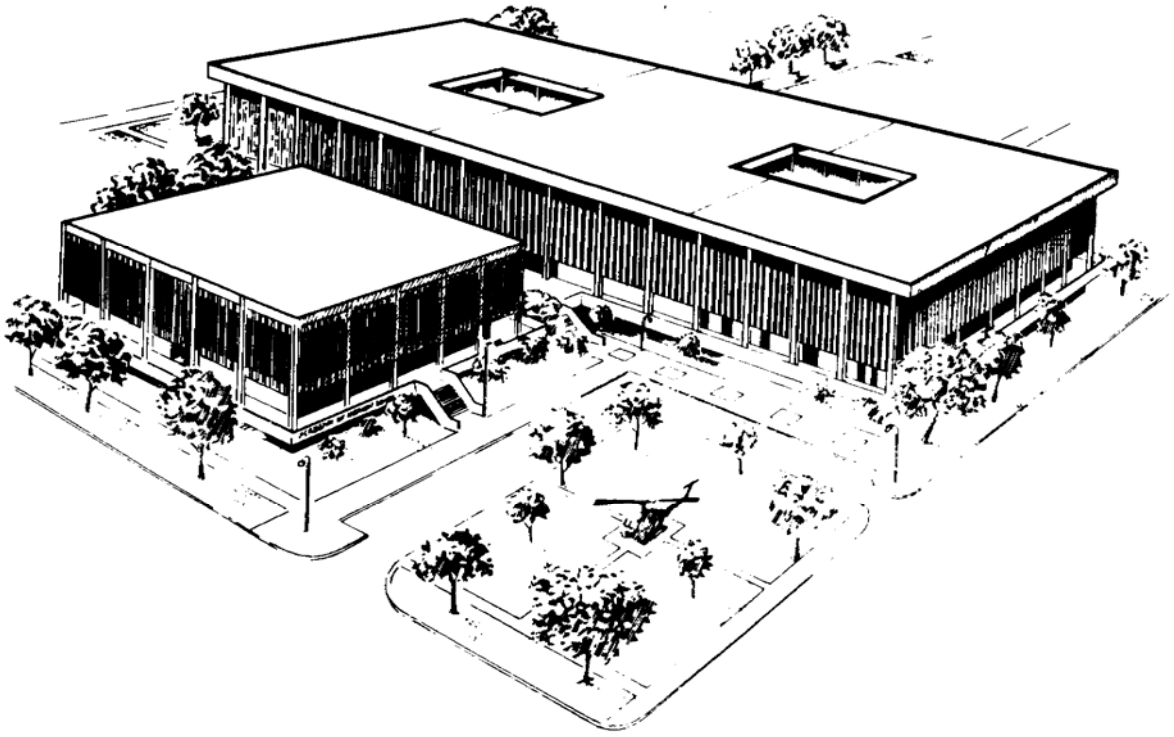

COMPRESSOR

SUBCOURSE MD0366 EDITION 100

DEVELOPMENT

This subcourse is approved for resident and correspondence course instruction. It reflects the current thought of the Academy of Health Sciences and conforms to printed Department of the Army doctrine as closely as currently possible. Development and progress render such doctrine continuously subject to change.

ADMINISTRATION

Students who desire credit hours for this correspondence subcourse must enroll in the subcourse. Application for enrollment should be made at the Internet website: http://www.atrrs.army.mil. You can access the course catalog in the upper right corner. Enter School Code 555 for medical correspondence courses. Copy down the course number and title. To apply for enrollment, return to the main ATRRS screen and scroll down the right side for ATRRS Channels. Click on SELF DEVELOPMENT to open the application; then follow the on-screen instructions.

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CLARIFICATION OF TERMINOLOGY

When used in this publication, words such as "he," "him," "his," and "men" 'are intended to include both the masculine and feminine genders, unless specifically stated otherwise or when obvious in context.

USE OF PROPRIETARY NAMES

The initial letters of the names of some products may be capitalized in this subcourse. Such names are proprietary names, that is, brand names or trademarks. Proprietary names have been used in this subcourse only to make it a more effective learning aid. The use of any name, proprietary or otherwise, should not be interpreted as endorsement, deprecation, or criticism of a product; nor should such use be considered to interpret the validity of proprietary rights in a name, whether it is registered or not.

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CORRESPONDENCE COURSE OF
THE U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL

SUBCOURSE MD0366

COMPRESSOR

INTRODUCTION

The Compresso-Dri, Model M5-A, Dental Equipment Compressor-Dehydrator supplies compressed air, free of oil, moisture, and particulate matter, to operate a dental operating and treatment unit. It is a completely portable unit and has an integral drying section that automatically regenerates a drying agent. Another indispensable part is a transit case, the cover of which serves as a sound suppressor and protective device during normal operation. The compressor can be rapidly placed into operation and is readily maintained. As a medical equipment repairer, it is your job to keep the compressor operating efficiently. This subcourse covers procedures for performing preventive maintenance checks and services (PMCS), verifying, isolating malfunctions, and repairing the compressor-dehydrator.

Subcourse Components:

This subcourse consists of four lessons and an appendix. They are:

- Lesson 1, Preventive Maintenance Checks and Services on Compressors.
- Lesson 2, Perform Verification of Compressors.
- Lesson 3, Isolate Malfunctions to Component Level in Compressors.
- Lesson 4, Remove and Replace or Repair Defective Components in Compressors.
- Appendix, Compressor/Dehydrator Troubleshooting Guide.

Credit Awarded:

Upon successful completion of the examination for this subcourse, you will be awarded 5 credit hours.

To receive credit hours, you must be officially enrolled and complete an examination furnished by the Nonresident Instruction Branch at Fort Sam Houston, Texas.

You can enroll by going to the web site http://atrrs.army.mil and enrolling under "Self Development" (School Code 555).

A listing of correspondence courses and subcourses available through the Nonresident Instruction Section is found in Chapter 4 of DA Pamphlet 350-59, Army Correspondence Course Program Catalog. The DA PAM is available at the following website: http://www.usapa.army.mil/pdffiles/p350-59.pdf.

LESSON ASSIGNMENT

LESSON 1	Preventive Maintenance Checks and Services on Compressors.
TEXT ASSIGNMENT	Paragraphs 1-1 through 1-5.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

1-1. Identify the functions of the compressor components.

1-2. Identify the theory of operation of the compressor.

1-3. Identify the general operating procedures, including operator controls and indicators, for the compressor.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 1

PREVENTIVE MAINTENANCE CHECKS AND SERVICES ON COMPRESSORS

1-1. GENERAL

You must ensure the Model M5A Compressor-Dehydrator continues to function efficiently. This lesson introduces the general operation of the compressor, its controls and indicators, safety precautions you need to follow, and the procedures you use for PMCS.

1-2. COMPRESSOR COMPONENT FUNCTIONS

In order to perform PMCS and other maintenance tasks to keep the compressor running smoothly, you need to be aware of the compressor's components and their specific functions. Refer to figures 1-1 and 1-2.

a. **Safety Relief Valve.** This over-pressure relief valve is factory set to release pressure when it has reached a value of 125 pounds per square inch (psi).

(1) This provides a safety release of pressure if the pressure switch does not operate properly.

(2) If this valve is not operating properly and the pressure switch failed to stop compression at the proper pressure, the compressor storage tank could explode from over pressure.

b. **Dryness Indicator.** The dryness indicator (also known as a humidity indicator) is a paper that changes color when moisture is present.

(1) When the indicator is blue, there is dry air in the storage tank.

(2) If the indicator is pink, the air has moisture in it. You should purge the unit of moisture before use.

c. **Flow Control Valves.** The flow control valve is a check valve that will allow limited back flow from the storage tank.

(1) During the filling or pumping cycle of the compressor, the flow control valve allows flow in the direction of the storage tank only. Refer to paragraph 1-3a.

(2) During the drying or purging cycle, air can flow through a small orifice in the flow control valve to allow regeneration of the desiccant. Refer to paragraph 1-3b.

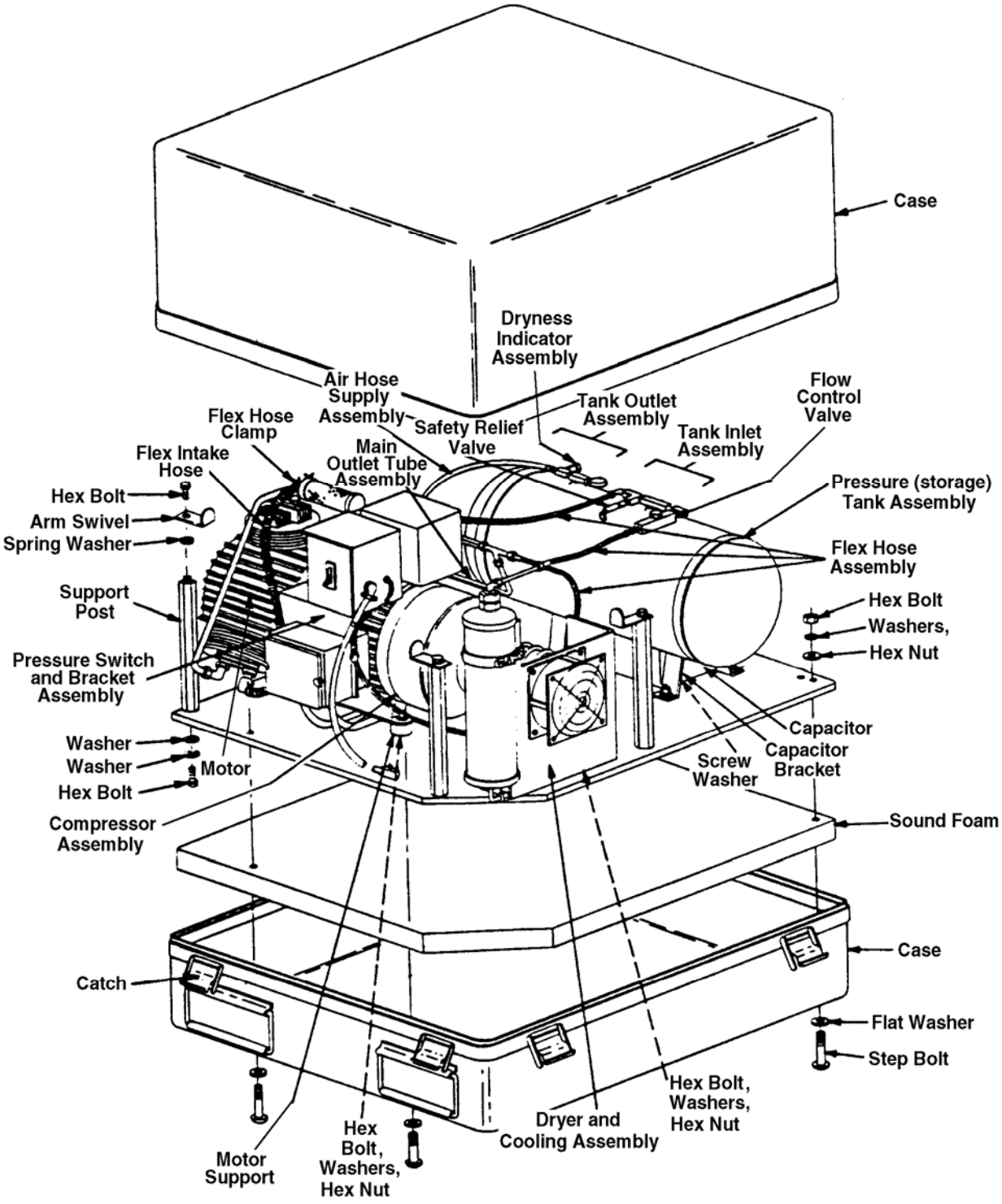


Figure 1-1. Compressor assembly.

