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PRELIMINARY  
OPERATING AND MAINTENANCE INSTRUCTIONS  
FOR  
LAUNCHER PNEUMATIC BOOSTER UNIT

D (R & D) SERIES

AZE-27-192

30 April 1959

CONVAIR-  
ASTRONAUTICS

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PREPARED BY *H. Frisbie*  
H. Frisbie

GROUP HYDRAULICS DESIGN

CHECKED BY *G. H. VanNortwick*  
RHS G. H. VanNortwick

APPROVED BY *C. Bierman, Jr.*  
C. Bierman, Jr.

EDITED BY *T. A. Brody*  
T. A. Brody

APPROVED BY *L. Standley*  
L. Standley

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## SECTION I

## INTRODUCTION

1-1. GENERAL.

1-2. This manual provides preliminary operating and maintenance instructions for the D (R and D) series launcher pneumatic booster unit. This unit is located at the following test sites: Sycamore Test Site (S-1 and S-2), California; Edwards Rocket Base (Pad 1-1), California; and AFMTC (Pads 11, 12, 13, and 14), Florida. The instructions for this equipment are based on information available on the date of publication and are of an interim nature. This manual will be revised as additional information is developed through actual operating and maintenance experience at the factory and test sites. Complete reissues of this manual will be made periodically.

1-3. Personnel concerned with the operation and maintenance of this equipment can contribute to the effectiveness of revised manuals by forwarding comments and suggestions to the Hydraulics Design Group or to Support Publications, Convair Astronautics.

1-4. DESCRIPTION OF THE EQUIPMENT.

1-5. The launcher pneumatic booster unit (7-08352) consists of a two-stage, direct acting, piston-type compressor. The compressor is actuated by hydraulic power from a fixed displacement-type pump. (See figures 1-1, 1-2, and 1-3.)

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1-6. The booster unit supplies compressed gas to the following missile and launcher components:

- a. Launcher components (2000 psig nitrogen).
  1. Release actuating cylinders.
  2. Stabilizer cylinders.
  3. Temperature compensator (stabilizer system).
  4. Auxiliary frame retraction system.
  5. Auxiliary support cylinders.
- b. Release cylinders (6250 psig nitrogen).
- c. Launcher charging panel (7000 psig nitrogen).
  1. Missile booster and sustainer accumulators.
  2. Missile vernier accumulator.
  3. Missile accessory power supply backup flask.
  4. Missile hydraulic reservoir.
  5. Head suppression accumulator.

1-7. APPLICABLE DRAWINGS.

| Title                                                  | Number  |
|--------------------------------------------------------|---------|
| Schematic Drawing for Launcher Pneumatic Booster Unit. | 7-89049 |

1-8. APPLICABLE DOCUMENTS.

| Title                                                                   | Number   |
|-------------------------------------------------------------------------|----------|
| Preventative Maintenance Procedure for Launcher Pneumatic Booster Unit. | ZE-7-087 |



# Section I

## Paragraph 1-8

AZE-27-192

Checkout Procedure  
for D Series Launcher Hydraulic and  
Pneumatic Systems.

