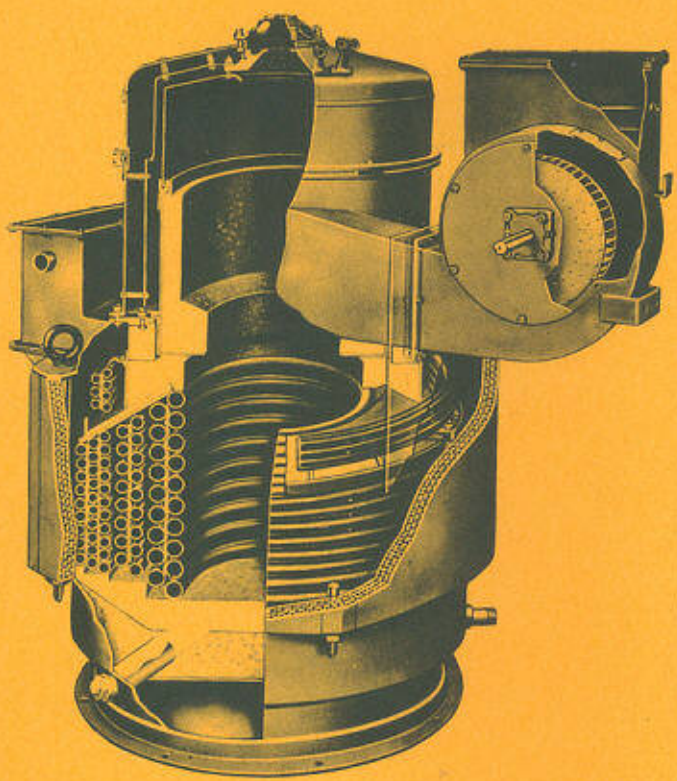
Amtrak

STEAM GENERATOR

VAPOR OK-4625-74



OPERATING MANUAL

OFFICE OF THE CHIEF MECHANICAL OFFICER
400 N. CAPITOL ST.,
WASHINGTON, D.C. 20001

NRPC CMO-115 (10-77)

AMTRAK STEAM GENERATOR (VAPOR CORP. OK-4625-74G)

OPERATING MANUAL

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10. GENERAL SPECIFICATION DATA

VAPOR OK-4625-74-G STEAM GENERATOR

Water Relief Valve—
unloading setting . . . . . 575 PSI.
Fuel Pressure Regulator—
set at high fire to give
manifold pressure of . . . . . 150-155 PSI.
Atomizing air pressure . . . . . 70-75 PSI (at 130-140 PSI main reservoir pressure—with #51 drill orifice).
Atomizing Air Pressure Switch Settings. Contacts close at 55 PSI. Contacts open at 45 PSI.
Water Pressure (Fill Position) . . . . . Normal—less with #4 valve fully opened. than 80 PSI.
Water Pressure Range (low
to high fire) . . . . . 225-350 PSI.
Normal Steam Temperature,
at 200 PSI pressure . . . . . 388°F.
Steam Temperature Limit (STL)
Control—operates at
approximately . . . . . 500-600°F.
Stack Switch Settings
High temperature contacts open at 900°F.
Low temperature contacts close at 250°F.
Outfire Relay—time delay is . . . . . 43-47 sec.
Motor Speed (high fire) . . . . . 1750-1800 RPM.
Blower Speed (high fire) . . . . . 2500-2550 RPM.
Water Pump Speed (high fire) . . . . . 915-935 RPM.
Amperage Draw (74 VDC) . . . . . 45-55 amperes.
Motor Overload Dashpot—
set to trip at . . . . . 82-84 amperes.
Maximum Evaporate
Capacity (high fire) . . . . . 347 gallons/hour.
Fuel Consumption at maximum
output . . . . . 30 gallons/hour.
Water Volume (coils and
related piping) . . . . . 24.5 gallons.
Dry Weight . . . . . 4000 lbs. net.

100. NORMAL OPERATION

1. Make sure water tanks are **full** before leaving servicing point.

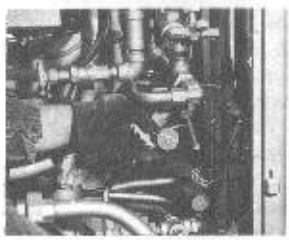
WARNING: DO NOT START STEAM GENERATOR UNLESS THE COILS ARE FILLED WITH WATER.

2. Refer to Valve Position Guide (Figure 500-3) for proper valve positions for all modes of operation.

The component identification numbers shown in parantheses in the following procedures are indexed on the piping diagram (Figure 500-1) in the rear of this manual. Valves are similiarily identified on the piping diagram (Figure 500-1) and on the Valve Position Guide (Figure 500-3) at the rear of this manual and in each locomotive steam generator room.

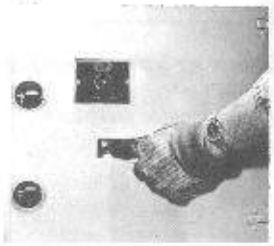
101. FILLING PROCEDURE

1. **Open** fill test valve # 4.

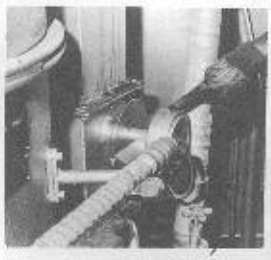


2. The following valves must be **closed** to properly fill the steam generator. Refer to Figure 500-1 as a reference:
   A. Trainline Shut-off #15. **Close** by manually turning valve handle **down;**
   B. Roof Orifice #273 turn handle clockwise (CW) to close;
   C. Separator Blow down #12. Valve is closed when pedal latching pin **is not** engaged under latching block and the pedal is floating freely.

3. Check the following **reset** buttons by pushing **in:**
   A. Motor Overload (106);



   B. Stack Switch (109); and,



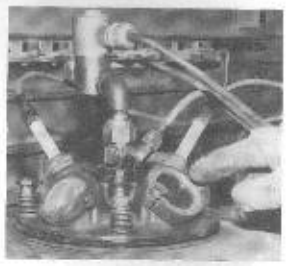
   C. Steam Temperature Limit Switch (110) (if equipped with **reset).** Refer to Figure 10-2 for switch location.

4. Turn main switch ON or close Main Circuit Breaker; located adjacent to each steam generator (E-8, E-9 loco) or top center of water deck tank (SD P-40 F loco).

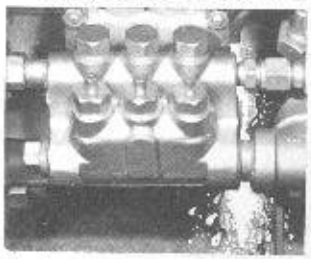
5. Turn Control Switch (102) to FILL. If generator does not run, refer to Trouble Shooting Procedures—Section 300.

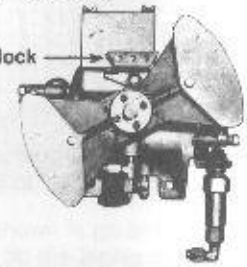
CAUTION: DO NOT TOUCH ANY PART OF THE IGNITION WIRING

6. Check for ignition spark by looking into the spray head sight glass for a bright blue arc at electrodes (220).



7. Turn Control Switch OFF when a strong flow of water is discharging from Fill Test Valve #4. Allow the servo "bow-tie" to return to the block so a smooth light-off will occur during starting. Servo is shown in OFF position.





8. Close Fill Test Valve #4.

102. RUN PROCEDURE

1. Refer to **Valve Position Guide** for proper valve positions (Figure 500-3).

2. Before starting steam generator, perform filling procedure (Section 101 above).

3. Insure #10 Valve is tightly **closed** to prevent tripping the Steam Temp Limit Switch (110) while generator is operating. See note on Valve Position Guide (500.3) under Amtrak Standard.
4. Set Water By-pass Regulator (111) to 230 PSI.

5. Open Separator Blowdown Valve #12 by pressing down on foot pedal and allowing latching pin to engage under latching block.

6. Turn Control Switch to RUN; generator should fire. Servo "bow-tie" should move clockwise to **high fire** position. If generator does not run, refer to Trouble-shooting Procedures—Section 300.

7. Close Separator Blowdown Valve #12 when steam pressure gauge (212) reaches 100 PSI.

8. Press down pedal on Separator Blowdown Valve and hold open for 3-5 second intervals during the first few minutes of operation.

9. During normal running mode, the Flapper in the Water Return Sight Glass should cycle 4 to 8 times per minute. If an abnormal condition exists, refer to **Abnormal Operation** and **Troubleshooting Procedures,** Sections 200 and 300 respectively.

10. Make sure Automatic Trainline Shut-off Valve #15 is **manually closed** before trainline is coupled. Valve handle must be screwed **down** to close.

11. When trainline coupling has been completed and all ground forces are clear. . .

12. Push "**open**" button for Automatic Trainline Shut-off Valve on Valve Controller (270), if unit is so equipped. Air pressure should be heard exhausting through magnet valve.

13. **Manually open** the Trainline Shut-off Valve #15 **slowly** by screwing **up** on valve handle. Do not allow steam generator pressure gauge (2-12) to fall below 100 PSI; if valve is operated too fast STL Switch (110) may trip and shut down the generator.

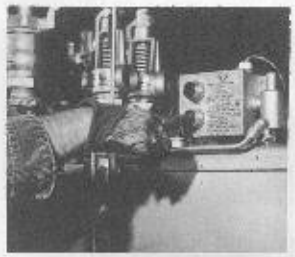
14. Observe Trainline Pressure Gauge (224) (if so equipped) or steam generator pressure gauge (212) and OPERATE ONLY the number of steam generators REQUIRED to maintain 180 to 250 PSI trainline pressure. Trainline pressure is the guide to determine the maximum number of generators that must be operating to satisfy any given train.

