THE NEW YORK CENTRAL SYSTEM

OPERATING INSTRUCTIONS

DIESEL ELECTRIC ROAD LOCOMOTIVES

E. M. D. GP-7 LOCOMOTIVES

CLASS DRSP-4G & DRS-4F.

ROAD NUMBERS 5676 TO 5685 INC.

Supt. of Equipment

P. & L. E. R. R.
McKEES ROCKS, PA.

Dec. 1, 1951

OPERATING INSTRUCTIONS:

ELECTRO-MOTIVE. CLASS DRSP-4G & DRS-4F

1500 H. P. LOCOMOTIVES

ROAD NUMBERS 5676 to 5685, INC.

CHANGING OPERATING CABS:

ENGINES RUNNING:

When the consists of the locomotive includes two units with operating controls the following procedure should be followed in changing from one operating end to the opposite end.

CAUTION: The complete change-over must be made as quickly as possible, because the fuel pumps are shut off and the Diesel engines will suck the fuel lines dry, possibly resulting in damage to the fuel injectors.

LEADING CAB:

1. Remove reverser handle.
2. Make a full service brake pipe reduction, and then LAP the automatic brake valve. Remove the automatic brake valve handle. Move the double-heading cock to TRAILING position.
3. Move the independent brake valve handle to RELEASE position, and remove the handle.
4. Place headlight control switch to the left, or controlled position.
5. Stop train control generator. (Switch is to the left and underneath the train control generator.)

6. Open all switches at engineman's control station ("OFF" position), except the Transition Forestalling switch which remains in "UP-AUTO" position. Toggle switch on engineman's control stand remains in ROAD position.

NEW LEADING CAB:

1. Close control and fuel pump switches ("ON" position), and all other switches that are necessary. Transition Forestalling switch should remain in "UP-AUTO" position. Toggle switch on engineman's control stand remains in ROAD position.
2. Insert reverser handle and brake valve handles.
3. Start train control generator. (Switch is to the left and underneath the train control generator.)
4. Place double-heading cock in LEAD position.
5. Reset train control by pulling reset valve handle back, pausing, and then placing handle forward. (Reset valve is located on right rear corner of locomotive in front of steps.)
6. Place independent brake valve in FULL APPLICATION position. Move the automatic brake valve to RUNNING position.
7. Place headlight switch to the right, or controlling position.
8. Before moving locomotive RELEASE independent brake.

SHUT DOWNS IN FREEZING WEATHER:

When it is decided to shut down engines during layover in freezing weather they must be either drained or heated by steam from an out side source.

When steam is available take the following steps for protection against freezing:

ENGINE COOLING SYSTEM PROTECTION:

1. Open steam admission valve to engine cooling water. (Located on floor, right front, inside of engine room near lube oil filters).
2. Open "G" valve.
3. Connect outside source of steam to trainline of locomotive. On locomotives not equipped with trainline connect outside source of steam to pipe under running board above front trucks, right side.

STEAM GENERATOR PROTECTION:

Those locomotives equipped with steam generators must have the following valves opened in addition to those under cooling system above. The following valves are numbered, and are located in the steam generator compartment:

1. Steam admission valve #11 from trainline.
2. Steam admission valve #10 to radiation.
3. Layover connection shutoff valve #6.
4. Water suction drain valve #20.
5. Water supply stop valve #21.

PC. SWITCH:

The pneumatic control switch (PC) is an air operated electrical switch. This switch is tripped by an automatic brake application, or by a manual emergency brake application. When this switch is tripped it automatically reduces the speed of the engines to idle in all throttle positions, except 5th and 6th positions. In these two positions the engines will stop immediately. The PC switch also shuts off all fuel pumps, and although the engines may have gone to idle, they will stop within a few minutes from the lack of fuel. The PC indicating light will show when the switch is tripped.