AZM-27-044

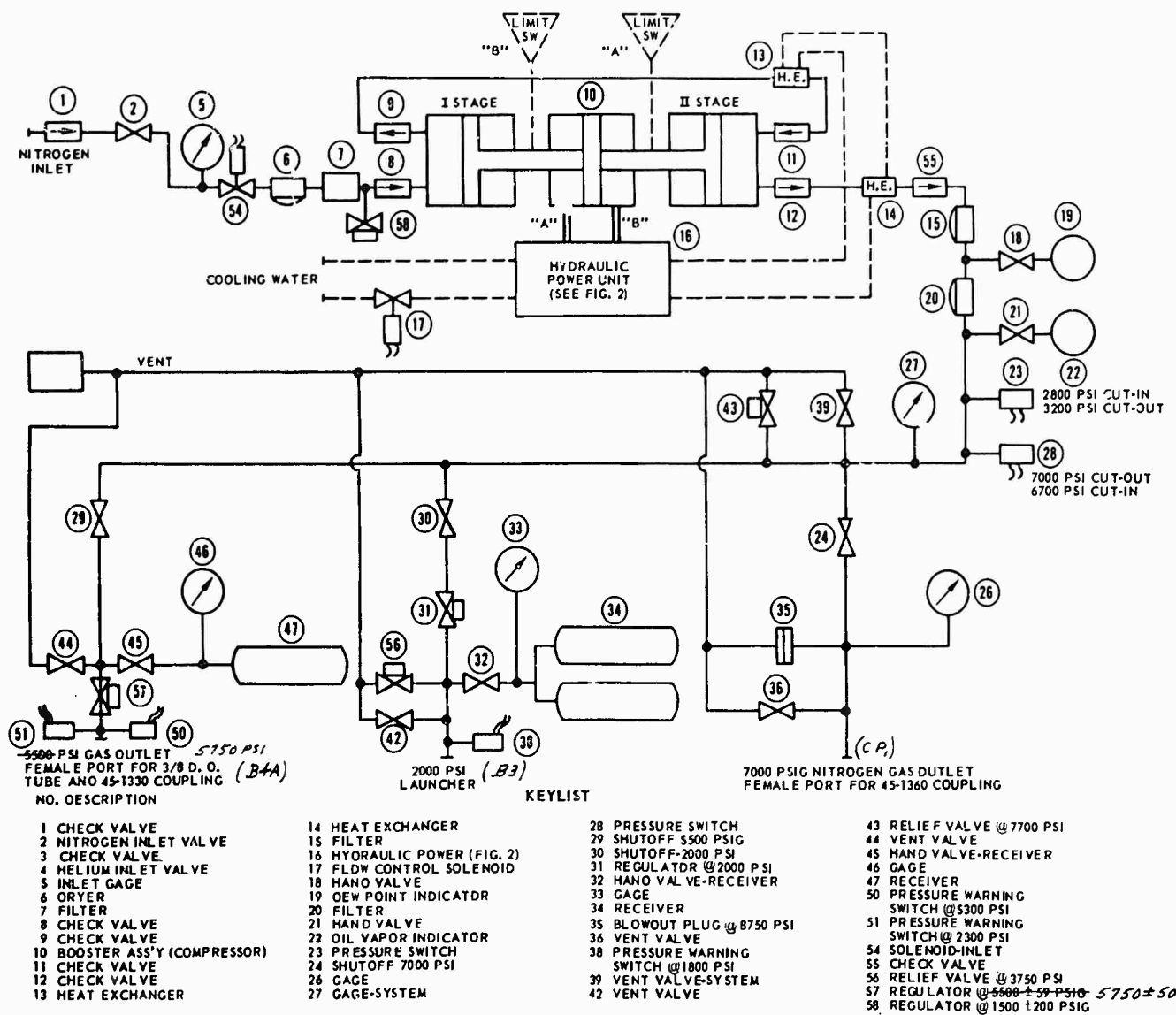
Checkout Procedure  
for the Missile Hold-  
down Release Control  
System (Electrical).

ZN-7-148

Preliminary Oper-  
ating and Mainten-  
ance Instructions for  
Launcher Hydraulic  
and Pneumatic Sys-  
tems.