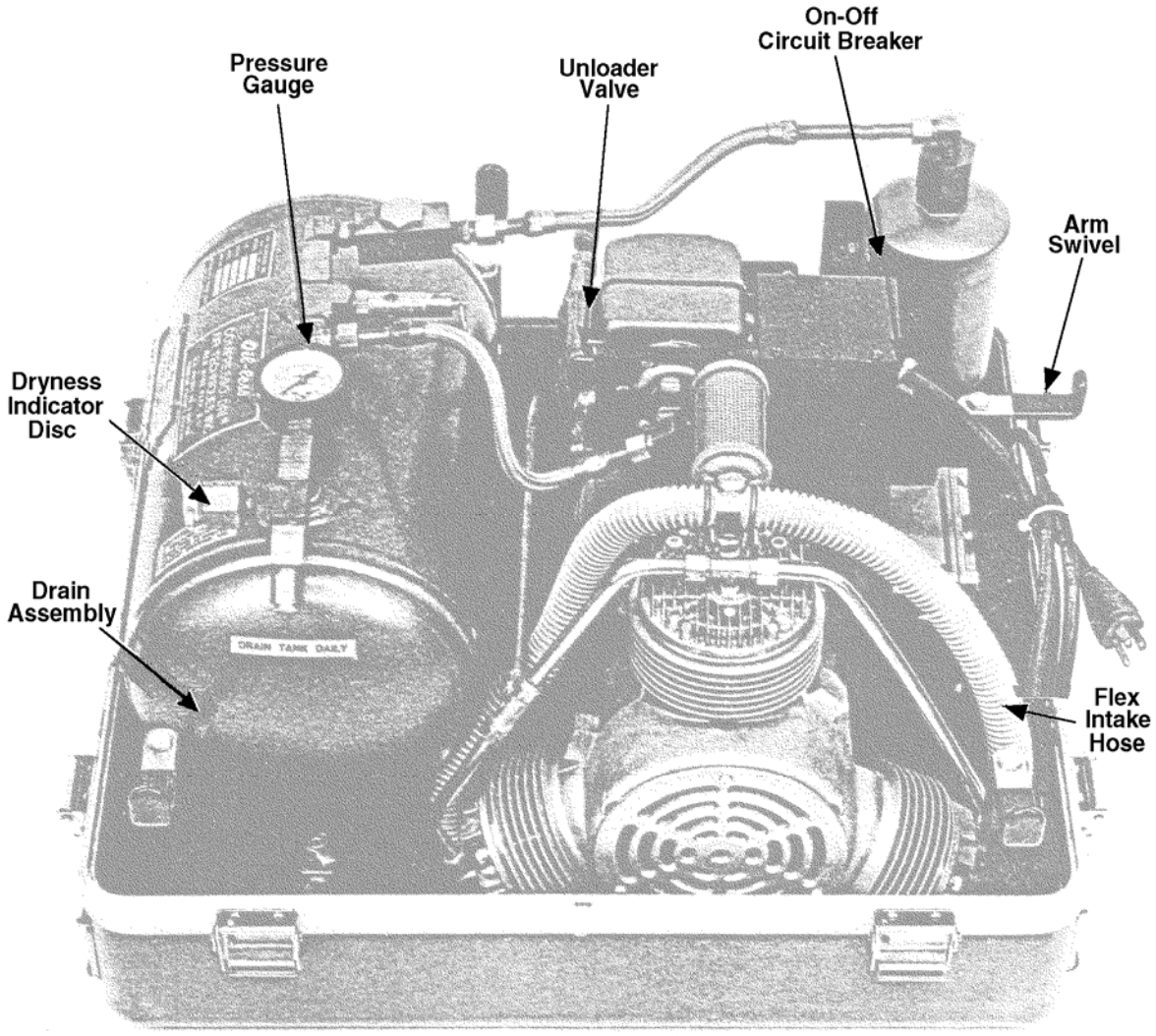


Figure 1-2. Operator controls and indicators.

d. **Desiccant.** The desiccant is SOY-R-B. The properties of this desiccant allow it to absorb the moisture that is in the compressed air. The moisture can be removed from this desiccant, and it has an indefinite life expectancy.

e. **Drying Chamber.** The drying chamber is the canister that holds the desiccant.

(1) The desiccant is shaped like a BB and is approximately the same size.

(2) Located inside the top portion of drying chamber is a 5 micron filter. It removes the small particles that were drawn into the compressor from the atmosphere.

(3) There is a screen in the bottom of the chamber to keep the desiccant from entering the storage tank.

f. **Unloader Valve.** The unloader valve is used to relieve pressure from the compressor head during initial start up.

(1) This valve is also used in the drying cycle to discharge stored air to the atmosphere, thus regenerating the desiccant.

(2) The unloader valve is mounted to the pressure switch housing.

g. **Exhaust Muffler.** The exhaust muffler has two main purposes.

(1) The main function is to reduce noise during the purging cycle.

(2) The other purpose or function is to keep contaminants out of the compressor when there is no pressure in the line keeping the unloader valve closed.

h. **Pressure Switch.** The pressure switch controls the maximum and minimum pressure that the M5A compressor delivers.

(1) The pressure switch has a rubber diaphragm that flexes due to the storage tank pressure.

(2) There are high and low settings that you can adjust.

NOTE: The pressure switch is factory preset at 80 psi and 60 psi respectively.

(a) At the high pressure setting (80 psi), the motor that controls the compressor is turned off. Also, the unloader valve is depressed and the compressor begins its drying cycle.

(b) At the low setting (60 psi), the compressor motor energizes, and the unloader valve is allowed to close. This occurs because the tab that had depressed it at the high setting is no longer pushed forward.

i. **Cooling Coil.** The cooling coil is a piece of copper tubing that is coiled. The muffin fan forces air over this coil to cool the air before it reaches the drying chamber on its way to the storage tank.

j. **Intake Silencer.** The intake silencer is a dry type filter used to remove contaminants from the atmosphere at the intake of the compressor. The silencer:

(1) Must be on the compressor and not damaged before you start the compressor.

(2) Reduces the noise created during the suction stroke of the air compressor.

k. **Reed Valves.** The reed valves control the intake and output of the compressor head.

(1) During the suction stroke, the following occurs:

(a) The intake is pulled down allowing the air to be drawn into the cylinder.

(b) The exhaust or output valve is pulled closed to prevent drawing air in from the tubing and storage tank.

(2) During the compression stroke, the following occurs:

(a) The intake valve is pushed closed.

(b) The exhaust or output valve is pushed open.

(3) These valves are made of a spring steel that is appropriate for the strength of the suction and pressure of this specific compressor.

l. **Induction Motor.** The induction motor requires two capacitors. These capacitors create greater starting torque due to the phase shift.

1-3. THEORY OF OPERATION

The operation of the compressor consists of two cycles: the pumping cycle and the purging cycle. During the pumping cycle, the compressor compresses intake air, cools it, directs it through a drying chamber where a desiccant removes any water vapor, and passes it into a storage tank (also called a pressure tank). Refer to figure 1-1. When the pressure in the storage tank reaches 80 psi, the compressor stops and the purging cycle begins. During the purging cycle, a portion of the dry compressed air in the storage tank is bled back through the drying tank to the atmosphere. This expanded dry air reabsorbs any moisture from the desiccant and carries it out into the atmosphere. When the pressure in the storage tank decreases to 60 psi, the compressor again starts, and the pumping cycle begins. These two cycles continue to automatically take place during operations of the compressor. Throughout both cycles, the cooling coil fan runs continuously, and the dry compressed air in the storage tank is supplied to the Dental Operating and Treatment Unit.

a. **Pumping Cycle.** Initially, with no pressure in the storage tank, the action of the pressure switch closes the unloader valve and the pressure switch contacts that are in series with the compressor motor. Refer to figure 1-3.

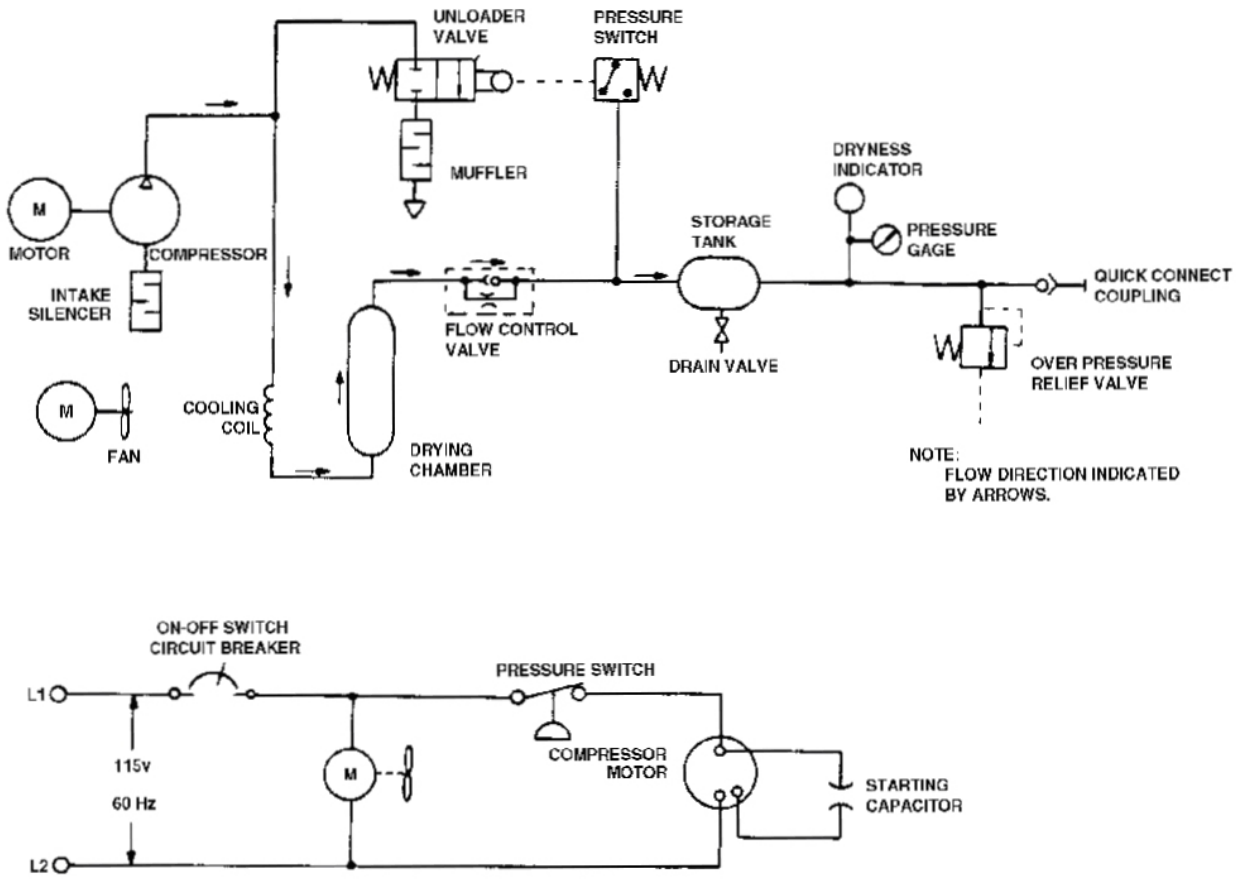


Figure 1-3. Pumping cycle schematic diagram.