To RESET "PC" switch after an AUTOMATIC BRAKE APPLICATION, return the throttle to idle and proceed as follows:

1. LAP the automatic brake valve.
2. Reset the train control by pulling reset valve handle back, pausing, and then placing handle forward. (Reset Valve is located on right rear corner of locomotive in front of steps.)

TO RESET "PC" switch after a MANUAL EMERGENCY BRAKE APPLICATION return the throttle to idle and move the automatic brake valve out of emergency position.

SECTION V
OPERATING INSTRUCTIONS

The Elesco Type M-2 steam generator is designed for a maximum operating steam pressure of 325 lbs. and a rated steam output of 3,000 lbs. per hour plus 20%. The controls and safety devices incorporated insure full automatic operation after starting, and are set to maintain an operating steam pressure ranging from 260 to 290 lbs. The fuel metering controls are actuated by boiler pressure and at high steam outputs the boiler pressure will be closer to 290 lbs. and at light loads the pressure will approach 260 lbs.

Two safety valves are provided, one being set for 325 lbs. and the other for 335 lbs., thus with the automatic controls working properly the safety valves should not come into play.

In starting the steam generator and while opening the steam line to the train heating system, the instructions given below should be followed. The operating procedure is simple and is such that the operator does not necessarily require an understanding of the working principle of the steam generator, yet, as is true with any mechanical device, a general knowledge of the working principle is desirable.

ELESCO STEAM GENERATOR TYPE M-2
TROUBLE SHOOTING

NORMAL	*TROUBLE*	*ACTION*
I. When Main Switch is Closed.		
A. Pressure gage lamp, water gage lamp, and Electric Eye indicating lamp light.	If one of these lamps does not light.	Check for burned out lamp.
	If none of these lamps light.	Check for blown main line 150 amp. fuses or tripped line circuit breaker if used. Check for blown fuses in motor control cabinet.
B. Alarm bell should not ring.	If alarm bell rings.	Push "Stop" button in. Check Control Switch—it should be in "Starting" position.
II. After pushing "Start" button with Control Switch in "Starting" position.		
A. Motor starts and comes up to speed, driving circulating pump, fuel oil pump, and blower fan wheel.	If motor does not start.	Check "Reset" of motor overload relay in motor control cabinet. Reset if necessary by pushing reset button down. Check main

(Cont. following page)

NORMAL	TROUBLE	ACTION
II. After pushing "Start" button with Control Switch in "Starting" position. (Cont.)		line fuses (or if circuit breaker is used, reset it if found tripped). Check for blown fuses in motor control cabinet.
B. "Start" indicating lamp lights.	If "Start" indicating lamp does not light and motor is running.	Check for burned out lamp.
C. Alarm Bell should not ring.	If alarm bell rings.	Check Control Switch. It should be in "Starting" position.
III. Steam Generator Motor Running.		
A. Pressure gage, white hand, circulating pump pressure should be 30 to 40 lb. greater than red hand. (The 30 to 40 lb. difference in these pressures is called "Differential Pressure"). It shows steam	If there is no differential pressure or pressure is low or unsteady.	Check for proper amount of water in steam separator which is with water level showing in glass and add water if necessary. Check circulating pump discharge line strainer — it may require cleaning.

(Cont. following page)

NORMAL	TROUBLE	ACTION
III. Steam Generator Motor Running. (Cont.)		
generator has proper water circulation.		
B. Fuel Oil Pressure Gage, red hand, pump pressure should be between 240 and 260 lb.	If fuel oil pump pressure is low or no pressure.	Check for oil in pump suction line by inspecting flow in sight glass. Turn handle on fuel oil pump suction line strainer to clean strainer. Check to see that fuel oil pump shaft is rotating. Check belt tension. Fuel oil relief valve may be stuck open.
	If fuel oil pump pressure is too high.	Fuel oil relief valve may be stuck closed. Pressure gage may be defective.
C. Main oil solenoid valve opens after differential pressure is established.	If main oil solenoid valve does not open. It makes a definite "click" when it opens.	