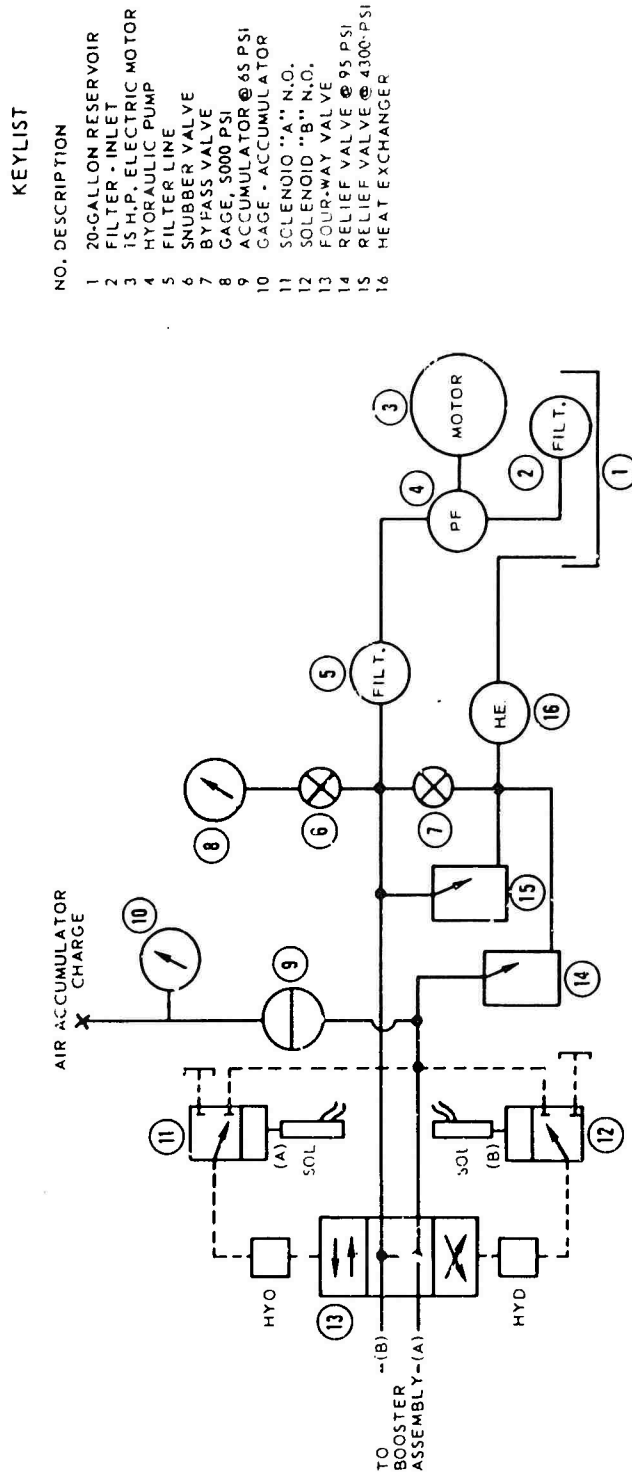
ZM-7-516

Specification, Launcher 7-08352  
Pneumatic Booster  
Unit.



22.33-1

Figure 1-1. Launcher Pneumatic Booster Unit, Schematic Diagram



7C17-0-2

Figure 1-2. Hydraulic Power Unit of Launcher Pneumatic Booster Unit, Schematic Diagram