The key to good steam generator performance is to MAKE THE GENERATOR WORK; DON'T LET IT IDLE.

103. SHUT-DOWN AND BACK-BLOW PROCEDURE

1. Refer to **Valve Position Guide** (Figure 500-3) for proper valve positions.

2. Push "**Close**" button on #15 Valve Controller (270) if so equipped.



3. Manually close #15 Valve. Screw Valve handle down to close.

4. Set Water Bypass Regulator (111) to maximum PSI position. Allow steam pressure to build up to maximum.

5. When fire shuts OFF turn Control Switch (102) OFF.

6. Immediately OPEN Coil Blowdown Valve #2.

7. When steam pressure drops to 75 PSI, CLOSE #2 Valve.

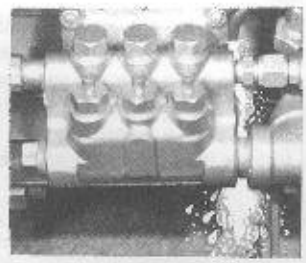
8. OPEN Separator Blowdown Valve #12.

9. Turn Control Switch to FILL and allow steam generator to fill for approximately 5 minutes.

10. OPEN Fill Test Valve #4, then . . .

11. CLOSE #12 Separator Blowdown Valve.

12. Wait for strong flow of water to discharge from Fill Test Valve #4.



13. Turn Control Switch OFF. Close Fill Test Valve #4.

14. Close Atomizing Air Valve #1.

15. Turn main switch OFF.

16. After the steam generator is shut down, the following steps in Section 104 **must be taken to prevent freeze-up in cold weather.**

104. COLD WEATHER PROTECTON

1. Refer to the **Cold Weather Protection** column of the **Valve Position Guide** (Fig. 500-3). See Note below.
2. Make sure Cold Weather protection valves are **opened** on **all** generators which are shut down. See step 5A or-B below.
3. If standby steam is not available, locomotive main engine must be idling and one steam generator operating.
4. If **more than one steam generator is in the consist, the Trainline Shut-off Valve** #15 must be **opened** on the generator that is operating and the locomotive trainline **End Valves** must be **cracked open** to prevent trainline freeze-up.

NOTE: Some locomotives are equipped with the two-valve (#6 & #10) Cold Weather Protection System. Refer to step 5B and the ***Valve Position Guide*** *(Figure 500-3) for explanation.*

5. Valve set up for Cold Weather protection on steam generator . . .

A. One-valve system. (#10 only)

(1) Open #10 valve.

(2) CHECK SYSTEM OPERATION BEFORE LEAVING LOCOMOTIVE; tracer and inlet coil lines should be hot to touch. Flapper Valve in Water Return Sight Glass must be opening intermittently and water return line should be hot to touch.

B. Two-Valve system. (#6 & #10);

(1) Open #6 valve.

(2) Open #10 valve.

(3) CHECK SYSTEM OPERATION BEFORE LEAVING LOCOMOTIVE; tracer and inlet coil lines should be hot to touch. Flapper Valve in Water Return Sight Glass must be opening intermittently and water return line should be hot to touch.

(4) #10 valve may be cracked open during operation.

200. ABNORMAL OPERATION

If abnormal conditions are encountered, make a written report to responsible maintenance personnel using prescribed forms on locomotive. Describe the condition as much as possible.

201. SUPERHEATING

Overheated steam may be causing the Steam Temperature Limit Switch (110) to shut off the fire. This condition can be detected when in the running mode by observing that the servo "bow tie" is in the **high fire** position with no fire present.

1. Check Water Return Sight Glass for proper water return. Flapper Valve in glass should open and close approximately 4 to 8 times per minute.
2. The **STL** Switch is faulty if the water return is normal as indicated by movement of the Flapper Valve 4-8 times per minute and generator is continuing to trip the **STL** Switch (110). If Flapper Valve remains open, this indicates a leaking Heat Exchanger (213). Close #81 valve and continue operating. With #81 valve closed Flapper Valve will stop moving.
3. Check for water leak at outlet of Coil Blowdown Valve #2 by CAREFULLY touching the valve discharge pipe. If pipe is warm or hot, it indicates #2 valve is leaking. Reduce steam output by cracking Valve #8 . Refer to **Manual Operation** column of **Valve Position Guide.** (Figure 500-3)
4. Excessive fuel pressure may also be the cause of tripping the **STL** Switch (110). Reduce output by cracking #8 valve. Refer to **Manual Operation** column of **Valve Position guide.** (Figure 500-3)
5. On a One-Valve Cold Weather Protecton System, make sure that the #10 valve is **tightly closed.** On a two-valve system, insure that the #6 valve is **tightly closed.**

NOTE: When the STL Switch trips, the steam generator will continue to run for three to four minutes until the low contacts of the Stack Switch open. When this occurs the alarm will ring and the motor will stop.

202. HOT DOME

An overheated Steam Generator Dome is usually the result of a reduction in the amount of combustion air delivered to the generator. If this occurs, inspect the Damper (203) and Damper Spring for binding. Make sure there are no restrictions, such as ice or debris in the air intake ducting, or soot on the coils. Check the tension of the Blower Belts with care. The speed of the Blower (202) should be 2500 RPM. Reduce output by cracking #8 valve. Refer to **Manual Operation** column of **Valve Position Guide.** (Figure 500-3)

203. SAFETY VALVES POPPING

The Water By-Pass Regulator (111) is not controlling steam pressure. Be sure Valves #13 and #19 are **open.** Check the Regulator for ruptured diaphragm. If steam blows from regulator, close #13 Valve. Also check for sticking operating rod or restrictions in the pipe between the #13 valve and the Regulator. Continue to operate the steam generator **manually.** Refer to **Manual Operation** column of **Valve Position Guide.** (Figure 500-3).

204. MOTOR CONVERTER SPEED VARIATION

(1) Speed Very High.
If voltage is normal (72-74 VDC), extremely high motor speed may be due to an open field circuit. Check electrically for open Field Resistor. If this is the case, jumper out the resistor. (If so equipped).

(2) Speed Very Low.
If voltage is normal, the motor may be operating through the Starting Resistor. This can be caused by an open circuit in the coil of the Pilot Relay or its contacts, or in the Timing Resistor.

205. POOR STEAM OUTPUT

Control Switch (102) must be in RUN. Check for any condition which may reduce the amount of fuel burned or restrict heat transfer from the fire to water, such as coils sooting, high water pressure (caused by internal coil scaling), #8 valve being cracked open or ruptured servo diaphragm. Perform procedure shown under Troubleshooting Procedures Section 300.

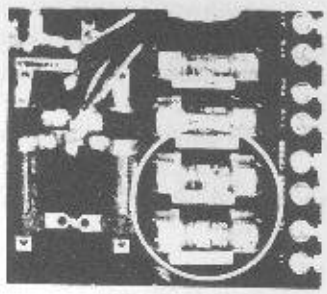
300. TROUBLESHOOTING PROCEDURES

To use this troubleshooting guide, follow the numbered procedure below (1, 2, etc.). If any lettered (**1A, 1B** etc.) symptom is applicable, the possible cause and corrective actions (1A1, 1A2, etc.) are listed below each symptom. Also refer to Abnormal Operation Section (200). and Emergency Procedures, Section 400.

1. TURN CONTROL SWITCH TO "FILL" AND CHECK ELECTRICAL SYSTEM AS FOLLOWS:

1A. IF MOTOR STARTS AND BELL DOES NOT RING. GO TO 1A1 BELOW

If motor does NOT start and alarm bell RINGS, go to 1B below.



1A1. Control or main power Fuses blown. This will be indicated by the Return Water Sight Glass light not burning. Test fuses located in steam generator electrical cabinet and in the main fuse panel in locomotive cab. If fuse blows again, examine control circuit for short. See Section 400.

1A2. Steam Generator main breaker or fuses may be tripped or blown if there is a short circuit in the steam generator motor. Reset this breaker, by pulling **down** on handle, then pushing **up.** Replace fuse if required. See Section 400.

NOTE: SPD-40F locomotives are equipped with 100 AMP fuses. E-8 and E- 9's are equipped with circuit breakers.

1A3. Circuit may be open in Starting Resistor. (in box behind control panel). This can be the result of bad order Pilot Relay coil or contacts, or open circuit in the Timing Resistor. Control Relay Coil may also be defective. See Section 400.

1A4. If Main Steam Generator Breaker or fuses continue to trip or blow, the contacts of the Control Relay may be stuck closed. Also, test Motor (215) electrically for short circuit.

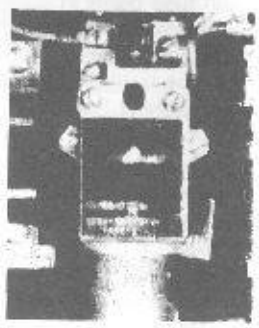
1A5. Check armature of Motor (215) electrically for open circuit.

1A6. Contacts of Control Switch (102) may not be making electrically due to worn cam or contacts. See Section 400.

1A7. Coil or contacts of Line Relay may be open. If so, repair contacts or replace coil. See Section 400.

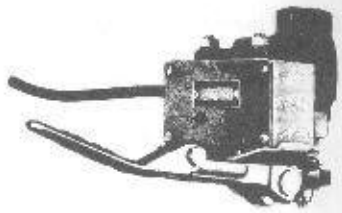
1B. IF MOTOR DOES NOT START AND ALARM BELL DOES RING.

1B1. Motor Overload Relay (106) may be tripped. Push reset button, fill coils and restart unit. Check for proper amount of oil in dash-pot of Motor Overload Relay. If switch opens again, open Valve #8 slightly to reduce the load on the Steam Generator Motor.