(1) When you set the circuit breaker to ON, both the compressor and the cooling coil fan motor start.

(2) The compressor directs compressed air through the cooling coil, the drying chamber, and the flow control valve into the storage tank.

(a) The drying chamber contains a desiccant to remove moisture from the air.

(b) The flow control valve contains a ball check valve to allow compressed air to enter the storage tank while preventing it from leaving during the pumping cycle.

(c) The pressure gauge on the storage tank indicates the internal air pressure within the tank.

(d) The dryness indicator shows the presence or absence of moisture in the stored compressed air by its color (blue for dry, pink for wet).

(3) When the storage tank pressure reaches 80 psi, the pressure switch opens the electrical switch in series with the compressor motor, which does the following:

(a) Stops the compressor.

(b) Opens the unloader valve, venting the compressor and drying chamber to the atmosphere.

NOTE: It should take approximately 40 seconds to build from 0 psi to 80 psi.

(4) This ends the pumping cycle, and the purging cycle automatically begins.

b. **Purging Cycle.** With the unloader valve open and the drying chamber vented to the atmosphere, dry compressed air in the storage tank passes through a bleed hole in the flow control valve where it expands at the controlled rate. Refer to figure 1-4.

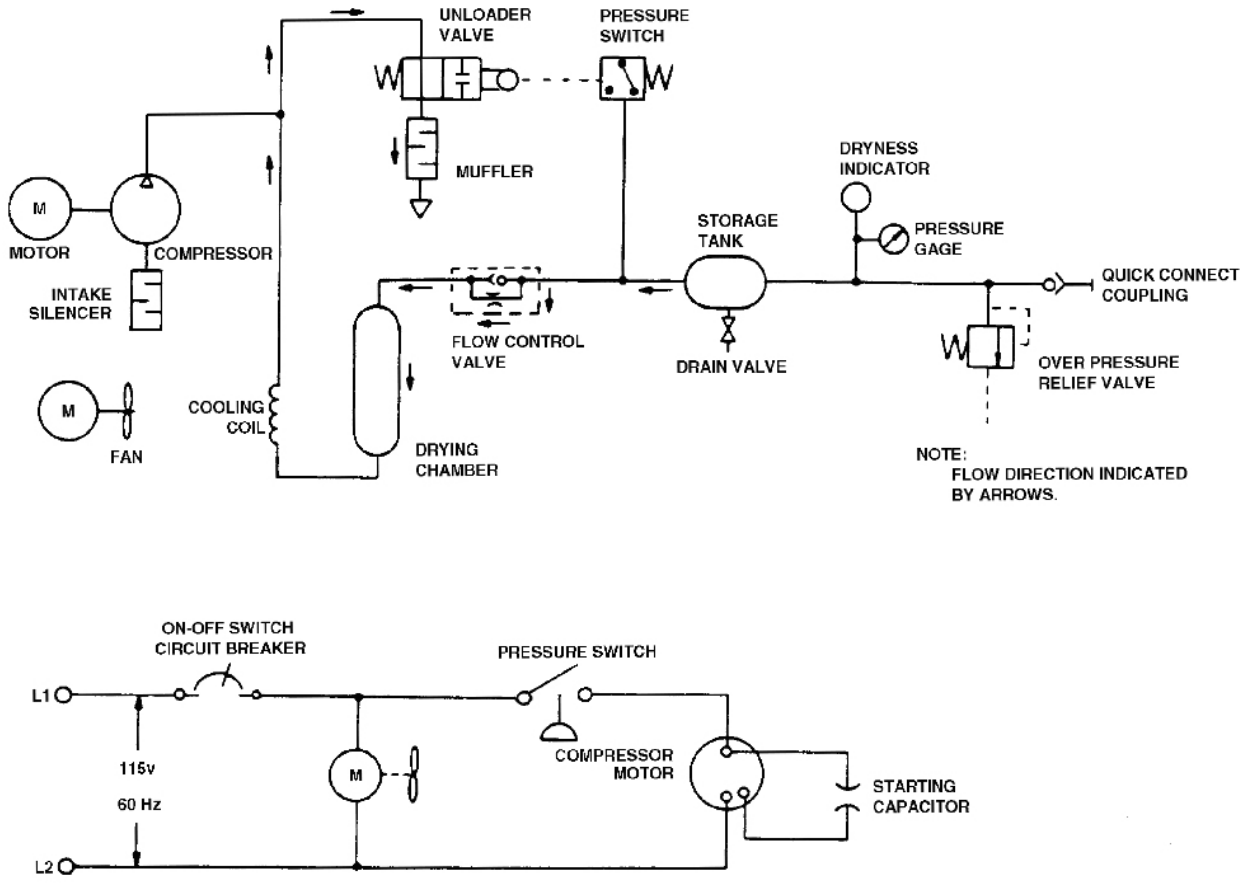


Figure 1-4. Purging cycle schematic diagram.

(1) This large volume of dry expanded air passes through the drying chamber, where it:

(a) Reabsorbs moisture from the desiccant.

(b) Releases the moisture absorbed into the atmosphere.

(2) When the pressure in the storage tank decreases to 60 psi:

(a) The pressure switch closes.

(b) The pumping cycle again begins.

NOTE: It should take approximately 31 seconds to bleed from 80 psi to 60 psi.

NOTE: It should take approximately 8 seconds to build from 60 psi to 80 psi.

1-4. OPERATING PROCEDURES

a. **General Operating Procedures.** Prior to operating the compressor, you perform the operational checkout procedure discussed in Lesson 2, Perform Verification of Compressors. The actual operating procedures of the compressor are fully automatic. As the load requires compressed air, the compressor operates to supply it. There are no operating adjustments associated with normal operation.

b. **Intermittent Operating Procedures.** If the dental operating unit will not be drawing compressed air from the compressor for any period of time, set the ON-OFF circuit breaker to OFF. Refer to paragraph 1-4c.

c. **Operator Controls and Indicators.** Refer to figure 1-2.

(1) Drain valve. Use to remove water and air from the storage tank.

(2) Dryness indicator. Indicates presence of moisture in the air (blue is dry, pink is wet).

(3) Pressure gauge. Indicates the pressure of air in the storage tank.

(4) Red manual unloader tab. Use to unload compressor head before starting.

(5) ON-OFF circuit breaker. Power switch and protective device for compressor motor.

(6) Swivel arm. Use to support the transit case cover above the compressor during normal operation.

CAUTION: Always remove compressor head pressure by depressing the red unloader valve tab on the pressure switch while setting the circuit breaker to ON. Failure to depress the red tab will result in the tripping of the circuit breaker.

d. **Restart Procedures**. To restart the compressor, set the circuit breaker to ON.

e. **Load Factors.**

(1) Normal load. The recommended maximum operating load under normal circumstances is 3.8 cubic feet per minute (cfm). Refer to Figure 1-5 for the load factors of various dental instruments. The normal recommended load is equivalent to the continuous operation of one high-speed handpiece and one venturi type oral evacuator at maximum capacity.

(2) Expedient load. The compressor has the capability of providing sufficient air to drive two operating units as a short-time expedient measure. The maximum operating load recommended in such a situation is continuous operation of two saliva ejectors at maximum capacity and intermittent operation of two high-speed handpieces.

SYSTEM	CFM
Oral Evacuator	2.5
Saliva Ejector	1.0
High-speed Handpiece	1.3

Figure 1-5. Load factors.

NOTE: If operation in an expedient situation is necessary, you may have to adjust the control block in the dental operating and treatment unit to permit higher pressure to the handpieces. You do this in order to ensure their peak efficiency when the two systems are operating simultaneously. After use in an expedient situation, check the dryness indicator. If it is not blue, refer to Lesson 2, paragraph 2-2e(2).

f. **Turn-off Procedures**. To turn off the compressor at the end of each day, use the following procedures:

(1) Set the circuit breaker to OFF.

(2) Drain the storage tank by placing the tank drain hose outside the transit case and opening the drain valve.

(3) When the pressure gauge indicates zero psi, close the drain valve and place the drain hose inside the transit case.

CAUTION: Do not allow water to accumulate in the transit case.

1-5. PMCS PROCEDURES

To perform PMCS on the Model M5A Compressor-Dehydrator, you need a Medical Equipment Repairer's Tool Kit, NSN 5180-00-611-7923, and a Medical Equipment Repairer's Tool Kit, NSN 5180-00-611-7924. Use the following procedures. If any repairs are necessary, refer to the Compressor/Dehydrator Troubleshooting Guide in the appendix. Refer to figure 1-1.

a. **Inspect the Case.**

(1) Check all the latches and handles to ensure they are not broken or missing.

(2) Check the foam inside the case to ensure it is not torn or deteriorated.

(3) Check the motor supports to ensure they are not bent or broken.

(4) Check the post supports to ensure they are not bent.

(5) Check all the tubing to ensure it is not deteriorated, cut, or nicked.

(6) Check the air relief valve.

(a) Ensure that the push button is not broken or missing.

(b) Ensure that the push button springs back after its release.

b. **Inspect the Dryer and Cooling Assembly.**

(1) Check the fan for bent or broken fan blades.

(2) Check the fan guard to ensure it is not broken or missing.

(3) Check for loose clamps or missing screws.

(4) Check the humidifier (also called the dryness indicator).

(a) Check for cracks, dents, or broken indicator cover.

(b) Check for blue desiccant. Refer to paragraph 1-3a(2)(d).

c. **Clean the Compressor.** Remove any accumulation of dust and dirt from the compressor periodically.

(1) Check the intake silencer for heavy accumulation of dust or dirt.

(2) Replace the intake silencer if there is a heavy accumulation of dust or dirt.

WARNING

Do not use any type of liquid cleaner or solvent to clean the intake silencer element.

CAUTION: Do not restrict air flow through the air intake silencer.

d. **Inspect the Running/Starting Capacitors.** Ensure there is no corrosion on the terminals or any indication of a chemical leak from the capacitors.

e. **Verify the Compressor.** The final step of PMCS is to verify the compressor is operating to manufacturer's specification. Refer to Lesson 2, Perform Verification of Compressor.

Continue with Exercises

EXERCISES, LESSON 1

INSTRUCTIONS: Answer the following exercises by marking the response that best answers the question.

After you have completed all of the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For exercises answered incorrectly, reread the material referenced after the solution.