(Cont. following page)

NORMAL	TROUBLE	ACTION
IV. Control Switch is placed in "Running" position to make steam generator fire.		
A. "Burner On" lamp lights.	If "Burner On" lamp does not light and steam generator fires.	Check for burned out lamp.
	If "Burner On" lamp does not light and alarm bell rings.	Check for proper amount of water in steam separator which is water level showing in glass. Not enough water can cause loss of differential pressure. Steam generator will not fire if differential pressure is less than about 20 lbs. Also check items under "Action", III-A.
B. Small burner oil solenoid valve opens. This will be indicated by fuel oil pressure gage, red hand dropping about 25 lb. Ignition converter runs	If steam generator does not fire within about 5 seconds, shut-down will occur and alarm bell will ring.	Restart steam generator, check fuel oil pump pressure and when Control Switch is placed in "Running" position note drop in fuel oil pump pressure which indicates that small

(Cont. following page)

NORMAL	TROUBLE	ACTION
IV. Control Switch is placed in "Running" position to make steam generator fire. (Cont.)		
for about 5 seconds providing spark, after which it cuts out. As soon as fire is established Electric Eye indicating lamp goes out.		burner oil solenoid valve opens. Check small burner tip for plugging. Check through burner peep hole for proper spark and oil atomizing. Check air damper and rigging to see that it is in low position.
	If no spark or improper spark.	Check electric wiring between ignition transformer and electrodes. Check for dirty or defective electrodes. (Gap between electrodes should be $\frac{3}{16}''$).
	If steam generator fires for about 5 seconds and Electric Eye indicating lamp remains on and then a shutdown occurs with both	With steam generator shut down clean Electric Eye lenses.

(Cont. following page)

NORMAL	TROUBLE	ACTION
IV. Control Switch is placed in "Running" position to make steam generator fire. (Cont.)		
	"Start" and "Burner On" indicating lights, going out and alarm bell rings.	
V. Steam Generator operating with closed trainline shut-off valve.		
A. Steam generator fire is automatically cut out when steam pressure reaches 295 lb. When steam pressure drops to 285 lb. it refires. Small burner going on and off at short intervals is called "Cycling."	If steam generator shuts down when cycling, alarm bell rings with both the "Start" and "Burner On" indicating lights out and motor running at reduced speed.	Place Control Switch in "Starting" position — this will cut out alarm bell. Restart steam generator. Place Control Switch in "Running" position. Also check items under "Action" IV-B.
	If alarm bell rings with "Start" indicating light on and "Burner On" indicating light out.	Check items under "Action" IV-A. Check feedwater pump steam valve for full open. Check water gage

(Cont. following page)

NORMAL	TROUBLE	ACTION
V. Steam Generator operating with closed trainline shut-off valve. (Cont.)		glass on steam separator for indication that water in steam separator may be foaming—if so, give good blow-down using manual blow-down valve.
	If smoke shows at stack when refiring and then stack clears.	Check small burner and electrodes. Burner is not igniting as quickly as it should.
VI. Steam generator feeding steam to trainline.		
A. With low steam demand steam generator may cycle as in "V". With normal steam demand both the small and large burners will be on. The large burner pressure white hand on	If steam generator stops firing alarm bell rings with "Start" indicating light on and "Burner On" indicating light out.	Check differential pressure, water in glass, water storage tank, feedwater pump and its piping. Check feedwater pump steam valve for full open. Check action feedwater pump, may be sucking air through leaky

(Cont. following page)

NORMAL	TROUBLE	ACTION
VI. Steam generator feeding steam to trainline. (Cont.)		
fuel oil gage is controlled by the oil regulating valve and it varies with steam demand.		cover on water treatment tank. Check items under "Action" V-A.
	If steam generator shuts down, alarm bell rings — "Start" and "Burner On" indicating lights out and motor running at reduced speed.	Check for fuel oil pump pressure. With steam generator off, clean Electric Eye lenses. Also check items under "Action" IV-B.
	If steam generator shuts down, alarm bell rings, both indicating lights out, motor shuts down.	Check for blown main line fuses. Also check items under "Action" II-A.
	If smoke shows at stack with large burner on.	Check action of air damper and rigging. Check blower fan wheel belts.