1B2. Stack Switch Button (109) is pushed out. Reset button and restart unit after filling coils. Open Valve #8 slightly if the switch opens again. See Section 400.

1B3. Check for proper latching of Coil Blowdown Valve. Check for open Coil Blowdown Switch circuit.



1B4. Check for overtightened belts or bad bearings in Motor (215).

1B5. If high temperature causes Stack Switch to open, check coils for heavy sooting or high water pressure due to internal coil scaling. Remove air dome and look for holes in the refractory which may by-pass hot gasses around coils. See Section 400.

1B6. Check Outfire Relay indicator light. When light is **on** this indicates relay contacts are closed. When light is off, it indicates relay contacts are open. Relay Indicating Light should be **on** anytime the Servo "Bow-Tie" is in the **off** or No-Fire position.The light should go out approximately 45 seconds after the Servo moves to the firing position. See Section 400.

2. WITH CONTROL SWITCH AT "FILL", CHECK WATER SYSTEM AS FOLLOWS:

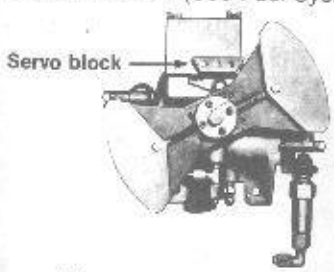
If motor starts and Servo "Bow-Tie" is rocking erratically or violently, go to 2B below.

If motor starts and Servo "Bow-Tie" turns smoothly, go to 2C below.

IF MOTOR STARTS AND SERVO "BOW-TIE" DOES NOT MOVE, CHECK FOR THE FOLLOWING:

(Full Servo travel can be expected in **FILL** position.)

2A1. Not enough water to operate "Bow-Tie" or No Fuel Manifold Pressure. (See Fuel System—3A3 below)



Servo will be in the position shown. (No Fire).

Open water pump Test Valve #18.

2A2. If the water flow is strong and steady, follow this procedure:

1. Check to be sure that Manual By-Pass Valve #8 is fully closed.

2. If water pressure is above 100 PSI, be sure Valve #3 is fully open. Back-blow coils several times to clear possible plugging, using the following procedure:

   a. Refer to **Valve Position Guide** for proper valve positions.

   b. Push **Close** button on #15 valve controller. (If so equipped).

   c. Manually close #15 Valve. (Screw valve handle down).

   d. Set Water By-Pass Regulator (111) to maximum PSI position. Allow steam pressure to build up to maximum.

   e. Turn Control Switch (102) OFF after fire shuts off.

   f. Immediately OPEN Coil Blowdown Valve #2.

   g. When steam pressure drops to 75 PSI, CLOSE Valve #2.

   h. OPEN Separator Blowdown Valve #12.

   i. Turn Control Switch to FILL and allow steam generator to fill for approximately 5 minutes.

   j. OPEN Fill Test Valve #4, then . . .

   k. CLOSE Separator Blowdown Valve #12.

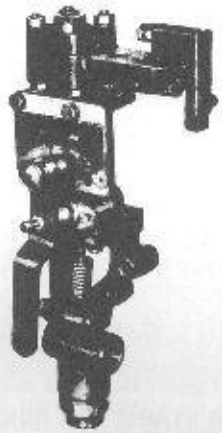
   l. Wait for strong flow of water to discharge from Fill Test Valve #4.

   m. Turn control switch **Off. Close** fill test valve #4 and **Open** Separator Blowdown Valve #12.

   n. Place Control Switch in **run** position and perform **Starting Procedure** (Section 102 above).

3. Acid wash the coils if possible. High water pressure can also be the result of stuck Feed Line Check Valves or other obstructions.

4. Close Water By-Pass Shutoff Valve #19. If servo "Bow-Tie" (108) moves **(CW),** Water By-Pass Regulator (111) is leaking. If moving handle of Regulator back and forth several times does not re-seat valve, **then leave Valve #19 closed and operate Steam Generator manually.** If possible, replace Water By-Pass Regulator Valve.



5. Check the Servo Fuel Control (108) for ruptured diaphragm or missing water-metering pin. Replace diaphragm or metering pin if necessary.

2A3. If water flow is weak or absent (as indicated by very slight or no movement of the "Bow-Tie") follow this procedure:

1. Open #18 valve (Water Pump Discharge Valve); check for strong water flow.
2. Check locomotive water tanks for proper water supply by observing gauges or tapping tank with metallic objects, listening for solid (not hollow) sound.
3. Make sure Water Supply Shutoff Valve #21 is open.
4. Be sure Water Treatment Tank Drain Valve #22 is closed.
5. If water supply is too hot (over 180°F.) close #81 valve and open #82 valve. This allows return water to dump overboard.
6. Be sure #6 valve (two-valve cold weather protection system) or #10 valve (one-valve system) are **closed.**
7. Take cover off Water Treatment Tank and see if strainer is plugged. Be sure there is no suction leak in cover seal. Check O-Ring for cuts, breaks or twists. Replace seal or lubricate old seal before reapplying.

8. Check Water Pump Belts for tension and condition.

9. Examine Water Pump valve and valve seats. Check Water Pump (230) piston packing and cylinder liner for dirt or wear.
10. Check feedwater line for suction leaks. Close #21 Valve.
11. Fill Water Treatment Tank with a bucket and run pump to see if it will draw water. If it will, then examine water suction line between treatment tank and water tanks for suction leaks or restriction in suction line.

2B. IF MOTOR STARTS AND SERVO "BOW-TIE" TURNS. FILL COILS WITH WATER AND CONTINUE TO PROCEDURE 3 BELOW.

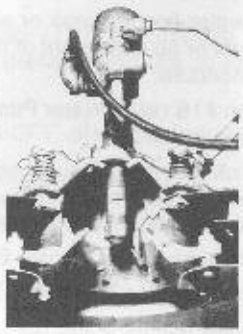
3. TURN CONTROL SWITCH TO "RUN"

If generator runs normally, go to 3B.

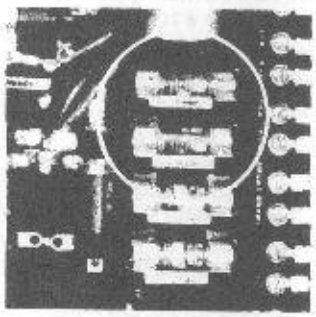
3A. MOTOR STARTS BUT RUNS ONLY 40 TO 60 SECONDS AND FIRE DOES NOT LIGHT. GENERATOR SHUTS DOWN WITH ALARM RINGING.

3A1. Ignition system fault. **Fuel spray present but not igniting.** Follow this procedure:

1. One of the Electrodes (220) may have twisted out of position. Spark gap should be 3/16" and be just outside but not touching the fuel spray. Reset the Electrodes with a gauge (if available). Position the spark just between two fuel jets. Spray-head (105) should be as deep into combustion chamber as threads will allow.



2. If there is no spark, test ignition fuses with light and fuse clips. Check for burned or loose leads to Electrodes. Check for burned out transformer (214) or loose internal connections (use test meter). Examine the brushes and slip rings in the Motor (215) visually for sticking brushes, pitting, burning, or open ignition circuit.



3A2. Fuel system fault: No fuel spray or poor fuel spray and air pressure is approximately 70 PSI.

1. If Fuel Manifold pressure is below 150 **(PSI)** turn knife handle of Cuno Filter (206) several times.

2. If Fuel Manifold pressure is still low, check for stuck pressure regulator by tapping lightly. Check for worn fuel pump (209), broken or loose fuel pump coupling. Change fuel pump if possible. Check regulator operation.
3. If there is no Manifold pressure at gauge, check for suction leaks in line and Fuel Pump (209). Check fuel pump coupling. Check belts.
4. If nozzle pressure equals manifold pressure when the generator should be firing, check for defective Solenoid Valve (104), improper setting of or defective Servo Cut-out Switch (108). Check operation of Atomizing Air Cut-out Switch (101), Steam Temperature Limit Switch (110), or Control Switch.

3A3. Air supply system fault. No fuel spray and air pressure is below 25 **PSI.** perform these checks.

1. Be sure Atomizing Air Shutoff Valve #1 is **open.**
2. Check locomotive Main Air Supply Cut-off Valve to the Steam Generator.
3. Drain water from bottom of Zenith Air Filter (200).
4. Clean Air Filter elements.

5. Check for other obstructions in the air line.

3B. **If generator runs normally . . .**

Cause of shutdown may have been a temporary misfiring during the **"ON"** cycle due to Sprayhead, Spark or Damper misadjustment.

400. EMERGENCY PROCEDURES

Always place control switch in OFF positon before performing any emergency set up procedure.

Before resorting to the following emergency procedures, it is important that an actual, urgent need is known to be present. These procedures are "last resort" measures to maintain passenger comfort and safety and should in no way preclude proper repair. In every case, what is done on the road should be carefuly documented on the appropriate locomotive report form in order to insure complete and final repair.

401. THE WATER RETURN SIGHT GLASS BREAKS, FILLING THE STEAM GENERATOR COMPARTMENT WITH WATER AND STEAM.

WHAT TO DO

(1) Close the #9 Valve. This will send wet steam into the trainline but will allow the steam generator to continue operating.

(2) If water level in the deck or hatch tank is above the return sight glass, water will discharge from the glass, if so plug opening with rags.

402. BOTH BELTS BREAK ON EITHER THE BLOWER OR PUMP, SHUTTING THE STEAM GENERATOR DOWN.

WHAT TO DO

Remove one appropriate belt from any other steam Generator and apply it to the steam generator with missing belts.

403. THE FUEL SOLENOID VALVE WILL NOT SHUT OFF (FIRE STAYS ON).

WHAT TO DO

(1) Move control switch to **Fill** in order to keep water in the coils and to electically de-energize the fuel solenoid valve.

(2) Latch open #12 valve.