1. If the pressure switch does not operate properly at the upper limit, what device in the M5A is utilized to protect the operator and equipment?

   a. Flow control valves.

   b. Unloader valves.

   c. Safety valves.

   d. Reed valves.

2. Which of the following components keeps contaminants out of the compressor when there is no pressure in the line?

   a. Flow control valves.

   b. Exhaust muffler.

   c. Intake silencer.

   d. Pressure switch.

3. The induction motor requires two capacitors. Which of the following statements describes what these capacitors do?

   a. Used to start motor only.

   b. Maintain proper running speed only.

   c. Create greater starting torque due to the phase shift.

   d. Create positive charge to keep motor running smoothly.

4. Which of the following statements is correct for describing the compressor's theory of operation?

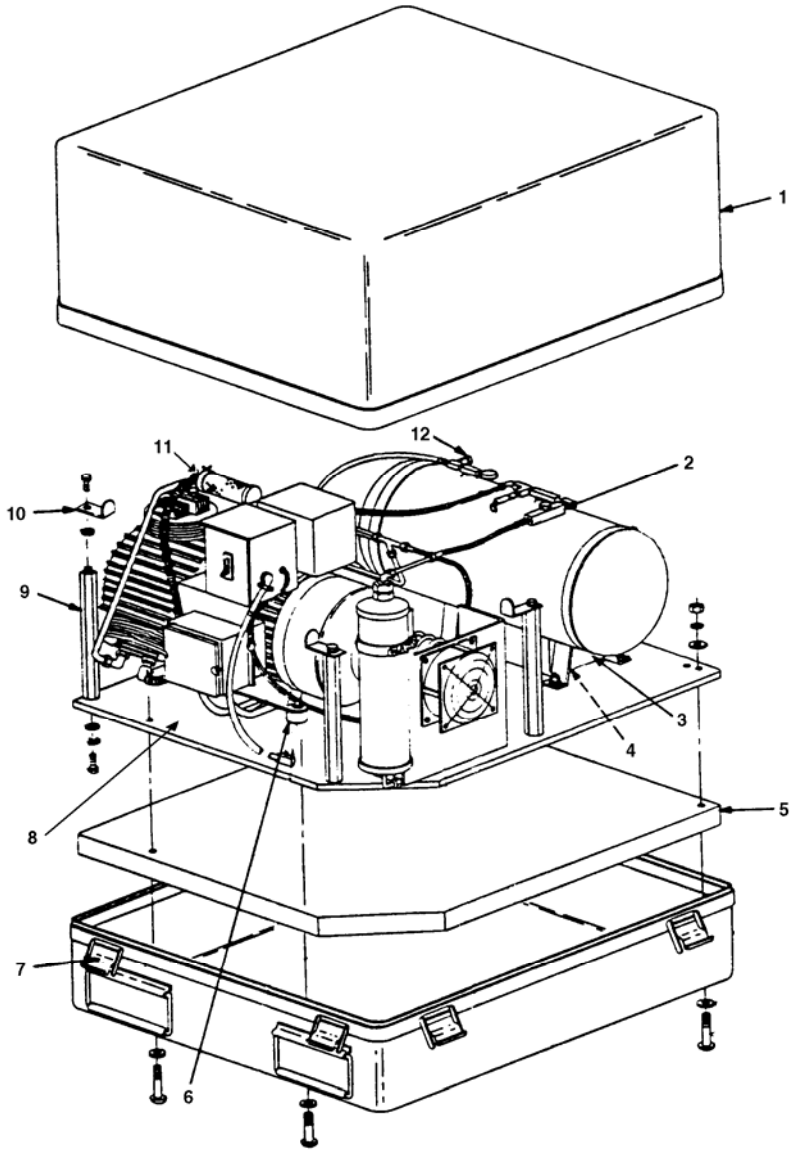
   a. When the pressure in the storage tank reaches 80 psi, the compressor stops, and the purging cycle begins.

   b. When the pressure in the storage tank reaches 60 psi, the compressor stops, and the purging cycle begins.

   c. The cooling coil runs only during the pumping cycle.

   d. The compressor starts again when the pressure in the tank decreases to 80 psi and the pumping cycle begins.

SITUATION: Refer to the following figure for exercises 5 through 7.



5. Refer to the above figure. What number indicates the sound foam?

   a. 1.

   b. 3.

   c. 5.

   d. 8.

6. Refer to the figure on the previous page. What number indicates the safety relief valve?

   a. 2.

   b. 6.

   c. 11.

   d. 12.

7. Refer to the figure on the previous page. What number indicates the arm swivel?

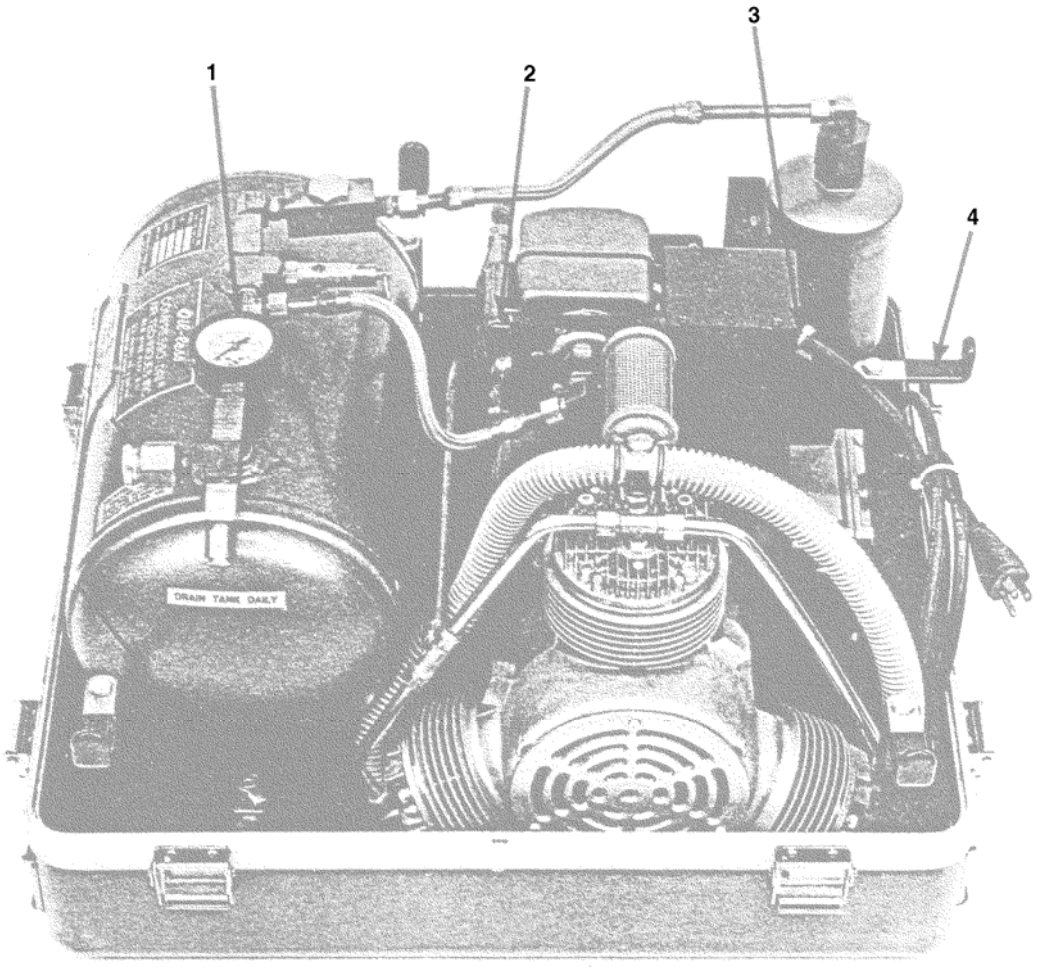
   a. 4.

   b. 7.

   c. 9.

   d. 10.

SITUATION: Refer to the following figure for exercise 8.



8. Refer to the above figure. What number indicates the ON-OFF circuit breaker?

   a. 1.

   b. 2.

   c. 3.

   d. 4.

9. When operating the compressor under normal circumstances, which of the following represents the recommended operating load?

   a. One oral evacuator, one saliva ejector, and one high-speed hand-piece.

   b. One oral evacuator, one saliva ejector, and two high-speed hand-pieces.

   c. One oral evacuator and two high-speed hand-pieces.

   d. One oral evacuator and either one high-speed hand-piece or one saliva ejector.

10. Which of the following procedures do you use during PMCS on the compressor?

   a. Ensure the desiccant is white.

   b. Clean the intake silencer element with a liquid cleaner.

   c. Ensure there is no air flow restriction through the air intake silencer.

   d. Check the air relief valve to ensure that the push button remains in when depressed.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 1.

1. c (para 1-2a)
2. b (para 1-2g)
3. c (para 1-2l)
4 a (para 1-3)
5. c (figure 1-1)
6. d (figure 1-1)
7. d (figure 1-1)
8. c (figure 1-2)
9. d (para 1-4e(1), figure 1-5)
10. c (para 1-5c CAUTION)

End of Lesson 1

LESSON ASSIGNMENT

LESSON 2	Perform Verification of Compressors.
TEXT ASSIGNMENT	Paragraphs 2-1 through 2-3.
LESSON OBJECTIVES	After completing this lesson, you should be able to: 2-1. Identify procedures for performing an operational checkout on the compressor.
SUGGESTION	After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 2

PERFORM VERIFICATION OF COMPRESSORS

2-1. GENERAL

As the medical equipment repairer, you must ensure that the compressor is operating efficiently. To verify the compressor is measuring up to manufacturer's specifications you must perform an operational checkout. The operator should conduct a performance verification daily and before each use.

2-2. PERFORM OPERATIONAL CHECKOUT

Use the following procedures to perform an operational checkout. Refer to figure 1-1.

NOTE: Do not draw air from the compressor during the operational checkout procedure.

WARNING

Do not restrict air flow through the air intake silencer.

a. **Check the Drain Valve.** Ensure it opens and closes properly.

b. **Turn On the Unit.**

(1) While depressing the red manual unloader tab on the pressure switch, set the ON-OFF circuit breaker to ON.

(2) Ensure the compressor motor and dryer cooling fan energize.

c. **Check the Pressure Gauge.**

(1) Check for a cracked or broken dial cover.

(2) Check for a bent or broken gauge indicator.

d. **Check the Compressor.**

(1) Verify the pressure reaches 80 psi in approximately 40 seconds, and the compressor shuts itself off.

(2) Verify the pressure decreases to 60 psi in approximately 30 seconds.

NOTE: During this time, you should hear a hissing sound as purged air is discharged through the exhaust muffler. This indicates the regeneration system is functioning properly.

(3) Verify the compressor turns itself back on at 60 psi and runs for approximately eight seconds until the pressure reaches 80 psi.

(4) Ensure the cycle then repeats steps (2) and (3).

e. **Check the Color of the Dryness Indicator.**

(1) If the color is blue, the compressor is ready for operation.

(2) If the color is not blue, regenerate the system before using the compressor.

f. **Rotate Transit Case Cover Supports.**

(1) Rotate the four transit case cover supports so that they overlap the edges of the transit case as right angles.

(2) Place the transit case cover on its supports. Refer to figure 2-1.