BEFORE STARTING STEAM GENERATOR:

1—Auxiliary Generator on locomotive should be running and main air reservoir should have at least 60 lb. pressure.

2—Check position of all valves. Valves with cross handles should be fully opened.

Valves with round handles should be closed, excepting water glass valves, Refs. 2 and 6.

3—Turn handle, Ref. 7, on fuel oil filter one full turn.

4—Close main switch by moving handle, Ref. 1, to the "ON" position.

STARTING STEAM GENERATOR:

1—If no water shows in the glass run feedwater pump, Ref. 10, on air as follows:—

(a) Close pump steam valve, Ref. 23.

(b) Open pump air valve, Ref. 9.

(c) Open steam separator air vent cock, Ref. 3, while filling.

2—When water reaches top of water glass, place control switch, Ref. 12, in starting position. Push "START" button, Ref. 14, and motor will run.

3—Continue to operate feedwater pump on air until water remains in water glass, then shut pump air valve, Ref. 9, and open pump steam valve, Ref. 23.

4—Close steam separator air vent cock, Ref. 3.

5—Place control switch, Ref. 12, in running position. Steam generator will fire.

6—As steam generator comes up to pressure, water will tend to rise, use manual blow-down valve, Ref. 25, to maintain water level in glass.

TO FEED STEAM TO TRAINLINE:

Steam generator pressure should be 275 lb. shown on pressure gage, Ref. 16, red hand before proceeding.

THE NEW YORK CENTRAL SYSTEM

INSTRUCTIONS FOR OPERATING REMOTE CONTROL EQUIPMENT FOR VAPOR-CLARKSON DRK-4516—1600 LB., OK-4625—2500 LB. AND DRK-4530—3000 LB. TYPE STEAM GENERATING UNITS ON DIESEL ELECTRIC ROAD LOCOMOTIVES.

Office of Gen'l. Supt. Equipment
New York, N. Y.
January 8, 1947.
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DRK-4516, OK-4625 AND DRK-4530 TYPE

VAPOR CLARKSON STEAM GENERATING UNITS

SECTION I

GENERAL DESCRIPTION

Steam generating units of the "DRK" and "OK" series are of the forced circulation, coiled water tube type. They are oil fired and have electric ignition. The heat absorption portion with most "DRK" type generators consists of three compactly wound coils of steel tubing, connected in series to form a single tube several hundred feet in length set within a fire box or furnace compartment. The "OK" type, and some "DRK" type, have, in addition to the above 3 coils, an economizer coil, located outside of the coil refractory in the path of the exhaust gases. The economizer coil is in series with the other coils and forms a part of the single tube.

Water is forced into the outer (or, economizer) coil of this tube by a feed pump. Oil is supplied to the burner by a fuel pump, while air for combustion is delivered to the combustion chamber by a blower. The hot combustion gases pass through the coil layers before flowing to the stack. The water in its passage through the coils is heated and converted into steam. The steam flows from the coils into an external steam separator and from it to the steam train line. After filling the coils with cold water, steam is generated to full operating pressure in one or two minutes after fire is lighted.

During operation, a slight excess of water is circulated through the coils to flush out scale-forming material. The water and sludge are removed from the steam in the separator and fall to a sump in the bottom of that vessel. The sludge is blown out periodically through a blow-down valve. The excess water is returned to the water supply tank through a coil type heat exchanger. In flowing through the coil, the hot water preheats the feed water which flows through the casing of the heat exchanger.