(3) Tap sides of fuel solenoid valve. This tapping may dislodge the foreign material holding the valve open.

(4) If still firing, turn control switch to **Off.**

(5) Crack open the fuel pump discharge tubing to break any siphon or keep steam generator operating in the manual mode opening the roof orifice valve if necessary.

404. BURNER SIGHT GLASS BREAKS, FILLING STEAM GENERATOR COMPARTMENT WITH COMBUSTION GASSES.

WHAT TO DO

(1) Remove sight glass assembly.

(2) Place several layers of aluminum foil against burner at sight glass opening.

(3) Replace sight glass assembly over foil.

405. THE CONTROL RELAY WILL NOT ENERGIZE. (STEAM GENERATOR WILL NOT FIRE)

WHAT TO DO

(1) Place Control Switch in OFF.

(2) Mechanically block Control Relay contact carrier in upward position. Control relay is in upper left hand corner of electrical cabinet.

(3) Place Control Switch in **Run** position.

CAUTION

Steam generator fire will not shut down automatically. Operate steam generator in the Manual Mode.

406. THE SERVO SWITCH ACTUATOR BREAKS.

WHAT TO DO

If the dual spring actuator is broken on one side, the entire assembly can be removed and rotated so that the intact section will actuate the switch plunger.

407. THE SERVO MICRO-SWITCH IS DEFECTIVE.

WHAT TO DO

(1) To **Fill.** Place a jumper wire between control panel terminals SS3 and CS2. This will complete the circuit to the Line Relay. Leave the jumper in place if you intend to run the steam Generator.

(2) To **Run** the steam Generator it is necessary to place a jumper between terminals FSV1 and FSV2; this will close the circuit for the Servo "A" switch.

CAUTION

The servo"A" switch is the low or no-water protection for the steam generator. After performing the above, it will be necssary to insure that water is actually flowing through the servo. Operate the steam generator manually.

408. THE CONTROL SWITCH KNOB BREAKS AWAY OR IS LOST.

WHAT TO DO

(1) Use pliers or adjustable wrench to turn the switch actuator to the left for **Fill** or to the right for **Run**, or . . .

(2) A knob can be removed from another steam generator control switch and used for both units.

409. THE FUEL SOLENOID VALVE WILL NOT OPEN. (NO FUEL OIL FROM SPRAY, BUT ALL OTHER REQUIREMENTS PRESENT)

WHAT TO DO

A. On "Square D" fuel solenoid valve.

(1) Remove inlet fitting from present position at bottom of valve.

(2) Remove brass plug from opposite side of valve.

(3) Install inlet fitting into port left open from plug. (This port is 180° away from the original opening).

(4) Place plug into original inlet valve port.

(5) Reconnect fuel tubing to fitting in new valve port.

B. "ITT" Fuel Solenoid valve.

(1) Remove 3/8" CT X 3/8" NPT 90° elbow inlet fitting to valve.

(2) Unscrew solenoid valve and outlet nipple from spray head inlet elbow.

(3) Fit the 3/8" CT X 3/8" NPT 90° elbow into the 3/8" spray head inlet elbow.

(4) Reconnect the fuel tubing to the inlet fitting.

CAUTION

The above procedures outline the by-passing of the Fuel Solenoid Valve. Fuel oil will now be fed to the spray head and ignited in either the FILL or RUN modes. BE SURE THE COILS ARE FILLED WITH WATER BEFORE THIS BY-PASS PROCEDURE IS USED. The steam generator must be operated in the MANUAL MODE.

410. THE CONTROL SWITCH IS SUSPECTED OF BEING DEFECTIVE IN ANY OF ITS THREE CIRCUITS.

WHAT TO DO

(1) Refer to Steam Generator Electrical drawing in Section 500. Figure 500-2.

(2) Circuit 1 failure—the Line Relay Coil will not pick up. Connect a "jumper" wire from CB2 (located on Electrical Cabinet terminal board) to the left side

(+) of the Line Relay Coil. If the control switch is at fault the Line Relay should pick up.

(3) Circuit 2 failure—the Fuel Solenoid Valve Circuit. Connect a "jumper" wire from SS2 terminal to FSV2 terminal on the Electrical Cabinet terminal terminal board. If switch is at fault the Steam Generator should "light off".

(4) Circuit 3 failure—the Outfire Relay Circuit. Connect a "jumper" wire from terminal CS to terminal SS3 located on the Electrical Cabinet terminal board. If the switch is at fault the Steam Generator should operate.

411. IGNITION SPARK IS LOST.

Perform these ten simple, safe steps:

WHAT TO DO

(1) Refill the coils with water as outlined in the Filling Procedure (Section 101). Be sure to operate the steam geneator in the **Fill** mode for at least 3 minutes to evacuate any unburned gasses and cool the steam generator as much as possible.

(2) Move control switch from **Fill** to **Off** and manually position the servo "bow-tie" to the **Off** position (left side down).

(3) Close #19 valve.

(4) Loosen the burner sight glass and move it to one side.

(5) Light a fusee in the following manner:

LIGHTING A FUSEE

(a) Hold fusee in your left hand.*

(b) Peel away the tape securing the cap to the body of the fusee. Remove the cap.

(c) Remove the tape completely from the cap of the fusee, exposing its striking surface located on the outer center of the cap. Hold the cap with right hand* with striking surface towards the fusee.

(d) Be sure no other person is standing near you.

(e) Place the striker area of the cap against the top of the fusee.

(f) Sharply press the striker portion of the cap against the top of the fusee and rub forward (away from you) all in one motion. The fusee should light. If not, repeat steps (e) and (f) until lit.

(g) Keep the lit fusee at arm's length, below the shoulder. Move it slowly.

If left-handed, reverse the holding position in steps A and C.

(6) Place the lit fusee into the burner sight glass opening with the burning end as close to the front spark plug electrode as possible.

(7) Move the Control Switch to **Run.** The fusee should ignite the oil spray immediately. If it does not, repeat steps 1, 2 and 6.

(8) Once ignition has started, remove the fusee from the burner assembly and extinguish it properly as follows:

EXTINGUISHING A FUSEE

Extinguish the fusee by strking its lit portion lightly over a solid object until the lit portion drops off. **Do not** allow the lit portion to contact combustible material: (oil, grease, paper, wood etc.).

> **CAUTION**
>
> Once lit, the fusee will continue burning for 15-20 minutes if not extinguished. **Do not** throw a lit fusee from a moving train, since the track will be closed to following traffic until the fusee burns itself out. Another danger is that brush fires could be started along the right-of-way.

(9) Swing the sight glass assembly to its **closed** position.

(10) Operate the steam generator in the **Manual Mode** by opening and closing the #8 valve to control trainline pressure.

NOTE: If the #8 valve is opened too much, the "Bow-Tie" will move to the OFF FIRE Position and the manual lighting procedure must be repeated.

412. THE HEAT EXCHANGER BEGINS LEAKING, CAUSING THE STEAM TEMPERATURE LIMIT SWITCH TO TRIP.

WHAT TO DO

(1) Close the #81 and insure that #82 valve is also closed.

(2) Continue running; this will allow excessive water to enter the trainline, but will do no harm to the steam generator.

413. THE STEAM GENERATOR IS EXTREMELY SOOTED. STACK SWITCH HIGH TEMPERATURE RESET ACTUATES.

WHAT TO DO

(1) Correct the cause for sooting before doing anything else. (Stuck damper, broken belts, no atomizing air, etc.)

(2) **Fill** coils with water as outlined in Section 101.

(3) Place Control switch in **Run** position.

(4) Once lit, move Control Switch to **FIII.** If coils are severely sooted, the fire will remain on. When fire goes out it means that excessive amounts of soot are burned off.

(5) Move Control switch to **Run** and operate steam generator in **Manual** mode.

(6) If Stack Switch continues to trip, remove stack switch whenever temperature indicator reaches the 1-2 o'clock trip position. When the temperature indicator drops to the 9 o'clock position reinsert the stack switch and repeat as many times as necessary until reaching a maintenance point.