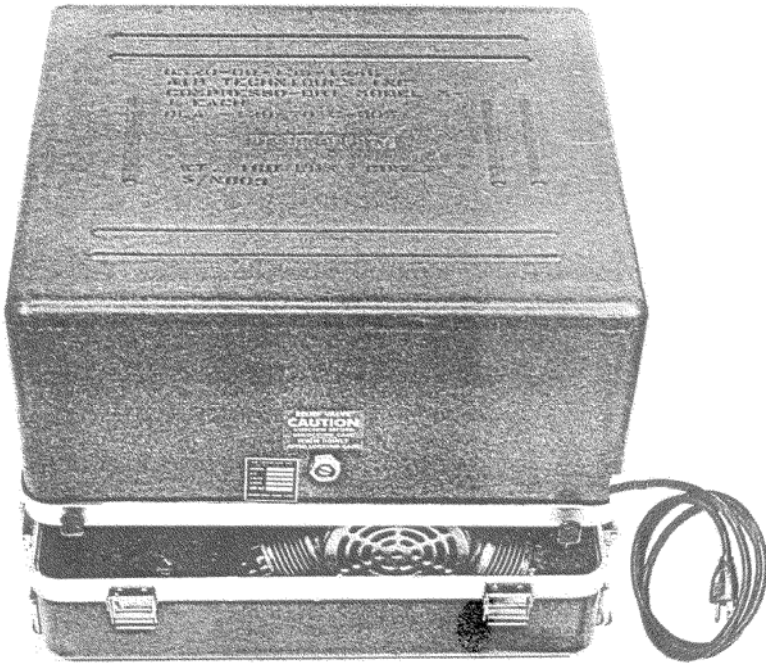


Figure 2-1. Compressor setup for operation.

2-3. UTILIZE TROUBLESHOOTING GUIDE

If the compressor does not meet manufacturer's specifications, refer to the Compressor/Dehydrator Troubleshooting Guide in the appendix. Also refer to Lesson 3, Isolate Malfunctions to Component Level in Compressors, for instructions in using the troubleshooting guide.

Continue with Exercises

EXERCISES, LESSON 2

INSTRUCTIONS: Answer the following exercises by marking the response that best answers the question.

After you have completed all of the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For exercises answered incorrectly, reread the material referenced after the solution.

1. Which of the following procedures do you perform when conducting an operational checkout?

   a. Depress the safety release when turning on the unit.

   b. Ensure the compressor motor and dryer cooling fas energize.

   c. Verify the pressure decreases to 60 psi in 10 seconds.

   d. Ensure you can hear no hissing sound as purged air is discharged through the exhaust muffler.

2. You are checking the color of the dryness indicator. The compressor is ready for operation if it is what color?

   a. White.

   b. Pink.

   c. Blue.

   d. Black.

3. During an operational checkout, you must do which of the following to the transit case cover supports?

   a. Lubricate them.

   b. Rotate them 180 degrees.

   c. Screw them firmly into the cover.

   d. Place the transit case cover on them.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 2

1. b (para 2-2b(2))
2. c (para 2-2e(1))
3. c (para 2-2f(2))

End of Lesson 2

LESSON ASSIGNMENT

LESSON 3	Isolate Malfunctions to Component Level in Compressors.
TEXT ASSIGNMENT	Paragraphs 3-1 through 3-2.
LESSON OBJECTIVES	After completing this lesson, you should be able to:
	3-1. Identify the steps in using the Compressor/Dehydrator Troubleshooting Guide when isolating malfunctions.
	3-2. Utilize the Compressor/Dehydrator Troubleshooting Guide to identify steps in isolation malfunctions.
SUGGESTION	After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 3

ISOLATE MALFUNCTIONS TO COMPONENT LEVEL IN COMPRESSORS

3-1. TROUBLESHOOTING GUIDE

Troubleshooting is a systematic method of isolating malfunctions based on symptoms and their associated probable cause(s). It is intended to reduce the amount of time normally required to locate maladjustments and defective components. It is also intended to restore equipment to a serviceable condition.

a. When you isolate malfunctions in the compressor, you use a troubleshooting guide. Refer to the Compressor/Dehydrator Troubleshooting Guide in the appendix. Based on the observed problem, the guide gives you a list of probable causes and the corrective action to take. The troubleshooting guide supplements your experience as the repairer. As you gain experience isolating malfunctions in the compressor, you will rely less and less on it. To troubleshoot you:

(1) Match the symptoms to probable causes.

(2) Match the probable causes to corrective measures.

b. To troubleshoot the compressor, you need a digital multimeter in addition to the tool kits described in Lesson 1, paragraph 1-5.

3-2. ISOLATE MALFUNCTIONS

The components selected for inclusion in the subcourse represent a portion of the total number of components in this piece of equipment. The skills required to isolate malfunctions to a portion of the components are transferable to isolating malfunctions in all components.

a. The compressor runs, but noises are present. You want to troubleshoot and isolate the malfunction. Use the following procedures. Refer to the Compressor/Dehydrator Troubleshooting Guide in the appendix.

(1) Find the symptom you are observing in the **SYMPTOM** column of the guide. In this case Symptom #3.

(2) Go to the **PROBABLE CAUSE** column to find the first probable cause, Intake, flex hoses not installed properly or cracked.

(3) Go to the **TEST PROCEDURE/CORRECTIVE ACTION** column to find the procedures you use to test for the probable cause indicated.

(a) Make sure flex hose does not touch other parts.

(b) If improperly installed, correct the installation.

(c) If you find cracked hoses, replace as necessary.

(4) If you find neither improperly installed nor cracked hoses, go back to the **PROBABLE CAUSE** column for the next most likely cause for the malfunction. Broken reed valves are the next most reasonable cause for noises when the compressor motor runs.

(5) Go to the **TEST PROCEDURE/CORRECTIVE ACTION** column to find the procedures you use to test for broken reed valves. If the valves are broken the compressor vibrates.

(a) If there is vibration, replace the reed valves as necessary.

(b) If there is no vibration, check for the next probable cause.

(6) Go to the **PROBABLE CAUSE** column to find the next most probable cause for noise when the compressor runs, defective bearings.

(7) Go to **the TEST PROCEDURE/CORRECTIVE ACTION** column and follow the directions to replace the bearings.

b. After repairing or replacing a defective component, perform an operational checkout. Refer to paragraph 2-2.

Continue with Exercises

EXERCISES, LESSON 3

INSTRUCTIONS: Answer the following exercises by marking the response that best answers the question.

After you have completed all of the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For exercises answered incorrectly, reread the material referenced after the solution.

1. Which of the following is a reason to use the Compressor/ Dehydrator Troubleshooting Guide?

   a. Because it provides a systematic method of isolating malfunctions.

   b. Because it guarantees you won't skip anything that could be the cause of the problem.

   c. Because it allows experienced repairers to spend their time on more difficult tasks.

   d. Because Army regulation requires you to use it.

SITUATION: You are isolating malfunctions in the compressor. Refer to the Compressor/Dehydrator Troubleshooting Guide in the appendix for exercises 2 through 4.

2. What is the most probable cause for the compressor motor running, but with noises?

   a. Worn rings or guides.

   b. Defective unloader valve.

   c. Intake silencer restricted.

   d. Flex intake hoses not installed properly.

3. You are isolating the cause of a compressor motor attempting to start, but not running. Which of the following procedures would you use?

   a. Replace the reed valves.

   b. Replace the pressure gauge.

   c. Replace or clean the intake silencer.

   d. Depress the red manual unloader valve tab.

4. You are troubleshooting the compressor running, but not building pressure to 80 psi. Which of the following procedures do you use?

   a. Regenerate the drying chamber.

   b. Remove reed valves and repair or replace.

   c. Make sure the flex hose does not touch other parts.

   d. With the power ON, insert an Allen wrench into the hole in the finned aluminum housing on the end of the compressor?

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 3

1. a (para 3-1)
2. d (Compressor/Dehydrator Troubleshooting Guide, Symptom 3)
3. d (Compressor/Dehydrator Troubleshooting Guide, Symptom 2)
4. b (Compressor/Dehydrator Troubleshooting Guide, Symptom 4)

End of Lesson 3

LESSON ASSIGNMENT

LESSON 4	Remove and Replace or Repair Defective Components of Compressors
TEXT ASSIGNMENT	Paragraphs 4-1 through 4-3.
LESSON OBJECTIVES	After completing this lesson, you should be able to:
	4-1. Identify the steps in removing and replacing major compressor components.
	4-2. Identify which compressor components can be field repaired.
	4-3. Identify steps in disassembling and repairing compressor components.
SUGGESTION	After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 4

REMOVE AND REPLACE OR REPAIR DEFECTIVE COMPONENTS OF COMPRESSORS

4-1. GENERAL

Once you have isolated a malfunction in the compressor, you must remove and replace or repair the defective component. Refer to Lesson 1 for the list of tools you use on this task. The procedures covered in this lesson are examples of the methods to use to correct common malfunctions. Remember, whenever you remove and replace or repair a defective component, before you put the unit back in service, you must perform the operational checkout discussed in Lesson 2, Perform Verification of Compressors.

NOTE: In accordance with AR 750-1, the Maintenance Allocation Chart (MAC) is the primary tool for assigning tasks within the levels of the Army maintenance system. Before any large repairs are performed, check the MAC to ensure that you are authorized to perform the task.

WARNING

Always remove compressor tank pressure by opening the drain valve and waiting for the pressure gauge to read zero psi before disassembling the compressor components.

4-2. REMOVE MAJOR COMPONENTS OF THE COMPRESSOR

a. **Remove the Compressor Assembly From the Transit Case.** To remove the compressor assembly from the transit case, refer to figure 1-1 and use the following procedures.

(1) Remove the four nuts, lock washers, and flat washers from the bolts securing the compressor base plate to the transit case bottom.

(2) Lift the compressor assembly (mounted on the base plate) from the transit case bottom.

(3) If the sound foam is damaged, remove and replace it.

NOTE: The four bolts extending through the lower transit case have rubber washers under the heads. Be sure they are in place when reassembling to ensure water proof integrity.

(4) Reassemble in reverse order of removal.