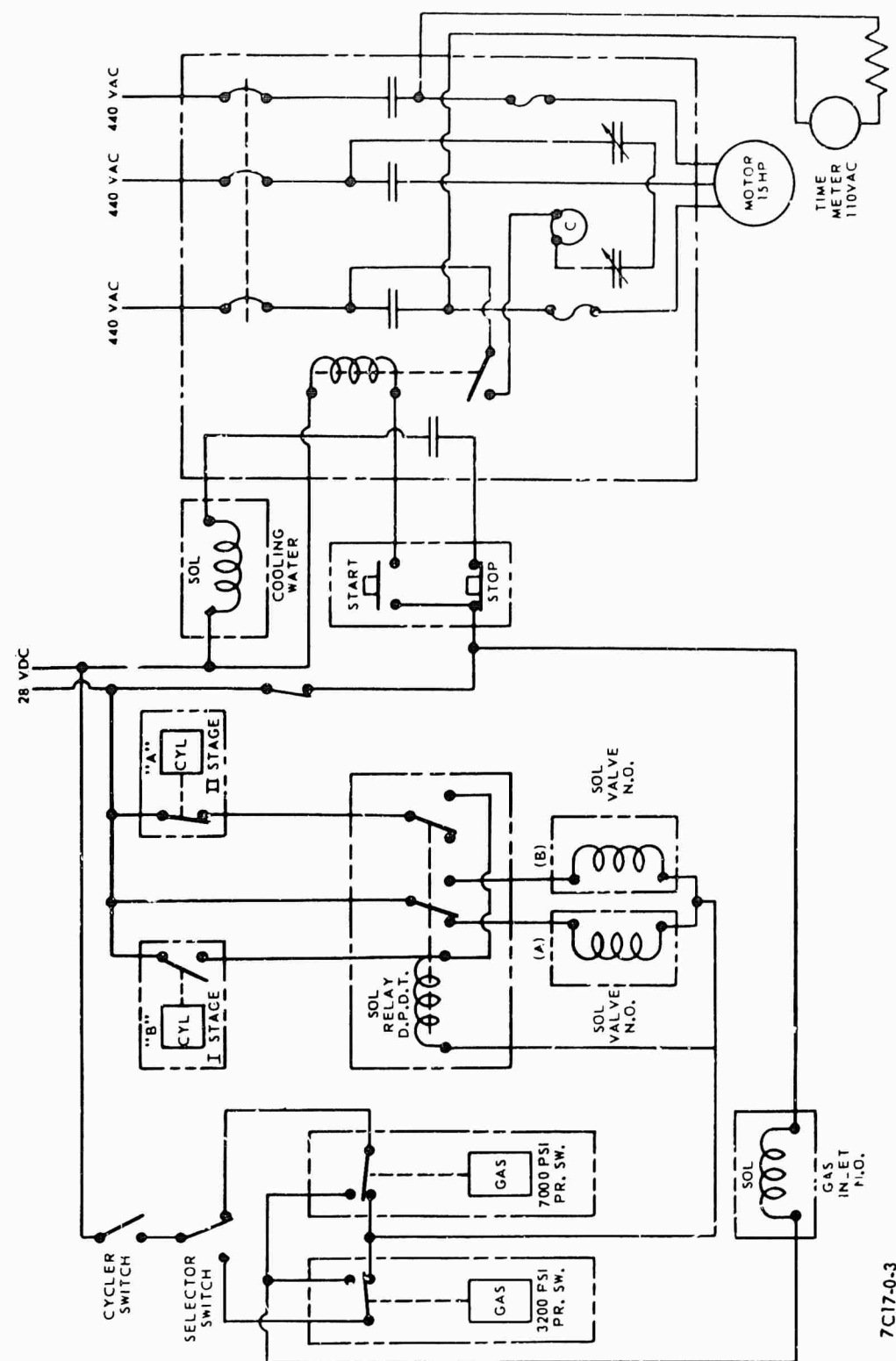


Figure 1-3. Electrical Launcher Pneumatic Booster Unit, Schematic Drawing

## SECTION II

## OPERATION

2-1. PREPARATION FOR USE.

- a. Open instrument panel cover.
- b. Close nitrogen inlet valve (2) and helium inlet valve (4); (see figure 1-1).
- c. Turn cyclor switch to OFF position.

## NOTE

Cyclor switch should be in OFF position when unit is not in use as it controls the 28-volt dc circuit.

d. Hydraulic accumulator should be charged with nitrogen to between 60 and 70 psig.

e. Check to ensure that 440-volt, 3-phase, 60-cycle power, and 28-volt dc power are wired into the explosion-proof box; turn main power switch to ON.

f. Check rotation of motor with rotation arrow on the pump by pushing the start button and quickly pushing the stop button.

g. Check to ensure that nitrogen supply is connected and open at source.

h. Check to ensure connection to 2000 psig launcher, 6250 psig release system, and 7000 psig charging panel.

i. Check to ensure connection of cooling water inlet and outlet; turn on water at source. (Electrically controlled solenoid will determine flow.)

j. Check oil level in 20-gallon hydraulic supply tank. Oil level must be 3/4 full to operate unit. MIL-0-5606 hydraulic oil should be used for filling.

k. Open supply tank shutoff valve (below tank).