414. THE CONTROL OR TRANSFORMER FUSES BLOW AND NO REPLACEMENTS ARE AVAILABLE.

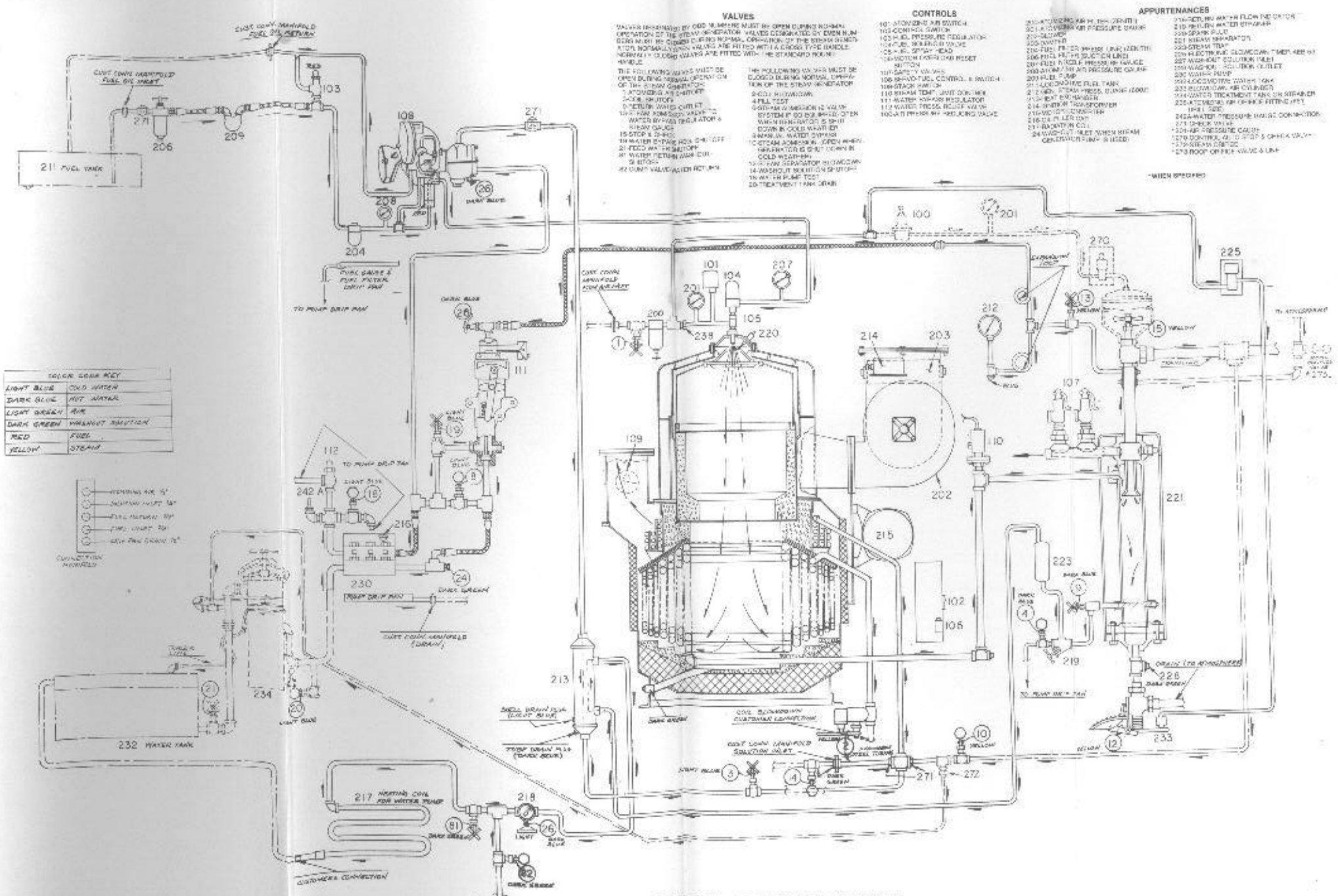
WHAT TO DO

(1) Open Circuit Breaker or Main switch.

(2) Examine all appliance cords for bare wires causing a short circuit. Repair such wires if possible with cardboard, paper towels or any other suitable material.

(3) Wrap the defective fuse with aluminum foil, or metal-coated chewing gum wrappers.

(4) Re-install fuse in clips and close main switch or circuit breakers. (Thin-gauge wire can also be used across the fuse clips). As a last resort, 3/8" copper tubing can also be used as a temporary jumper across the fuse clips.



COLOR CODE KEY	
LIGHT BLUE	COLD WATER
DARK BLUE	HOT WATER
LIGHT GREEN	AIR
DARK GREEN	WASHOUT SOLUTION
RED	FUEL
YELLOW	STEAM

FIGURE 500-1. STEAM GENERATOR PIPING DIAGRAM

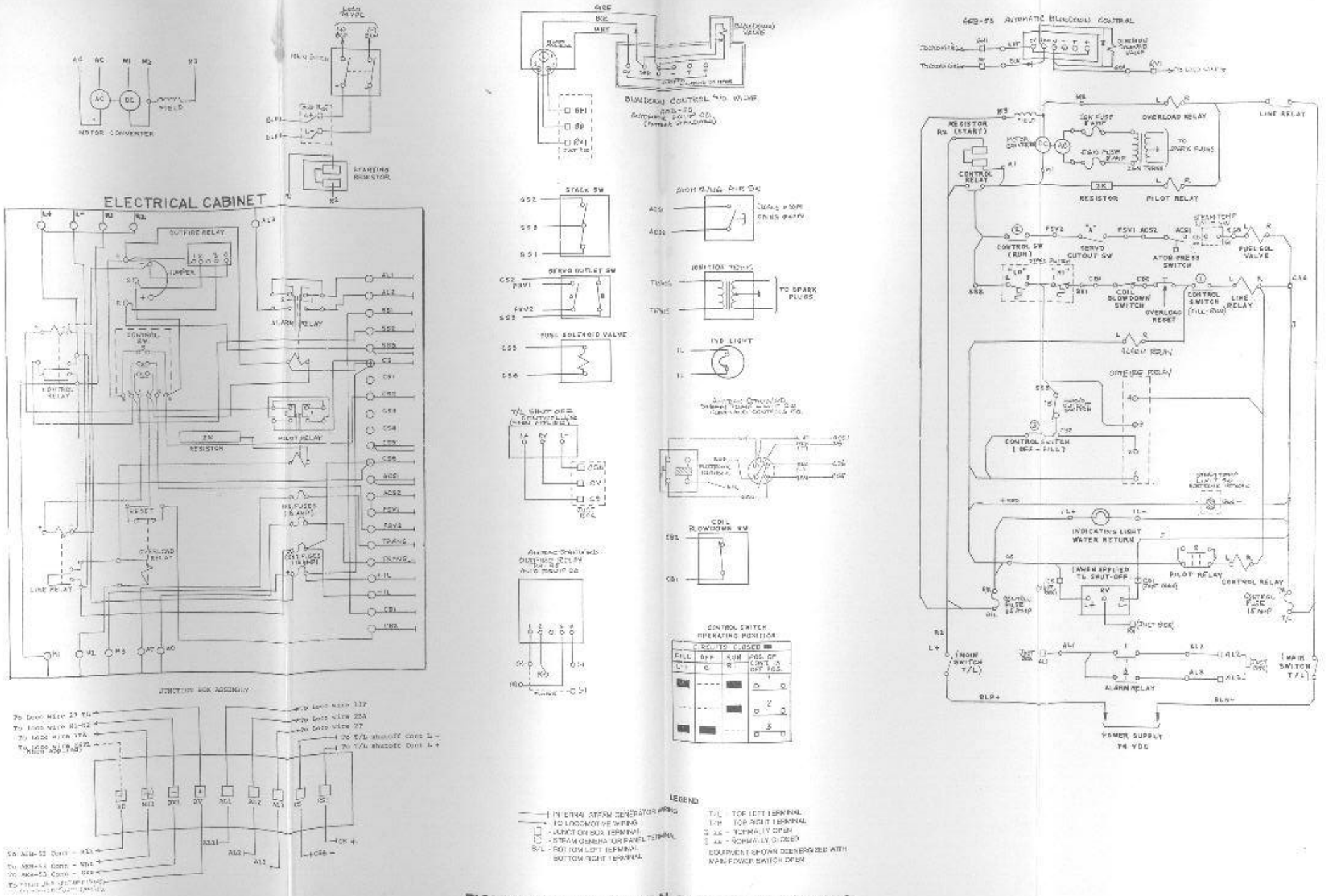


FIGURE 500-2. ELECTRICAL SCHEMATIC DRAWING

STEAM GENERATOR VALVE POSITION GUIDE

VALVE NAME & NUMBER		FILL	RUN	MANUAL OPERATION	SHUT DOWN	COLD WEATHER PROTECTION
ATOMIZING AIR	#1	☐	☐	☐	■	■
COIL BLOW-DOWN	#2	■	■	■	☐ (A) ■	■
FILL TEST	#4	☐	■	■	■	■
MANUAL BY-PASS	#8	■	■	◪ (B)	■	■
STEAM ADMISSION TO GENERATOR	#10	■	■ (C)	■	■	☐ *
SEPARATOR BLOW-DOWN	#12	■	☐ (D) ■	■	■ ☐ (E)	■
TRAINLINE SHUT OFF	#15	■	☐	☐	■	☐
WATER PUMP TEST	#18	■	■	■	■	■
WATER BY-PASS REGULATOR SHUT-OFF	#19	☐	☐	■	☐	☐
ROOF ORIFICE	NO #	■	■ ◪ ☐ (F) (G)	■	■	■

The following valves MUST remain in the position indicated EXCEPT for certain maintenance procedures:

COIL SHUT OFF	#3	☐	WASH-OUT SHUT-OFF	#14	■
RETURN WATER OUTLET	#9	☐	WATER PUMP SUCTION DRAIN	#20	■
STEAM SHUT-OFF TO WATER BY-PASS REGULATOR	#13	☐	ALL DRAIN VALVES	#26	■
SUCTION SHUT-OFF	#21	☐	WATER RETURN DUMP VALVE	#82	■
WATER RETURN WASH-OUT SHUT OFF	#81	☐			

NOTES

(A) OPEN until steam pressure drops to 100 PSI, then CLOSE.

(B) MANUALLY regulate to control steam pressure.

(C) Must be CLOSED to prevent possibility of tripping steam temperature limit switch.

(D) OPEN during startup, CLOSE when steam pressure is 100 PSI.

(E) CLOSE until steam pressure drops to 100 PSI, then OPEN.

(F) May be CRACKED to prevent generator from short-cycling or water-logging.

(G) MUST BE FULLY OPEN during orifice test. If the generator is operating, it should maintain 180-240 PSI.

*AMTRAK STANDARD is the single-valve (#10 only) cold weather protection system; this valve must be positioned as shown in the valve guide.

Some generators are equipped with a two-valve system (#6 as well as #10); on such generators, position the valves as follows:

#6 CLOSED during operation to prevent tripping steam temperature limit switch; OPEN in cold weather when generator is shut down.

#10 May be CRACKED while generator is operating in cold weather. MUST BE OPEN when generator is shut down in cold weather.

LEGEND

■ Indicates CLOSED.

◪ Indicates CRACKED or PARTIALLY OPENED.

☐ Indicates OPEN.