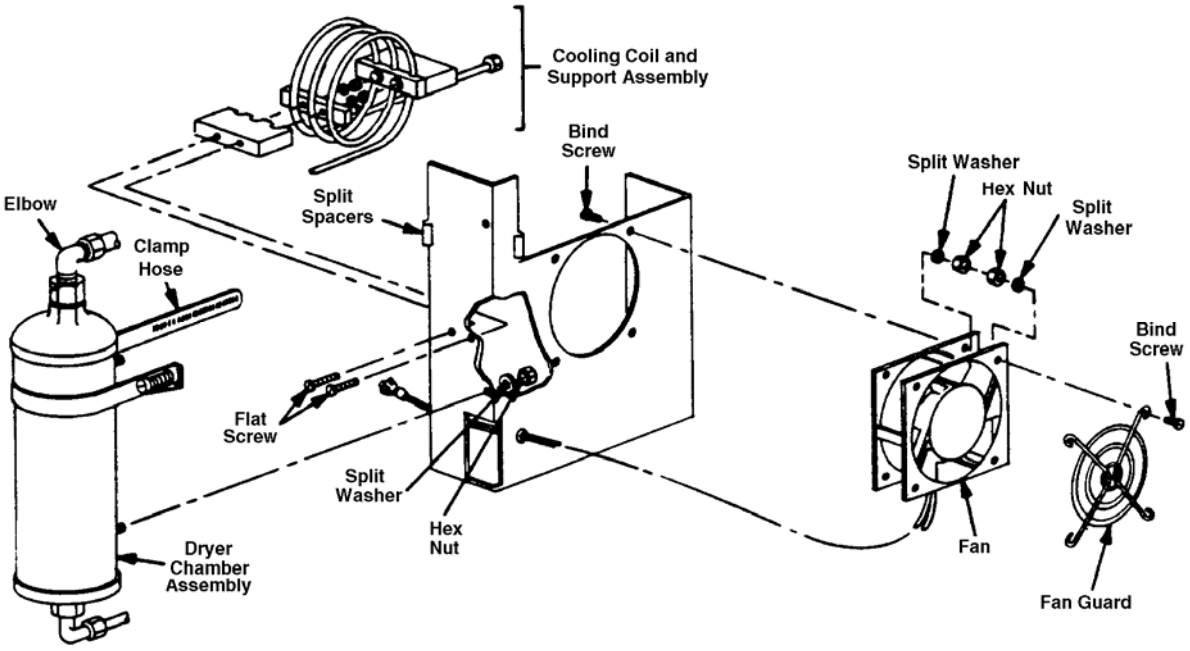


Figure 4-1. Dryer and cooling coil assembly.

b. **Remove the Dryer and Cooling Coil Assembly.** To remove the dryer and cooling coil assembly, refer to figure 4-1 and use the following procedures.

(1) Disconnect the cable from the cooling fan to the circuit breaker at the connector.

(2) Disconnect the fittings between:

(a) The top of the drying chamber and the metal flex hose to the flow control valve.

(b) The cooling coil and metal flex hose to the unloader valve.

(3) Remove two nuts, lock washers, and flat washers from the bolts securing the dryer and cooling assembly to the compressor assembly base plate.

(4) Replace the malfunctioning component.

(5) Reassemble unit in the reverse order of removal.

(6) Ensure that all fittings are leak proof.

(7) Apply a paste-type pipe dope to all threads, except compression fittings, before assembling.

c. **Remove the Pressure Switch and Bracket Assembly.** You have isolated the cause of a malfunction in the compressor to a defective pressure switch and must now replace the switch. Refer to figures 4-2 and 4-3.

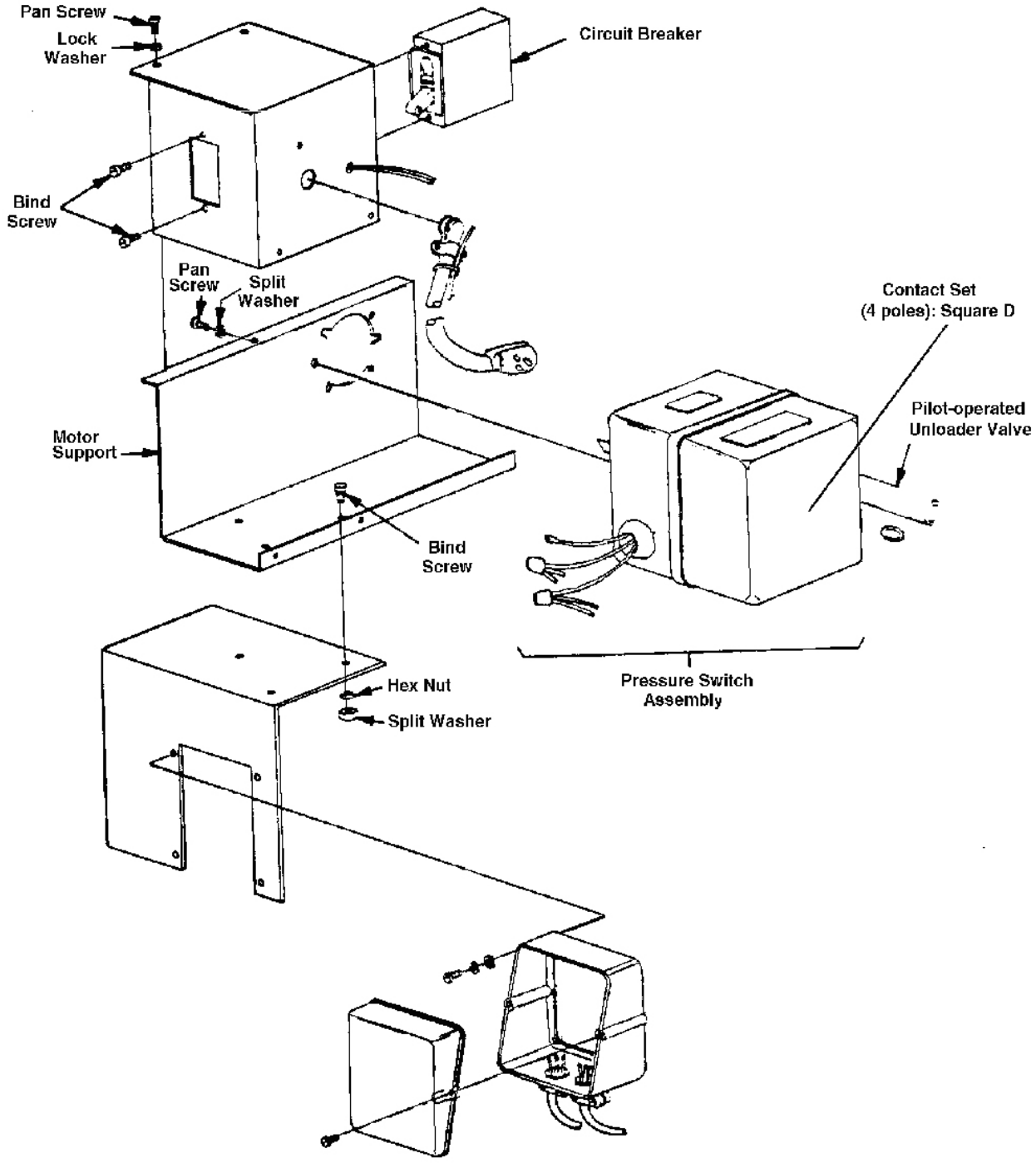


Figure 4-2. Pressure switch and bracket assembly.

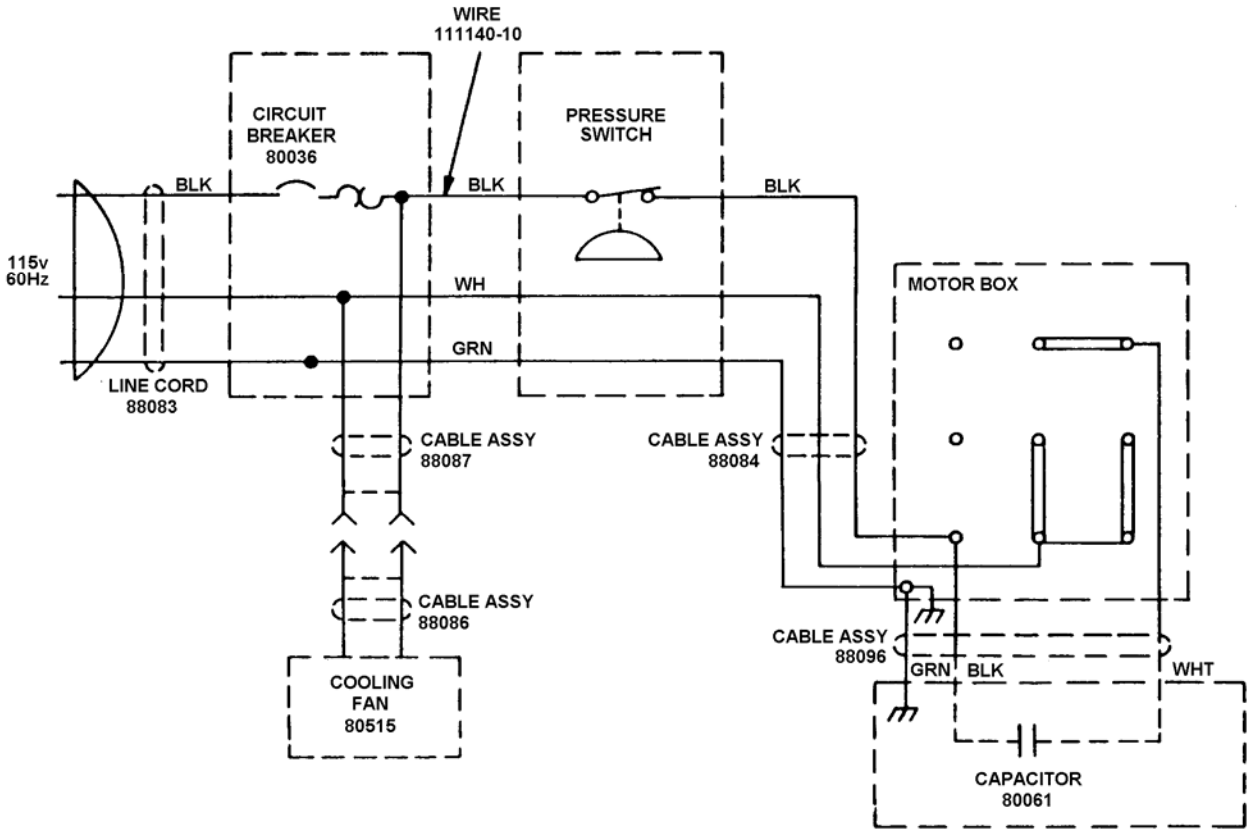


Figure 4-3. Compressor wiring diagram.

(1) Remove the cover from the motor box by removing two screws.

(2) Remove the four screws, lock washer, and flat washers from the inner corners of the motor box. Note the ground wires (green) under one of the screws.

(3) Disconnect the cable from the circuit breaker to the cooling fan at the connector.

(4) Remove the black, green, and white pressure switch wires from under the appropriate screws within the motor box.

(5) Disconnect the fittings between the pressure switch and the flex hose to the storage tank inlet assembly and between the unloader valve and the flex hose to the cooling coil.

(6) Raise the pressure switch and bracket assembly from between the motor and motor box.

(7) Disassemble the pressure switch.

(8) Replace the pressure switch with a new component.

(9) Reassemble by reversing procedures described in paragraphs 4-2c(1) through (7).

d. **Remove the Capacitor.** To remove the capacitor, refer to figure 1-1 and use the following procedures.

(1) Remove the cable between the motor and the capacitor at the connector on the capacitor.

(2) Loosen the four nuts and lock washers securing the capacitor bracket to the base plate.

(3) Slide the capacitor out from under the bracket.

(4) Replace the capacitor with a new component.

(5) Reassemble by reversing procedures described in paragraphs 4-2d(1) through (3).

4-3. DISASSEMBLE AND REPAIR COMPONENTS

The following paragraphs contain disassembly and repair procedures for those components on which you can do field repair. Only disassemble the component to the extent required to accomplish the repair.

a. **Disassemble and Repair the Flow Control Valve.** You can disassemble, clean, and repair the flow control valve as required. Refer to figure 4-4 and use the following procedures.