CAPACITY AND PRESSURE

The rated capacity of the 4516 type steam generator is 1600 lbs. of water evaporation per hour from 60° feed water to steam at 300 p. s. i.; that of the 4625 type—2750 lbs.; that of the 4530 type—3000 lbs. The 4516 and 4530 type are capable of delivering 20% above rated capacity; the 4625 type can deliver 10% above rated capacity.

STEAM OUTPUT AND TRAIN LINE PRESSURE CONTROL

The steam output of the generator is automatically controlled, in accordance with demand, by a water by-pass regulator which by-passes a varying amount of the water being delivered to the coils.

The steam generator pressure (boiler pressure) and train line pressure are also controlled by the automatic water by-pass regulating valve which may be set to any desired pressure between 50 and 250 p.s.i. The length of train and the weather conditions determine what the setting should be.

BURNER

The burner which burns Diesel Fuel oil, consists of a fuel spray head which is equipped with a spray nozzle of the air atomizing type. Air for atomizing, or breaking up the fuel into a fine spray, is supplied by the air brake compressor on the locomotive. This spray is ignited by the spark plugs as it issues from the nozzle. Should the air pressure be too low for proper atomization, a valve within the spray head, "DRK" type generator, will close to prevent the discharge of fuel oil into the combustion chamber. With the "OK" type generator, low air pressure will allow spring tension to open the air switch contacts, de-energizing the fuel solenoid valve and preventing the discharge of fuel oil into the combustion chamber. The amount of fuel delivered to the burner is regulated by the servo-fuel control in proportion to the quantity of water entering the steam generating coils. To control the air for combustion, the servo-fuel control is linked to a damper in the air intake stack.

MOTOR CONVERTER

The motor which drives the water pump, fuel pump and blower is a combination motor-converter which furnishes alternating current to a transformer for electric ignition.

MAIN SWITCH

The main switch for starting the equipment is located on a wall near the steam generating unit.

CONTROL SWITCH

The motor will not start unless the control switch, is in either the "Fill" or "Run" position.

On "DRK" type generators, with the switch in the "Fill" position, water will be pumped into the steam generator, the fuel cut-off valve is shut and the burner will not light. Turning the switch to "Run" opens the fuel cut-off valve and the burner starts at once.

On "OK" type generators, with the switch in the "Fill" position, water will be pumped into the steam generator, the fuel solenoid valve is de-energized and the burner will not light. Turning the switch to "Run" energizes the fuel solenoid valve and burner starts at once.

STEAM GENERATOR CONTROL PANEL

The control panel contains the relays and resistors required for starting and accelerating the motor. It also contains a re-settable overload switch to protect the motor.

STEAM SEPARATOR

The excess water removed from the steam in this vessel drains to the bottom of the separator and, as the level rises above the return water outlet pipe, this water is forced out through the return water outlet valve and through a steam trap.

PROTECTIVE DEVICES

To protect the steam generator against possible damage, a number of safety devices are provided. These

devices will either shut down the burner or the motor. They are as follows:

STACK SWITCH

This device is operated by a temperature-sensitive helix inserted into the side of the stack. Should the steam generating coils become scaled or sooted up externally, the heat transfer through the coils to the feed water will be reduced and the stack temperature will rise. If this temperature exceeds 900° F., the stack switch will open and shut down the motor. Shut down due to the operation of this device will be evident by the tripping out of its reset button. The alarm bell will ring.

Also located in the stack switch is a low temperature set of contacts. These are open when the stack is cool and will close as the stack temperature reaches approximately 250° F. The low temperature contacts do not cause the reset button to trip.

OUTFIRE RELAY

This is a time delay device. Since the stack switch low temperature contacts are open at temperatures below 250° F., it is necessary to provide a means of temporarily by-passing this device in order to start the motor when the stack is cold.

When the main switch is on and the control switch is in the "OFF" or "FILL" position, the outfire relay is closed. In the "RUN" position of the control switch, the outfire relay is de-energized, however the time delay feature requires 45 seconds before the relay opens. After this time, if the stack switch low temperature contacts have not closed, the motor will be stopped and the alarm bell will ring.