NRPC CMO-115DS (9-77)

FIGURE 500-3. STEAM GENERATOR VALVE POSITION GUIDE

1. ELECTRODE & FUEL SOLENOID VALVE WIRES
2. IGNITION TRANSFORMER
3. FUEL PRESSURE REGULATOR
4. FUEL MANIFOLD PRESSURE GAUGE
5. ELECTRICAL CONTROL CABINET
6. WATER RELIEF VALVE
7. #18 VALVE
8. WATER PRESSURE GAUGE
9. SAFETY VALVES
10. DAMPER INDICATOR
11. FUEL STRAINER
12. ATOMIZING AIR PRESSURE SWITCH
13. FUEL NOZZLE PRESSURE GAUGE
14. DAMPER ACTUATING RODS
15. SELECTOR SWITCH "FILL-OFF-RUN"
16. #19 VALVE
17. MOTOR-CONVERTER
18. FUEL PUMP
19. DIP STICK
20. WATER PUMP
21. RADIATION COIL
22. ACID SOLUTION INLET WHEN SG PUMP IS USED
23. #81 VALVE
24. #82 VALVE
25. ATOMIZING AIR PRESSURE GAUGE
26. #15 VALVE
27. SOL. VALVE FOR AEB-53
28. AUTO. BLOWDOWN TIMER ASSY. (AEB-53)
29. #15 VALVE CONTROLLER "SHUT-OPEN"
30. SERVO SWITCHES
31. SERVO CONTROL "BOW TIE"
32. SERVO FUEL METERING VALVE
33. RETURN WATER SIGHT GLASS
34. WBR DELAY ADAPTER
35. WATER-BY-PASS REGULATOR (WBR)
36. STEAM TRAP
37. WBR SELECTOR HANDLE
38. #8 VALVE
39. #4 VALVE
40. OUTLET OF INNER COIL
41. FUEL SUCTION FILTER

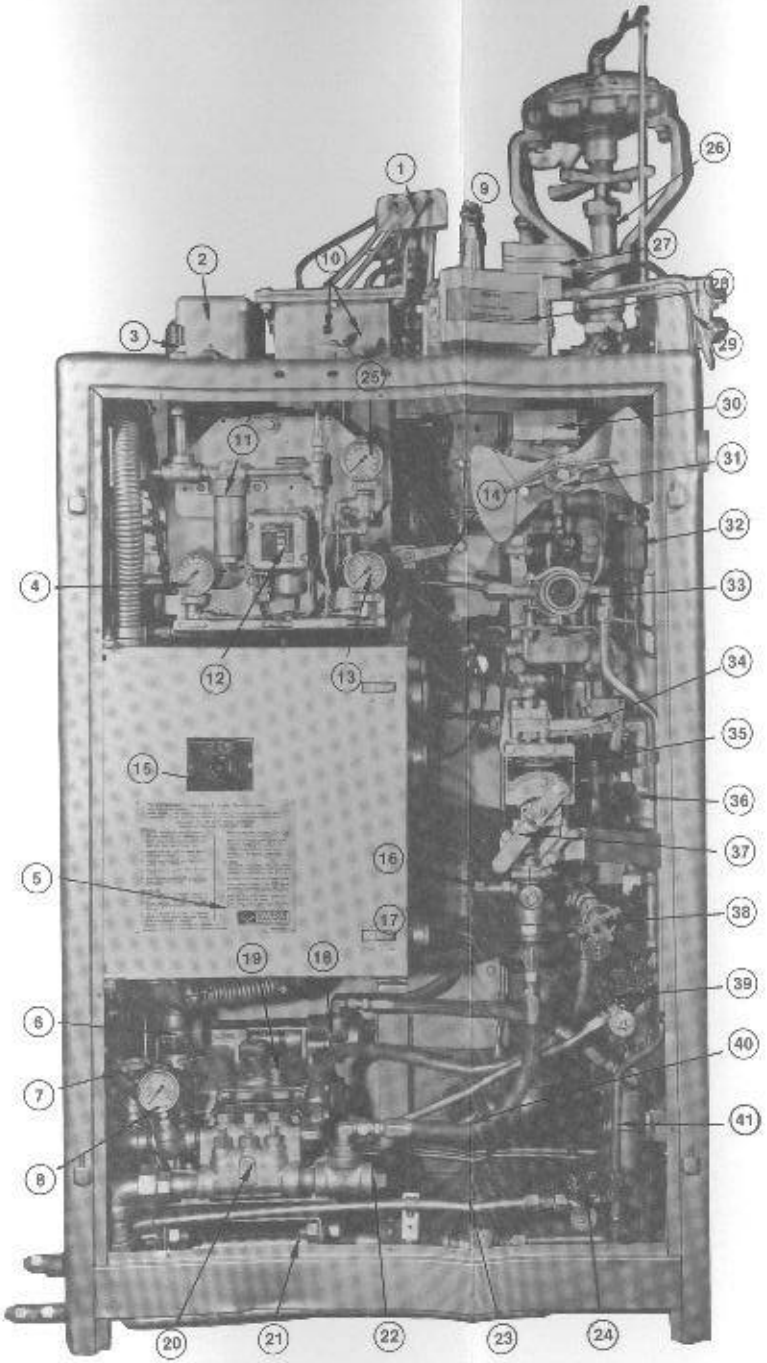


FIGURE 10-1. OK-4625-74 RIGHT HAND STEAM GENERATOR (FRONT VIEW)

1. AEB-53 AUTO BLOWDOWN CONTROL
2. SERVO
3. WATER-BY-PASS REGULATOR
4. #82 VALVE
5. FEEDWATER INLET
6. PRIMARY FUEL FILTER
7. TRAP STRAINER
8. ACID INLET #14 VALVE
9. FUEL PUMP
10. TRAP
11. HEAT EXCHANGER
12. AIR INTAKE HOUSING
13. AUTOMATIC TRAINLINE SHUTOFF VALVE #15
14. FUEL SOLENOID VALVE
15. BURNER ASSY.
16. SPARK PLUGS
17. SAFETY VALVES
18. AIR DOME ASSY.
19. STEAM TEMP LIMIT SWITCH
20. FEEDWATER INLET TO COILS
21. CHECK VALVES
22. STACK OUTLET
23. LAYOVER STEAM INLET (FROM #10 VALVE)
24. #3 VALVE
25. ACID INLET FROM MANIFOLD
26. OUTER COIL INLET
27. SMOKE HOOD
28. ECONOMIZER COIL OUTLET
29. #2 COIL BLOWDOWN VALVE
30. UPPER CASING ASSY.
31. BASE ASSY.

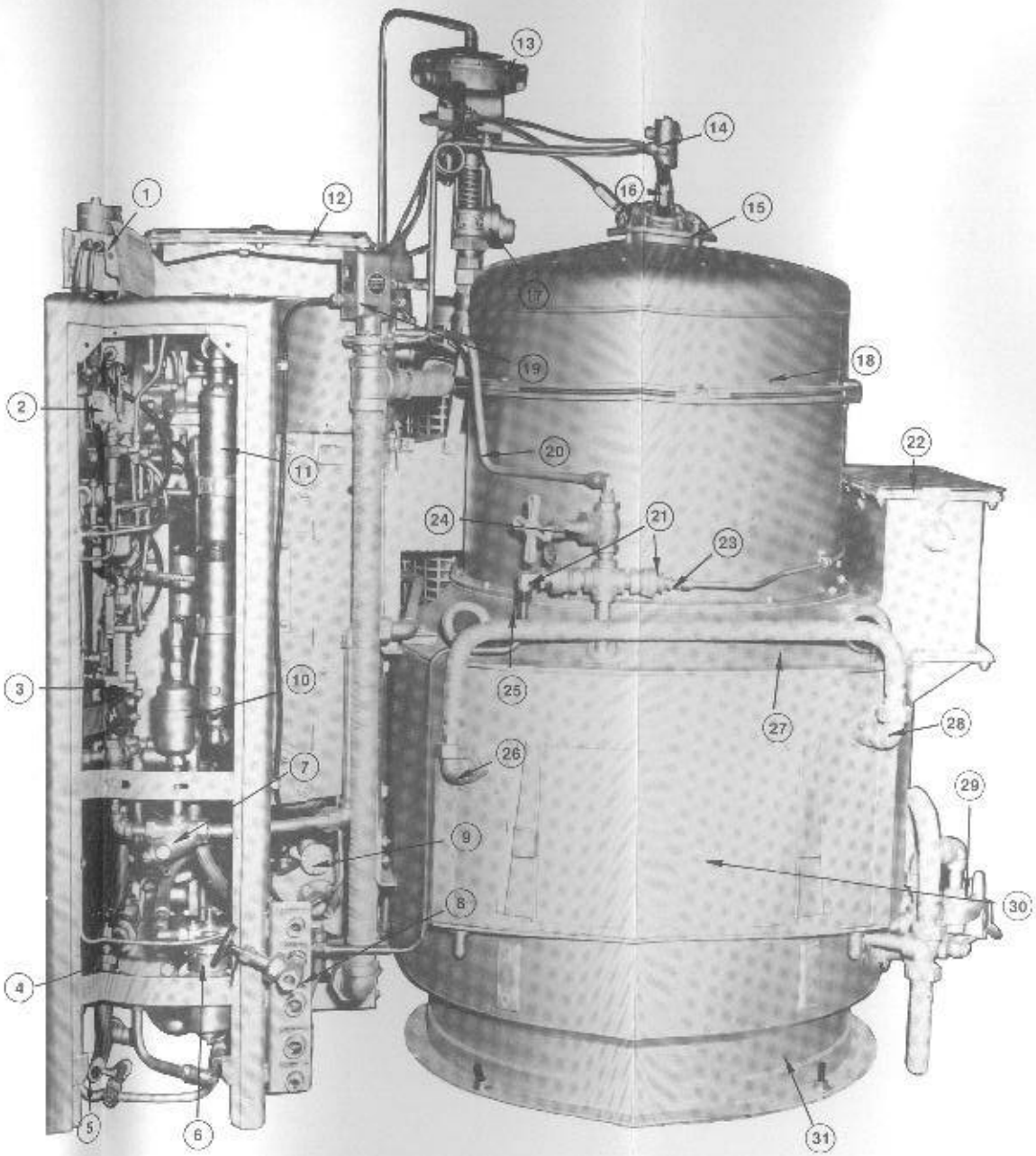


FIGURE 10-2. OK-4625 LEFT-HAND STEAM GENERATOR (RIGHT SIDE VIEW)