2-2. OPERATION OF BOOSTER UNIT.

- a. Open hydraulic bypass valve; close hydraulic snubber valve.
- b. Close all other panel hand valves.
- c. Open nitrogen inlet hand valve.

**CAUTION**

Inlet pressure must be between 600 psig and 2200 psig for proper operation of unit. Pressure is reduced to 1500 psig  $\pm$  200 psi prior to compressor.

d. Set selector switch at 3200 psig.

e. Push START button. If motor and pump do not start, push STCP button and investigate cause.

f. After about 2 minutes of operation, close hydraulic bypass valve.

g. Open hydraulic snubber valve (gage shutoff) slightly.

h. Turn cyclor switch ON. If unit does not start compressing, push STOP button and investigate cause.

i. With booster unit cycling and system pressure approximately 3000 psig, open both oil vapor indicator valve (21) and dew point indicator valve (18) for about 2 minutes. If indicators show no change, close valves and continue operation.

1. If moisture appears in dew point indicator glass, push STOP button and proceed as instructed in paragraph 4-1, 1.

2. If discoloration of the crystal in the oil vapor indicator occurs, push STOP button and proceed as instructed in paragraph 4-1, 1.

## Section II

AZE-27-192

### Paragraphs 2-3 to 2-12

j. Unit will automatically stop cycling when pressure reaches selector switch setting and will start again when pressure drops approximately 400 psig below this setting.

k. Selector switch setting may be reset to 3200 psig or 7000 psig as required, without stopping operation.

l. To shut unit down, turn cycler switch OFF, open hydraulic bypass valve, and push STOP button.

#### 2-3. PRESSURIZATION OPERATION.

#### 2-4. LAUNCHER 2000 PSIG SYSTEM PRESSURIZATION.

- a. With unit running and selector switch set at required pressure (3200 psig or 7000 psig), close 2000 psig vent valve (42).
- b. Open 2000 psig receiver valve (32).
- c. Open 2000 psig shutoff valve (30).

#### NOTE

Preset regulator (31) will maintain 2000 psig  $\pm 100$  psi to launcher as shown by 2000 psi gage.

#### 2-5. LAUNCHER 6250 PSIG RELEASE SYSTEM PRESSURIZATION.

- a. With unit running, set selector switch to 7000 psig.
- b. Close 6250 psig vent valve (44).
- c. Open 6250 psig receiver valve (45).
- d. Open 6250 psig shutoff valve (29).

#### NOTE

Preset regulator (57) will maintain 6250 psig  $\pm 50$  psi to launcher release cylinders as shown by gage on outlet line. (Receiver gage will show 7000 psi.)

#### 2-6. LAUNCHER CHARGING PANEL PRESSURIZATION.

- a. With unit running, set selector switch to 7000 psig.
- b. Close 7000 psig vent valve (36).
- c. Open 7000 psig shutoff valve (24).

#### 2-7. INDIVIDUAL SYSTEM DEPRESSURIZATION.

- a. Close shutoff valve.
- b. Open receiver valve (if required).
- c. Open vent valve.

#### 2-8. ENTIRE UNIT DEPRESSURIZATION.

- a. Close inlet valve.
- b. Open all vent and receiver valves.

#### CAUTION

Before shutdown of the booster unit, the operator must ensure that the missile is properly supported by some means other than the stabilizing system.

#### 2-9. BLOCKHOUSE WARNING INDICATIONS.

2-10. Should the pressure in the 2000 psig launcher system drop below 1800 psig, pressure warning switch (38) will close, causing the red light to glow at the holddown release panel and the warning horn to sound.

2-11. If the pressure in the 6250 psig release system drops below 5300 psig, pressure warning switch (50) will close, causing the red light to glow at the holddown release panel and the warning horn to sound.

2-12. Should the pressure in the 6250 psig release system drop below 2300 psig, pressure warning switch (51) will close, causing the red light to glow at the holddown release panel and the warning horn to sound.