NOTE: It is necessary to return the control switch to "OFF" position to reset the outfire relay and obtain another 45 seconds time interval.

FUEL CONTROL (Also Low Water Cut-off)

This control meters the fuel to the burner in proper relation to the water entering the coils. It also adjusts

the air damper for good combustion throughout the entire range of output. Both functions are accomplished by adjustable cams.

If an insufficient amount of water is flowing to the steam generating coils, the servo-fuel control will open the low water cut-off switch to de-energize the air solenoid valve. Lack of atomizing air will cause the burner to shut down. The stack temperature will then begin to drop and as it falls below 250° F., the low temperature stack switch will stop the motor and ring the alarm. The stack switch reset button does not appear.

STEAM TEMPERATURE LIMIT CONTROL

This control consists of a rod and tube thermostat set within the combustion chamber which operates a fuel metering valve. The tube of the thermostat is also the steam outlet pipe from the coils. Excessive steam temperatures (above 410-425° F.), or absence of steam, causes the tube to expand and meter the fuel preventing damage to the coils from overheating. This control does not cause the motor to shut down and does not require manual re-setting.

OTHER SAFETY DEVICES

Other safeguards provided in addition to those mentioned before are as follows:

(1) Two safety valves mounted on the steam separator. These valves are usually set to relieve at 295 and 300 lbs. pressure

(2) Two fuses in the control circuit and two fuses in the ignition circuit, located on the control panel.

(3.) A water relief valve to protect against excessive water pressure should the coils become clogged with scale or the line become obstructed. It is set to open at between 500 and 600 lbs. pressure.

REMOTE CONTROLS

Some installations are provided with remote control equipment to allow for blowing down of the steam sep-

arator and for shutting off the steam to the train line from the locomotive cab. Such equipment includes a remote control cabinet located in the cab in front of the fireman's seat, an electro-pneumatic control cabinet and an electrically operated automatic train line shut-off valve, as well as the required air cylinder on the separator blowdown valve. On multiple steam generator installations, there is one electro-pneumatic cabinet and one automatic train line shut-off valve for each generator. One remote control panel, however, will control all of the steam generators.

ELECTRO-PNEUMATIC CONTROL CABINET

The electro-pneumatic control cabinet is located near the steam generator and contains an electrically operated air valve. This valve admits air to the air cylinder on the separator blowdown valve to open it when the separator blowdown button is pressed on the remote control panel.

TRAIN LINE SHUT-OFF VALVE

When the train line shut-off button on the remote control panel is pressed, the train line shut-off valve is electrically tripped to close. By going back to the steam generator and depressing a latching lever on the train line shut-off valve to open it, steam can be again admitted to the train line.

SECTION II

DIRECTIONS FOR OPERATING

BEFORE STARTING

1. Check to see that the following valves are open: Water Suction Stop Valve, Coil Shut-off Valve, Water Inlet Valve to Water By-Pass Regulator, Steam Generator Stop Valve. Return Water Outlet Valve at Steam Separator, Water Return Valve in line to tank, and Atomizing Air Admission Valve. Also, pet cocks in steam lines to Water By-Pass Regulator and to Steam Gauge.
2. The following valves should be closed: Washout Solution Admission Valve, Washout Solution Return Valve, Manual Water By-Pass Valve, Coil Blowdown Valve, Water Pump Test Valve, and all drain valves in the line between the water tank and the water pump. Type "OK" generators, only—layover connection shut-off valve and steam admission valve to radiation (open in cold weather.)
3. See that reset button on Control Panel is "in".
4. See that Stack Switch reset button is "in".