1. STACK SWITCH
2. #10 VALVE
3. #2 VALVE (COIL BLOWDOWN)
4. STEP RAIL
5. BASE ASSY DRAIN PLUG
6. ACID OUTLET
7. SEPARATOR
8. ROOF ORIFICE VALVE PLUG
9. AUTOMATIC TRAINLINE SHUTOFF VALVE (#15)
10. #13 VALVE
11. AUTOMATIC TRAIN-LINE VALVE (#15) CONTROLLER
12. OPEN
13. SHUT
14. PRESSURE GAUGE (FOR VAPOR T/L VALVE ONLY)
15. STEAM PRESSURE GAUGE
16. BLOWER SHAFT OPENING
17. BELT TENSION ADJUSTER OPENING
18. #9 VALVE
19. BELT COVER
20. MOTOR-CONVERTER SHAFT OPENING
21. WATER PUMP SHAFT OPENING
22. SEPARATOR BLOW-DOWN VALVE AND PEDAL

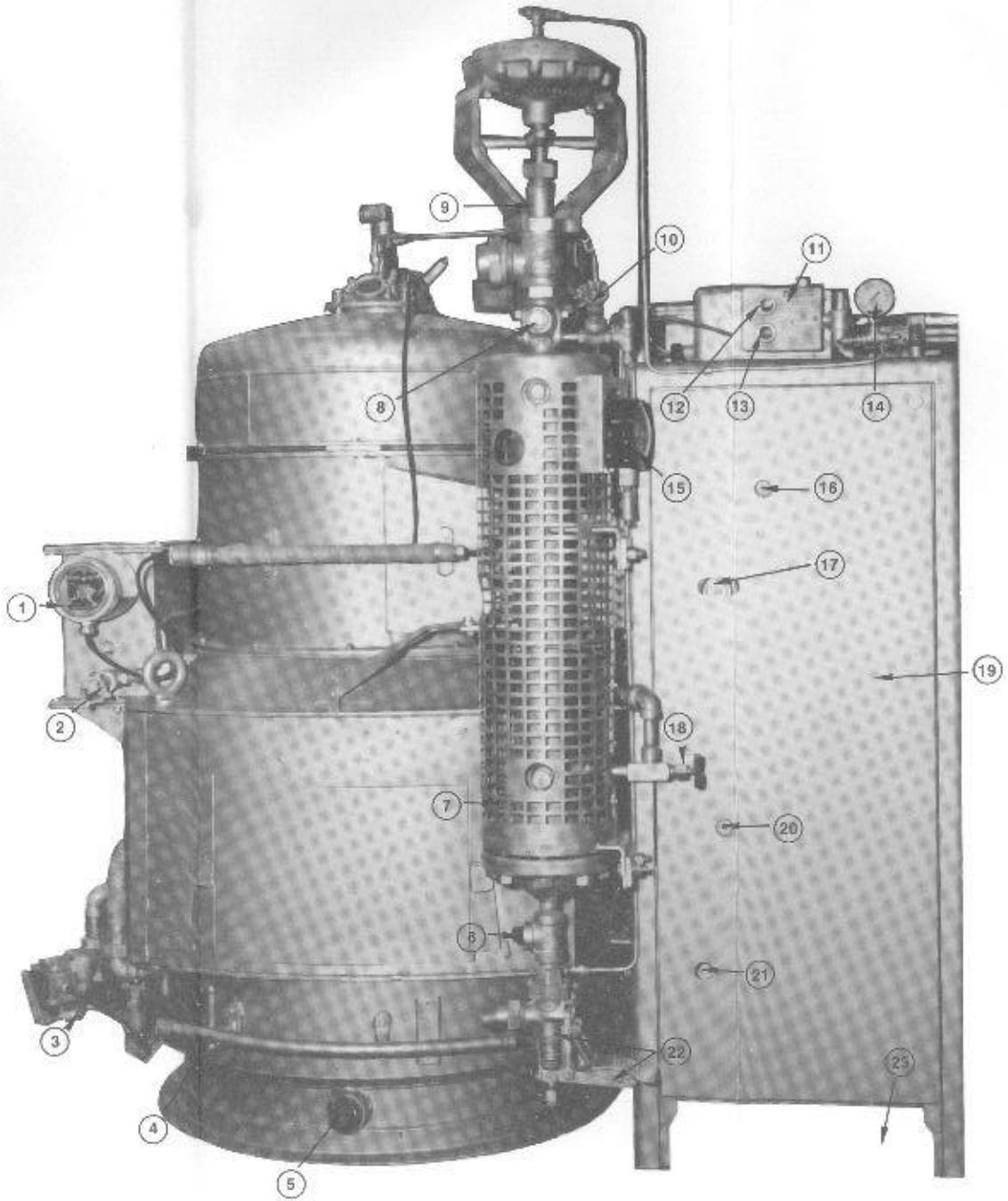


FIGURE 10-3 OK-4625-74 LEFT-HAND STEAM GENERATOR (LEFT SIDE VIEW)

1. DOME ASSEMBLY
2. #3 VALVE
3. ECONOMIZER COIL INLET
4. SMOKE STACK CONNECTING FLANGE
5. LIFTING EYE
6. ECONOMIZER COIL OUTLET
7. OUTER COIL OUTLET
8. COIL INSPECTION DOOR CLAMP
9. SEPARATOR
10. STACK SWITCH
11. #10 VALVE
12. COIL INSPECTION DOOR CLAMP
13. INNER COIL INLET
14. INTERMEDIATE COIL OUTLET
15. #2 VALVE
16. INTERMEDIATE COIL INLET

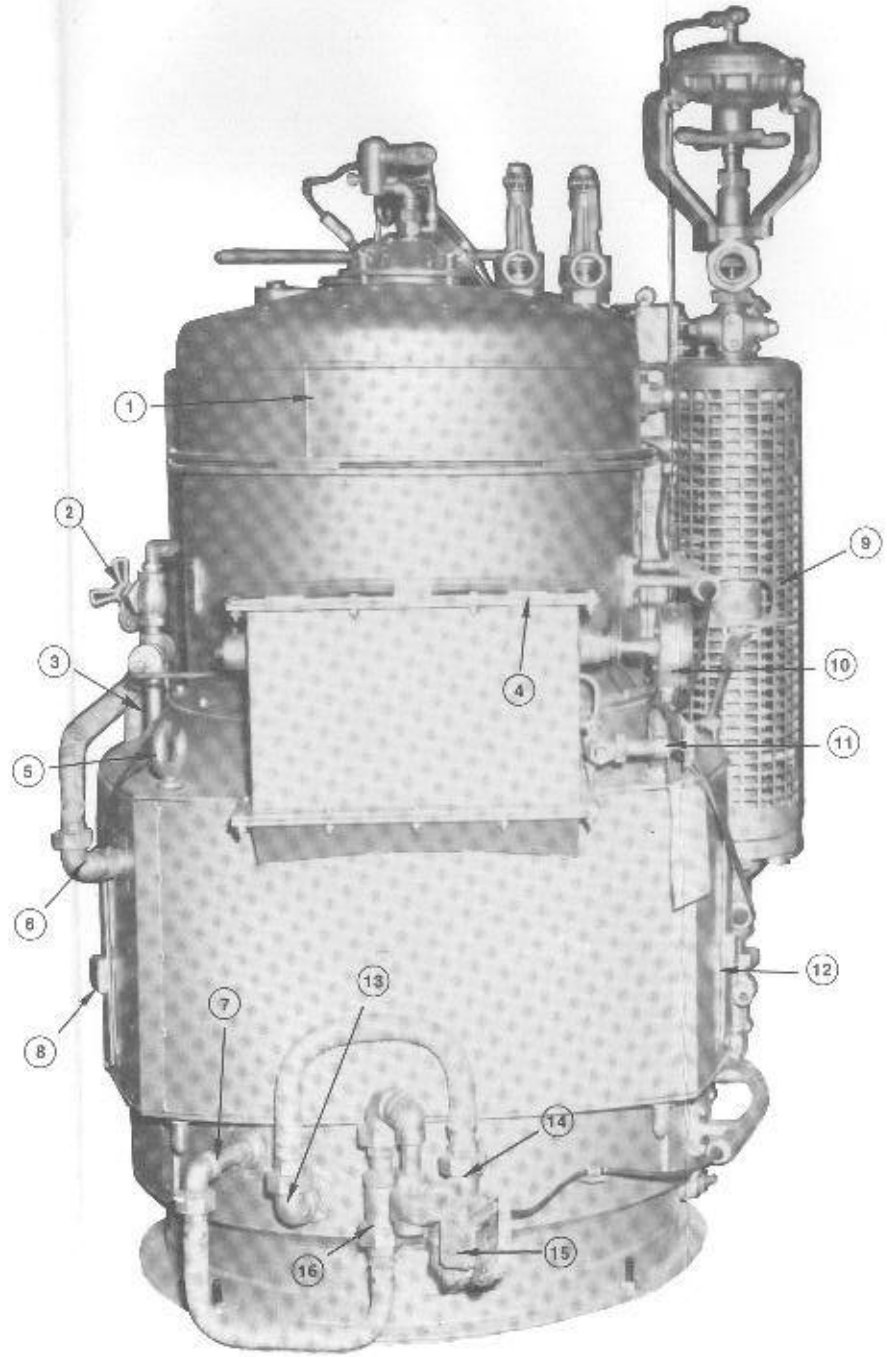


FIGURE 10-4. OK-4625-74 LEFT-HAND STEAM GENERATOR (REAR VIEW)

NATIONAL RAILROAD PASSENGER CORPORATION

INTEROFFICE MEMO

DATE: May 24, 1978

TO: TO ALL HOLDERS OF STEAM GENERATOR OPERATING MANUAL VAPOR OK-4625-74

FROM: J.F. Roseman

SUBJECT: Corrections to Steam Generator Operating Manual

Enclosed are corrected Figure 500-1 Steam Generator Piping Diagram and Figure 500-2 Electrical Schematic drawing. Please substitute these in your book.