(1) Remove the hex cap, spring, and orifice seat from the valve body.

(2) Inspect the hex cap O-ring and orifice seat O-ring for damage.

(3) Inspect all parts for wear, pock marks, dirt or other signs of damage. Clean or replace as required.

(4) Insert the orifice seat (with the O-ring in place), spring, and hex cap (with the O-ring in place) into the valve body and tighten securely.

CAUTION: When installing the flow control valve on the compressor, be sure to connect the end marked INLET to the flex hose from the drying chamber.

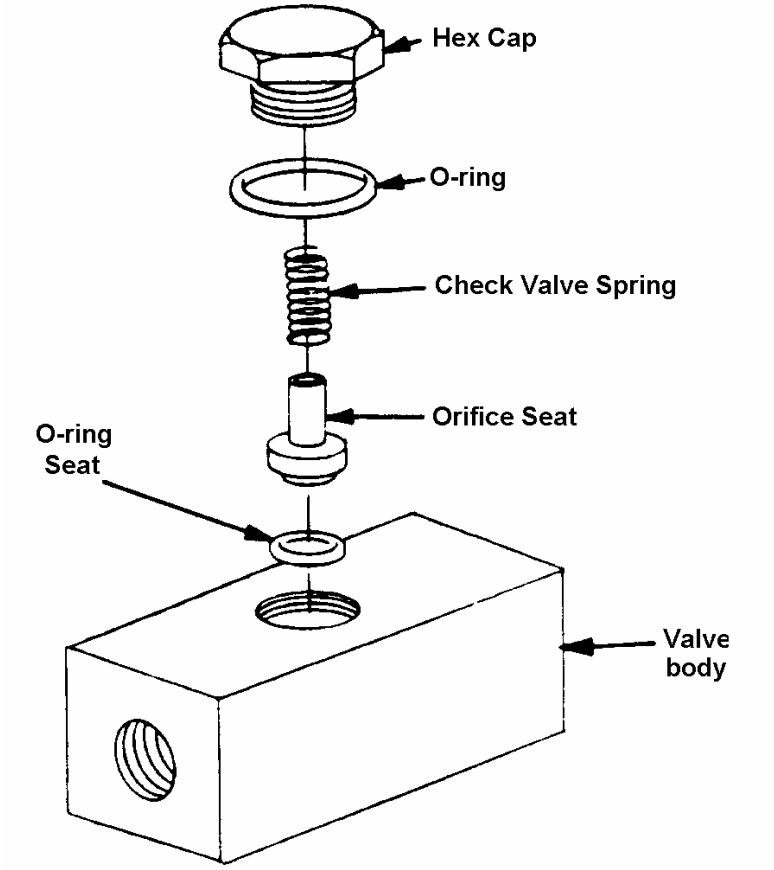


Figure 4-4. Flow control valve.

b. **Disassemble and Repair the Pilot-Operated Pressure Switch Unloader Valve.** You can disassemble, clean, and repair the unloader valve as required. Refer to figure 4-5 and use the following procedures.

NOTE: This assembly is factory installed on M5A compressors, Serial Number 2100 and above. It may be installed on any M5 series compressor by following the steps outlined in paragraph 4-3b(8).

(1) Remove the unloader valve from the pressure switch bracket by removing the nut and lock washer.

(2) Remove the inlet tee from the valve body.

(3) Remove the strainer from the inlet tee.

(4) Tilt the valve body to remove the valve seat pin assembly.

(5) Remove the muffler from the valve body and clean if necessary.

CAUTION: Do not plug the muffler port in any manner.

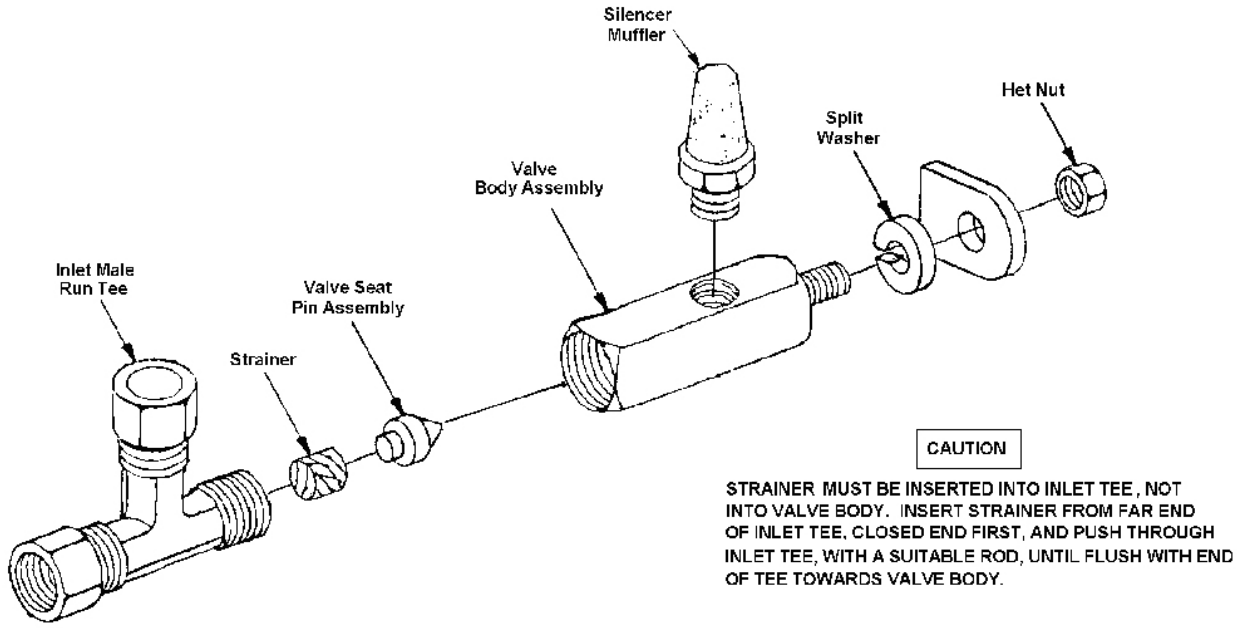


Figure 4-5. Pilot-operated pressure switch unloader valve.

(6) Inspect all parts for wear, pock marks, dirt, or other signs of damage. Clean or replace as required.

(7) Reassemble the unloader valve by inserting the valve seat pin assembly strainer and the inlet tee into the valve body. Install the muffler.

NOTE: When installing the pilot-operated pressure switch, be sure to position the lock washer and the mounting nut on each side of the pressure switch bracket.

CAUTION: Remove power from the compressor when working inside the pressure switch.

(8) Adjust the pilot-operated pressure switch unloader valve as follows.

(a) Remove the pressure switch cover.

(b) Loosen the lock nut located inside the pressure switch in the upper right-hand corner.

(c) Turn the adjusting screw counterclockwise until it is free of tension from the opposing pressure switch tab.

(d) Run the compressor until it turns itself off at 80 psi. The unloader valve should not discharge air.

(e) Turn the adjusting screw clockwise (use light pressure on the screw driver) until air just begins escaping through the unloader valve.

(f) Turn the adjusting screw clockwise one and on-half more turns.

(g) Tighten the lock nut. Be sure the adjusting screw does not move when tightening the lock nut.

(h) Replace the pressure switch cover. Test the unloader valve by performing an operational checkout. Refer to Lesson 2, paragraph 2-2.

(i) If air is discharging from the unloader valve, remove the unloader valve, inspect, and clean or replace the valve seat pin assembly.

c. **Disassemble and Repair the Dryness Indicator.** If the dryness indicator is not blue, regenerate the drying chamber using the following procedures.

(1) If the dryness indicator is pink, run the compressor for approximately three hours without drawing any air from the storage tank.

(a) If the dryness indicator does not start to turn blue, follow the procedures in paragraph 4-3c(2) below.

(b) If the dryness indicator starts to turn blue, continue to run the compressor until it is blue.

(2) If the dryness indicator is white or does not start to turn blue, drain the storage tank and allow the compressor to run for five to seven nights.

(3) If the dryness indicator still does not turn blue, replace the dryness indicator disk.

(4) If the disk does not remain blue, replace the drying chamber.

d. **Disassemble and Repair the Motor and Compressor Assembly.** To repair or replace any damaged or worn parts, you must disassemble the compressor assembly. Before disassembly, verify any suspected damage to the reed valves. Refer to figure 4-6.

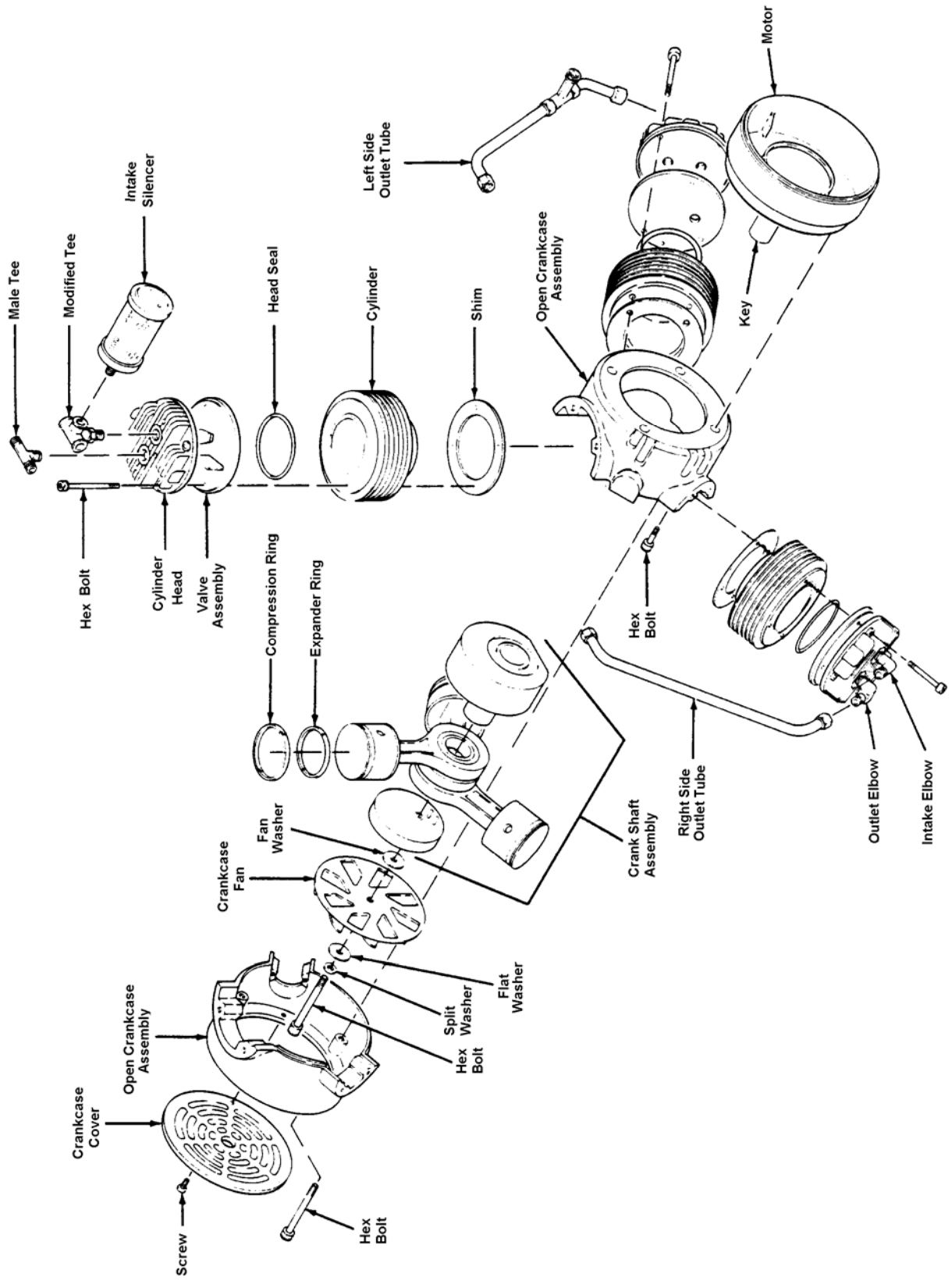


Figure 4-6. Motor and compressor assembly.