STARTING STEAM GENERATOR

1. Open Separator Blowdown Valve (foot operated) for about one minute to drain Steam Separator; then reclose valve.
2. Open Fill-Test Valve at Separator.
3. Close Main Switch.
4. Turn Control Switch to "Fill" position. (Motor will start and fill the steam generator with water.)
5. As soon as water discharges from the Fill-Test Valve, turn control switch to "off" position, close the "Fill-Test" valve, wait a few seconds until the motor stops, then turn the control switch to "Run". Burner should start at once.
6. Depress latching lever on Train Line Shut-Off Valve, to open the valve to admit steam to the train line, and open manual train line valve.

7. Set Water By-Pass Regulator to required steam train line pressure. Where two or more steam generators are used on a locomotive and their running is required by the weather conditions, the Water By-Pass Regulators on all steam generators should be set approximately the same.
8. Open the foot-operated Separator Blowdown Valve two or three times, for three to five second intervals, to drain Separator during the first few minutes of operation.

NOTES:

1. It may take 5 to 10 minutes time to fill the steam generator with water, if entirely empty. DO NOT START STEAM GENERATOR UNLESS THE COILS HAVE BEEN FILLED WITH WATER.
2. It may take several minutes time to build up required steam train line pressure.
3. Check the return water flow. On 4530 and 4625 generators the indicator should cycle 10 to 12 times per minute at high fire and 3 to 4 times per minute low fire with generator up to operating temperature. 4516 generators should cycle 6 to 8 times "high fire" and 2 to 3 times per minute "low fire".

Check to Be Made By the Operator

After Starting Steam Generator

1. Check the atomizing air pressure as indicated on gauge. This pressure should be:

   About 60-80 lbs. on the DRK-4530 types of Units

   About 30-35 lbs. on the DRK-4516 types of Units

   About 70 lbs. on the OK-4625 types of Units

Check Fuel Pressure

Manifold Pressure	Type of Unit
145-160 lbs.	DRK-4516
145-160 lbs.	DRK-4530
145-160 lbs.	OK-4625

If Motor or Fire Fails to Start

If fire fails to start within 10 seconds, look through peep sight glass at top of steam generator to see if there is sparking at the spark plug electrodes. Also, check the water pressure and the fuel pressure.

(a) If motor fails to start, check to see that the Main Switch is closed and motor overload reset button is in.

(b) If motor is operating and there is no sparking at the plugs, turn Control Switch at once to "Off" position and check for chafed or broken ignition cable or loose or broken cable connections.

(c) If motor is operating and spark plugs are functioning, check the water pressure. If no pressure shows on gauge, or the pressure is too low, check to see that Water Suction Stop Valve is open. The Coil Blowdown Valve or one of the drain valves may be open. There may be no air pressure to the Spray Head Nozzle, or the air pressure may be too low.

OPERATING STEAM GENERATORS

WITH REMOTE CONTROL

NOTE: After the steam generator(s) has (have) been started and the steam pressure on each generator, and train line pressure has been properly set, the following operations can be performed from the locomotive cab, when Remote Control equipment is installed:

1. Turn the Master Switch on the Remote Control Panel to "On" position.
2. Adjust the Rheostat on the right-hand side of the Remote Control Panel to give desired illumination for the steam train line pressure gauge.
3. About every half hour, depress the Separator Blowdown Push Button and hold it "in" for 3 to 5 seconds.

4. If the admission of steam to the train line is to be shut off for the purpose of cutting a car out of the train, lift the protecting cap over the Train line- Shut-off Button and press the button and close train line globe valve.
5. After the admission of steam to the train line has been shut off by remote control, it will be necessary to open each Train Line Shut-off Valve manually (at the steam generator) by depressing the latching lever, when ready to get steam back into train line. Globe valve must be opened slowly to full open position.

RUNNING ATTENTION WHEN NO REMOTE CONTROL EQUIPMENT IS INSTALLED

1. Open the Separator Blowdown Valve half hourly from 3 to 5 seconds to blow down Separator.
2. Check the various gauges to assure yourself generator is running satisfactorily.