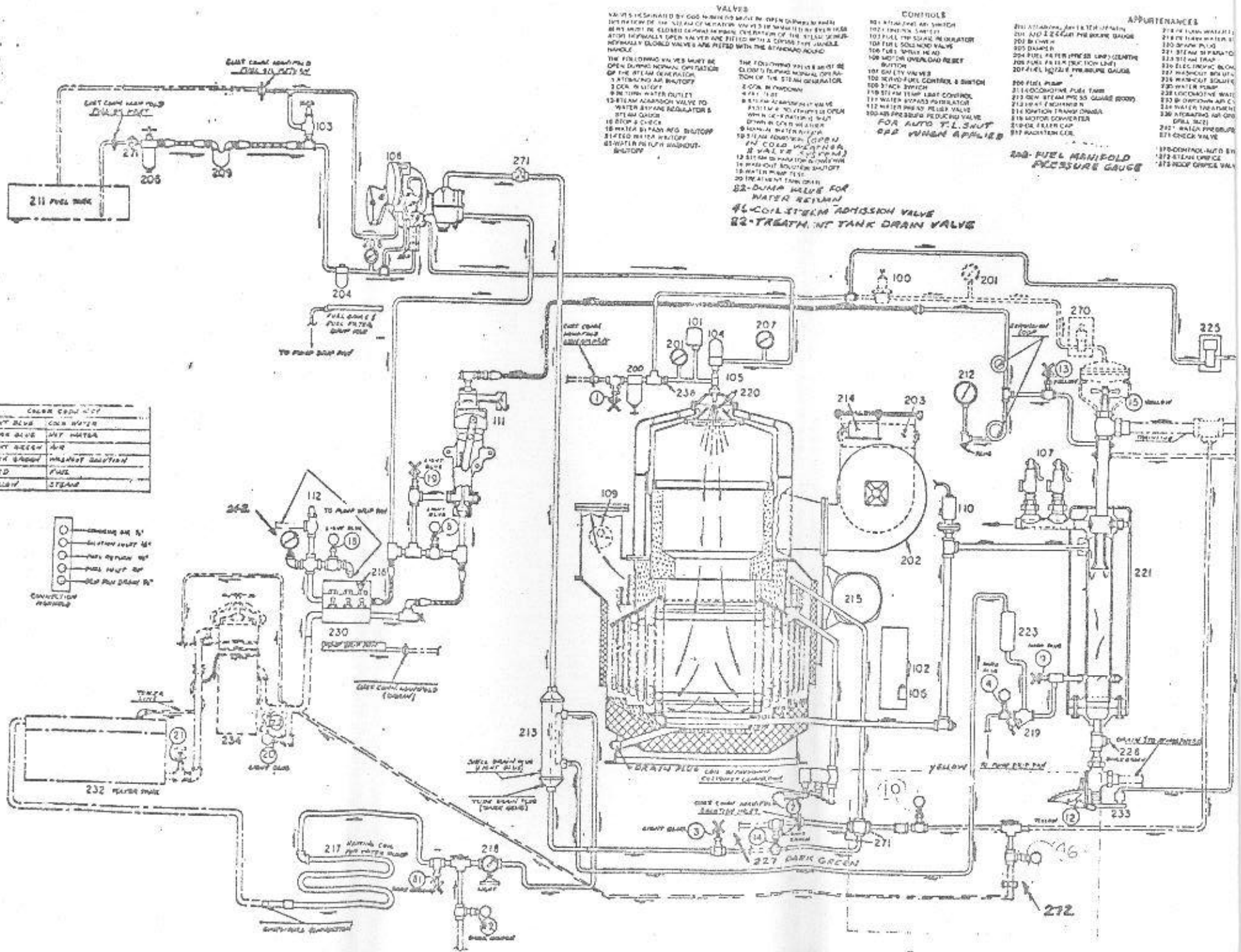
In addition, add to section 10, General Specification Date (page 3) the following:

Fuel nozzle pressure 15-60 PSI depending on load.

Spark Gap 3/16".

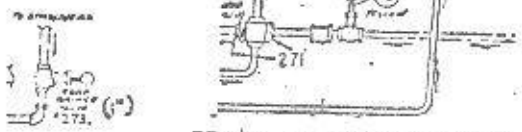
J.F. Roseman

Amtrak



E-8 Two-Valve Cold Weather Protection System

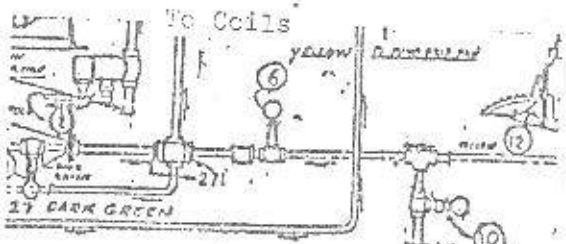
SDP40 Cold Weather Protection Systems



To Coils

SDP40 One-Valve Cold Weather Protection System

To Coils



To Tracer Lines

SDP40 Two-Valve Cold Weather Protection System

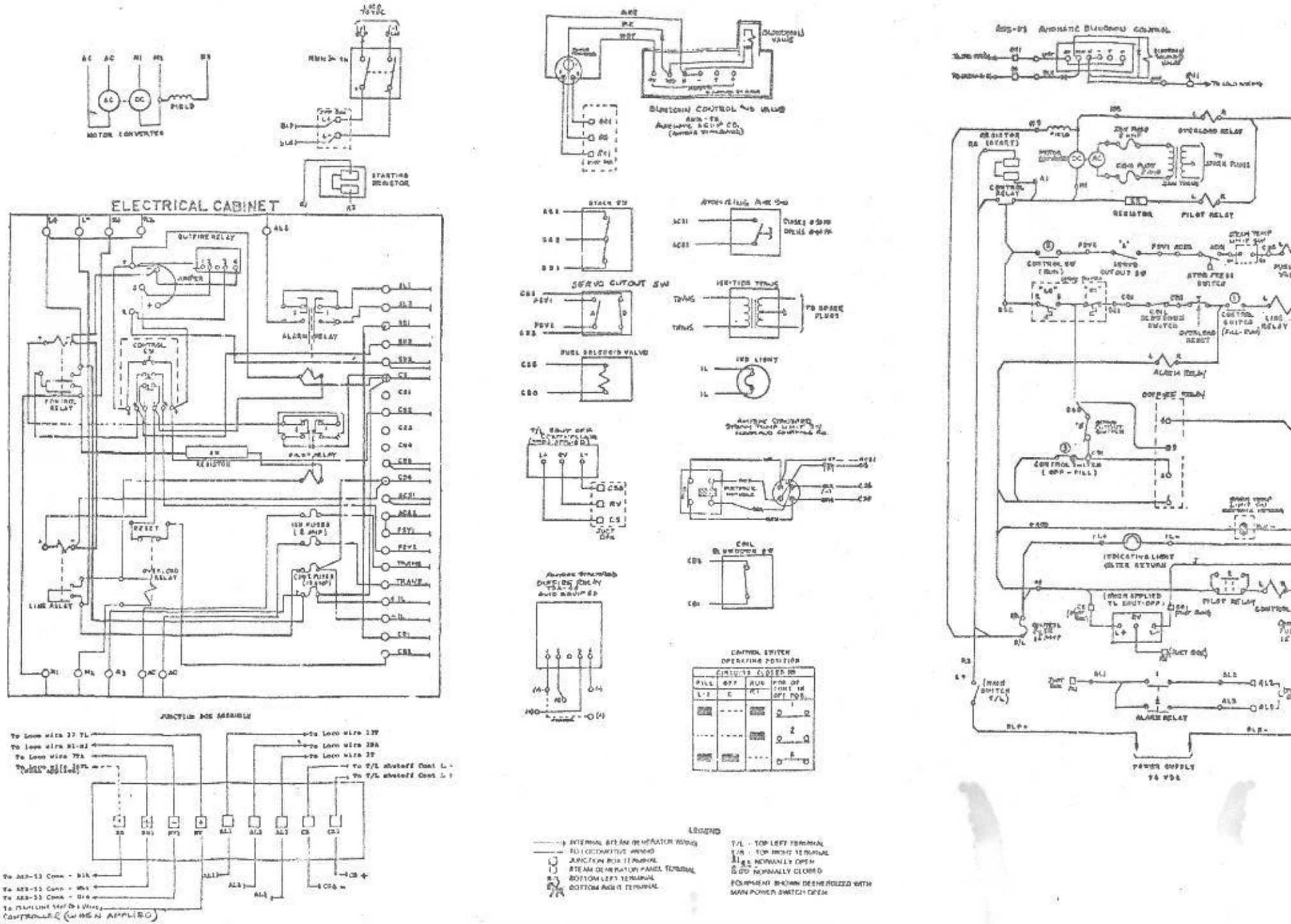


FIGURE 500-2. ELECTRICAL SCHEMATIC DRAWING