(1) Verify suspected damage to reed valves.

(a) Disconnect the intake flex hose from between the cylinders.

(b) Remove the intake silencer from the top cylinder.

(c) With the compressor running, check one cylinder at a time by placing your thumb across the open end of each cylinder elbow or tee.

(d) For the top cylinder, use three fingers to block all parts of the tee.

(e) Verify there is a strong suction at each cylinder. If you feel little or no suction, either the inlet or outlet reed valve is defective in that cylinder.

CAUTION: If any reed valves are broken, you must locate all pieces of the reeds and remove them from the compressor. These pieces may be anywhere within the tubing and the connecting system.

(2) Remove the motor and compressor assembly. In order to reach the reed valves, you must remove and disassemble a portion of the motor and compressor assembly.

(a) Remove the motor and compressor assembly from the transit case. Refer to paragraph 4-2a(1)--(3).

(b) Remove the intake flex hoses from cylinder to cylinder (hose clamps secure flex hoses at each end).

(c) Disconnect the cable from the motor box to the capacitor at the connector on the capacitor.

(d) Disconnect the cable from the circuit breaker to the fan at the connector.

(e) Remove the four nuts, lock washer, and washers from the bolts that secure the motor and compressor assembly to the base plate.

(f) Lift the motor and compressor assembly from the base plate. (Note four spacers under motor and compressor assembly.)

(g) Remove cylinder assemblies by removing four bolts and lock washers from each cylinder head.

(3) Remove any defective reed valves.

(a) Inspect the O-ring head circle and shim (if present) for damage.

(b) Remove the defective valve assemblies from each cylinder and inspect for damage.

(c) Locate all pieces of the reeds and remove them from the compressor. Check the tubing and the connecting system for pieces of the reeds.

(d) Replace any defective reed valves, O-ring head circle, and shim. If there are no faults, go to paragraph 4-3d(4); otherwise continue with (e) below.

(e) Assemble the cylinder head and the valve assemblies as shown in Figure 4-6.

(f) Apply a thin film of O-ring grease to the O-ring head circle.

(g) Install the cylinders and secure in place with four bolts and lock washers. Torque these bolts to 70-inch pounds.

CAUTION: Check head clearance while rocking piston between top of casting and piston using a depth gauge. Clearance must be between 0.010 inches and 0.016 inches. Insert appropriate shim.

(h) Install the intake flex hoses using the appropriate hose clamps. Install the left and right outlet tubes between the cylinders.

(i) Reassemble in the reverse order of removal ensuring that all fittings are leak-proof.

(j) Apply a paste-type pipe dope to all threads except compression fittings before assembling.

(k) Test the reed valves by using the procedures in 4-4d(1)(a)--(e).

(l) If the reed valve corrections do not correct the fault to the motor, continue with paragraph 4-3d(4).

(4) Remove and replace the compression assembly.

(a) Remove the motor and compressor assembly from the transit case per the steps described in paragraph 4-2a(1)--(3).

(b) Remove the intake flex hoses from cylinder to cylinder (hose clamps secure flex hoses to each end).

(c) Remove the intake silencer from the top cylinder.

(d) Disconnect the cable from the motor box to the capacitor at the connector on the capacitor.

(e) Disconnect the cable from the circuit breaker to the fan at the connector.

(f) Remove four nuts, lock washer, and washers from the bolts that secure the motor and the compressor to the base plate.

(g) Lift the motor and compressor assembly from the base plate. (Note the four spacers under the motor and compressor assembly.)

(h) Remove the cylinder assemblies by removing the four bolts and lock washers from each cylinder head.

(i) Remove the front half of the crankcase by removing three bolts.

(j) Inspect the compression and expander rings for signs of wear or damage. If you must replace them, carefully remove them from the pistons.

(k) Remove the counterbalance by removing one bolt and lock washer.

(l) Insert two jacking bolts into the two threaded holes in the crankshaft assembly. Slowly turn them in equal increments to pull the piston assembly off the motor shaft.

(m) If you are replacing the motor or crankcase, remove four bolts and lock washers to remove the rear half of the crankcase.

(n) Replace the rear half of the crankcase by securing in place with four bolts and lock washers. Torque these bolts to 250 inch-pounds and apply Locktite 271.

NOTE: The front and rear assemblies are a matched assembly. You must replace them as a set.

(o) Place the piston assembly and counterbalance on the motor shaft with the key in place. Secure in place with a bolt and lock washer.

NOTE: The piston assembly and counterbalance are a matched assembly. You must replace them as a set.

(p) Replace any compression and expander rings removed from pistons.

(q) Install the front half of the crankcase and secure in place with three bolts.

(r) Assemble the cylinder head and valve assemblies. Apply a thin film of O-ring grease to the O-ring head circle. Install cylinders and secure in place with four bolts and lock washers. Torque these bolts to 70-inch pounds.

CAUTION: Check head clearance while rocking the piston between the top of the casing and piston using a depth gauge. Clearance must be between 0.010 inches and 0.016 inches. Insert the appropriate shim.

(s) Install the intake flex hoses and left and right outlet tubes between cylinders.

(t) Replace all components remaining in the reverse order of removal.

(u) Ensure that all fittings are leak-proof.

(v) Apply a paste-type pipe dope to all threads except compression fittings before assembling.

Continue with Exercises

EXERCISES, LESSON 4

INSTRUCTIONS: Answer the following exercises by marking the response that best answers the question.

After you have completed all of the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For exercises answered incorrectly, reread the material referenced after the solution.

1. The last step in removing and repairing or replacing a component of the compressor is which of the following?

   a. Drain the storage tank.

   b. Rinse the intake silencer.

   c. Perform an operational checkout.

   d. Ensure the air relief valve push button is functioning.

2. The flow control valve can be disassembled, cleaned, and reassembled. When doing this inspection, how many O-rings are required for proper functioning?

   a. One.

   b. Two.

   c. Three.

   d. Four.

3. When reassembling the compressor, the cylinder head clearance between top of casting and piston must be between which of the following?

   a. 0.005 inches and 0.009 inches.

   b. 0.010 inches and 0.016 inches.

   c. 0.017 inches and 0.020 inches.

   d. 0.021 inches and 0.030 inches.

4. You have performed all dryness indicator checks and the dryness indicator will not stay blue. Your next step is which of the following?

   a. Replace the flow control valve.

   b. Replace the compressor assembly.

   c. Replace the cooling coil.

   d. Replace the drying chamber.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 4

1. c (para 4-1)
2. b (para 4-3a(4))
3. b (para 4-3c(3)) CAUTION)
4. d (para 4-3c(4))

End of Lesson 4

APPENDIX

COMPRESSOR/DEHYDRATOR TROUBLESHOOTING GUIDE

SYMPTOM	PROBABLE CAUSE	TEST PROCEDURE/ CORRECTIVE ACTION
1. Compressor motor will not start or attempt to start.	No power at motor terminals.	Check for voltage at power outlet. If there is no power (should be 115 vac at the wall), turn on main circuit breaker. If there is voltage at power outlet but not at motor terminals, check for broken or loose wire, defective circuit breaker, or defective pressure switch. Refer to wiring diagram, Figure 4-3, as a guide. Replace/repair appropriate component.
2. Compressor motor attempts to start, but will not run.	Defective unloader valve.	Depress red manual unloader valve tab on pressure switch. If compressor will not unload, repair or replace unloader valve.
	Defective capacitor.	Use an ohmmeter(+lead to +terminal) to measure across the capacitor terminals. Voltage should rise. Reverse position of leads and the voltage should decrease.

APPENDIX

COMPRESSOR/DEHYDRATOR TROUBLESHOOTING GUIDE (continued)

SYMPTOM	PROBABLE CAUSE	TEST PROCEDURE/ CORRECTIVE ACTION
2. Compressor motor attempts to start, but will not run (cont'd).	Defective capacitor (cont'd).	Replace capacitor.
	Frozen motor/ compressor	With power off, insert 6mm Allen wrench into hole in finned aluminum housing on end of compressor and attempt to turn by hand. It should turn freely in either direction. If not, motor/compressor is frozen and must be repaired or replaced.
	Circuit breaker tripped.	Restart unit while depressing red unloader valve tab. If circuit breaker still trips, check for low voltage at power outlet, defective circuit breaker, or dirty unloader valve. Replace/repair/ clean applicable component.

APPENDIX

COMPRESSOR/DEHYDRATOR TROUBLESHOOTING GUIDE (continued)

SYMPTOM	PROBABLE CAUSE	TEST PROCEDURE/ CORRECTIVE ACTION
3. Compressor motor runs, but noises are present.	Intake, flex hoses not installed properly or cracked.	Make sure flex hose does not touch other parts. If improperly installed, correct. If cracked, replace.
	Broken reed valves.	If valves are broken, the compressor will vibrate. Check and replace as necessary.
	Defective bearings.	Replace bearings.
4. Compressor runs, but will not build up pressure to 80 psi.	Defective pressure gauge.	Replace pressure gauge.
	Defective pressure switch.	Replace pressure switch.
	Intake silencer restricted.	Replace or clean intake silencer.
	Worn rings or guides.	Replace rings.
	Drain valve open.	Close drain valve.
	Leak in system.	Locate and repair leak.
	Defective unloader valve.	Repair or replace valve.
	Broken reed Valves	Remove reeds and repair or replace valves.

APPENDIX

COMPRESSOR/DEHYDRATOR TROUBLESHOOTING GUIDE (continued)

SYMPTOM	PROBABLE CAUSE	TEST PROCEDURE/ CORRECTIVE ACTION
5. Dryness indicator is not blue.	Purging system not functioning.	Perform operation checkout procedure. If purging not taking place, check unloader valve, pressure switch, and exhaust muffler. Repair or replace appropriate component.
	Compressor running too frequently.	Compressor undersized for installation or leaks. If leaks, locate and repair. If undersized, replace with appropriate sized compressor.
	Drying chamber saturated.	Regenerate drying chamber.

End of Appendix