## SECTION III

### MAINTENANCE

#### 3-1. MAINTENANCE.

3-2. Preventative Maintenance Technical Manual ZE-7-087A, Pneumatic Booster Unit, Launcher, provides instructions for routine maintenance.

#### 3-3. LIMIT SWITCH ADJUSTMENT.

##### NOTE

The following provides for adjustment of limit switch A (compressor stage II) and limit switch B (compressor stage I).

#### 3-4. LIMIT SWITCH A.

- a. Loosen two Allen setscrews on adjustment nut; turn until the switch clicks.
- b. Turn nut slowly counterclockwise until switch clicks closed; tighten setscrews. (It may be necessary to readjust slightly after unit is running.)

#### 3-5. LIMIT SWITCH B.

- a. Loosen two Allen setscrews on adjustment nut; turn until the switch clicks.
- b. Turn nut slowly clockwise until switch clicks closed; tighten setscrews. (It may be necessary to readjust slightly after unit is running.)

## SECTION IV

## TROUBLESHOOTING

4-1. TROUBLESHOOTING PROCEDURE.

| TROUBLE AND PROBABLE CAUSE                                                                                                                                          | REMEDY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a. Excessive Noise.<br><br>1. Air in hydraulic lines.<br><br>2. Vibration.                                                                                          | Check to ensure that no air is being drawn into pump inlet; bleed hydraulic system at several points.<br><br>Check to ensure solid mounting of the unit.                                                                                                                                                                                                                                                                                                                                                                                           |
| b. Motor Pump Failure.                                                                                                                                              | Overhaul unit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| c. No Hydraulic Pressure.<br><br>1. Pump not operating.<br><br>2. System relief valve not operating properly.<br><br>3. Return relief valve not operating properly. | (With motor running, bypass closed, and the cycler switch OFF, 95 psi should show on the air accumulator gage.)<br><br>Check to ensure hydraulic oil supply to pump inlet and delivery from pump outlet.<br><br>Disconnect return line from system relief valve return port; no fluid should be discharged from port. If fluid flows from this port, valve must be reset to 4300 psig or replaced.<br><br>Remove end cap and turn adjustment screw until air accumulator gage reads 95 psi. Valve should be replaced if 95 psig cannot be reached. |
| d. Unit does not compress or is overloaded at beginning of compression.<br><br>1. Inlet pressure too high to be overcome by compressor.                             | Close inlet valve; open system vent and close when pressure is relieved. Open inlet valve slightly until inlet gage reads                                                                                                                                                                                                                                                                                                                                                                                                                          |

| TROUBLE AND PROBABLE CAUSE                                                                                                                          | REMEDY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                     | 500 psi. Start unit and maintain 500 psig with inlet valve while unit is compressing. When system outlet reaches approximately 1500 psig, open inlet valve fully.                                                                                                                                                                                                                                                                                                                                                                                                        |
| e. Compressor piston does not move or moves to second stage side only.                                                                              | Note piston movement by removing compressor breather caps. With motor running, bypass closed, and 95 psig accumulator pressure, turn cycler switch ON. If piston fails to move or moves to second stage side only, shut down unit and open inlet valve; piston should be forced to second stage side of compressor. Loosen 1/4-inch tube fittings on each end of 4-way valve (located on compressor). Start unit, close bypass valve, and turn cycler switch OFF. Both lines should be pressurized. Turn cycler switch ON. Second stage side only should be pressurized. |
| f. Pressure check is unsatisfactory.<br><br>1. System pressure will not reach 4300 psig.<br><br>2. Four-way valve not operating.<br><br>3. Leakage. | Check system relief valve. (See paragraph 4-1, c, 2.)<br><br>Replace valve.<br><br>Check for gas leakage in lines and fittings. Leakage past piston denotes need for compressor overhaul. Check muffler for leakage.                                                                                                                                                                                                                                                                                                                                                     |
| g. No pressure in either stage one or stage two lines.<br><br>1. Solenoids A and B not open.                                                        | See paragraph 4-1, c. Replace solenoids if necessary.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| h. Pressure in one line only with cycler switch OFF.<br><br>1. Unpressurized line solenoid not open.                                                | Replace solenoid.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |



| TROUBLE AND PROBABLE CAUSE                                                                                                               | REMEDY                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>i. Pressure in both lines with cycler switch ON.</p>                                                                                  | <p>Check electrical circuit, cycler switch, selector switch, and pressure switches (23) and (28) for 28-volt dc; (see figure 1-3). Also check double-pole, double-throw relay (located in explosion-proof electrical inlet box). Relay should be in position to energize solenoid B. Check voltage to solenoid B for 28-volt dc. If solenoid B has not closed, it must be replaced.</p> |
| <p>j. Pressure in first stage only with cycler switch ON.</p>                                                                            | <p>Shut down unit and adjust limit switch B; (see paragraph 3-5). Start unit and repeat check procedure 4-1, e. Check that double-pole, double-throw relay is in position to energize solenoid B. If solenoid B does not close, it must be replaced.</p>                                                                                                                                |
| <p>k. Compressor piston moves to first stage side only or moves erratically.</p> <p>1. Piston moves to first stage side and stops.</p>   | <p>Remove compressor breather caps. With the motor running and the bypass closed, turn cycler switch ON.</p> <p>Shut down unit and adjust limit switch A; (see paragraph 3-4). Be sure that double-pole, double-throw relay is in position to energize solenoid A. Ensure 28-volt dc to solenoid A. If solenoid A does not close, it must be replaced.</p>                              |
| <p>2. Piston moves erratically.</p>                                                                                                      | <p>Adjust limit switches A and B. If erratic piston movement persists, double-pole, double-throw relay must be replaced.</p>                                                                                                                                                                                                                                                            |
| <p>l. Unit fails to reach or stop at required pressure.</p> <p>1. Pressure switches (located behind left rear door) not functioning.</p> | <p>Pressure switch (23) is for a selector switch setting of 3000 psig. This switch should remain closed until opening pressure of 3200 psig is reached. It should close when pressure drops to 2800 psig.</p>                                                                                                                                                                           |

| TROUBLE AND PROBABLE CAUSE                                                                                                                                                                                                                                                                                                                              | REMEDY                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                         | <p>Pressure switch (28) is for a selector switch setting of 7000 psig. This switch should be closed until opening pressure of 7000 psig is reached. It should close when pressure drops to 6700 psig. Remove switch cover; note operation. If switch does not operate properly, adjust as shown by printed instructions.</p> |
| <div data-bbox="640 841 895 922" style="text-align: center; border: 1px solid black; padding: 5px; margin-bottom: 10px;"><b>CAUTION</b></div> <p>Do not attempt to adjust the 400 to 500 psi differential as it is determined by the switch mechanism. If switch cannot be set or does not maintain the proper differential, it should be replaced.</p> |                                                                                                                                                                                                                                                                                                                              |
| m. Regulators not operating properly.                                                                                                                                                                                                                                                                                                                   | Adjust by turning hand knob; if regulator fails to adjust, it should be replaced.                                                                                                                                                                                                                                            |
| <div data-bbox="640 1360 895 1441" style="text-align: center; border: 1px solid black; padding: 5px; margin-bottom: 10px;"><b>CAUTION</b></div> <p>Do not adjust regulator to increase flow as pressure setting will be lost.</p>                                                                                                                       |                                                                                                                                                                                                                                                                                                                              |
| n. Moisture appears in dew point indicator.                                                                                                                                                                                                                                                                                                             | Shut down unit, close gas supply at source, and investigate heat exchanger, compressor, and lines for source of moisture. After condition is corrected, open gas supply at source and start unit. Close vent system and resume operation.                                                                                    |
| o. Oil vapor indicator crystals change color.                                                                                                                                                                                                                                                                                                           | Shut down unit, close gas supply at source, and vent unit. Investigate compressor and lines for oil leaks. After condition is corrected, disconnect booster unit and clean thoroughly; replace crystals in indicator and oil filter.                                                                                         |