TO SHUT DOWN STEAM GENERATOR WITH REMOTE CONTROL

1. Depress Train Line Shut-off Button on Remote Control Panel.
2. Turn Master Switch on Remote Control to "Off" position.
3. When train stops, go back to each steam generator and shut it down in the following manner:
   (a) Turn Control Switch to "Off" position.
   (b) Open Coil Blowdown Valve. Observe boiler pressure; when it falls to 50 lbs. close the valve.
   (c) Open Separator Blowdown Valve to blow down Steam Separator with remaining pressure; then, reclose valve.

Revised May, 1950

(d) Refill the steam generator with water by turning the Control Switch to "Fill" position and open the Fill-Test Valve on the Separator. When water begins to discharge from the valve, close it and turn Control Switch to "off" position.

(e) Open Main Switch. Close atomizing air valve.

NOTE: The steam generator is now filled and ready for use. When restarting, do not omit draining Separator, opening Fill-Test Valve and again filling the steam generator with water, as this may not have been done by someone when shutting down. When coils are already filled with water it will only take about one minute for this to be indicated by discharge of water from the Fill-Test Valve.

INSTRUCTIONS FOR DRAINING VAPOR DRK-4516, DRK-4530 AND OK-4625 TYPE STEAM GENERATORS FOR PROTECTION AGAINST FREEZING.

1—When possible, raise steam pressure on steam generators letting it cycle several times. Set train line pressure at 100 lbs. and open remote control and manual steam train line valves with steam end valves closed. Close steam train line valves after pressure in train line reaches 100 lbs. and open both end valves. Open coil blowdown valve until generator pressure reaches 75 lbs., close it and open separator blowdown valve.

2—It will be necessary to proceed with work outlined as follows whether the above can be done or not.

3—Open water supply line floor drain valves at "A" and "B" unit steam generators, (this valve will be applied to "OK" generators.) Also water return line floor drain valve at "B" unit steam generator small water tank. Open water supply line valve and open plug drain valve at large water tank in "B" unit.

4—Close water suction stop valve and open wide the drain valve in line from bottom of water treatment

tank. (This valve will be applied to "OK" generators).

5—Open water pump test valve wide.

6—Open wide water pump, test valve, the three bleeder test plugs and remove drain plug in bottom of water pump. Work water out of pump by turning it over by hand in clockwise direction.

7—Remove cover from water treatment tank, lift out treatment chamber and strainer screen and empty water from both.

8—Close stop valve on top of separator.

9—Coil admission valve to be wide open.

10—Separator blowdown valve to be closed.

11—Close water return line valve ahead of steam trap at separator.

12—Open coil blowdown valve wide.

13—Connect air hose to water fill test valve at separator and blow what water remains in steam generator coils (with exception of economizer coil, "OK" and some "DRK" generators, only) and piping out of oil blowdown valve. Then close water fill test.

14—Open water return line valve at separator.

15—With air hose connected to water fill test valve blow air through the strainer, trap, coils in heat exchanger and then out through drain line valve.

16—Break pipe connection at right of water by-pass regulator and connect air hose to blow through the fuel control, heat exchanger chamber (and economizer coil, "OK" and some "DRK" generators, only) and piping out of coil blowdown valve. Close coil blowdown valve.

17—Remove plug in strainer at separator and reapply.

18—Break connection at left side of water by-pass regulating valve and with pump test valve open, blow air through piping.

19—Open separator blowdown valve.

20—Break water return line from heat exchanger.

21—Break water inlet and outlet connectings to servo-fuel control body and blow out with air.

22—Remove drain plugs in bottom of heat exchanger and steam trap.

23—Break steam and water lines to all steam gauges, water pressure gauge and to water by-pass regulating valve and blow out with air. Soak up with a cloth what water remains on top of steam actuated diaphragm of water by-pass regulator.

24—Break connection on bottom of water by-pass regulating valve and blow with air.

25—Break water hose connection between "A" and "B" units and blow out with air.

26—Break steam connections between "A" and "B" units, let drain and reconnect.

27—Open drain valve in steam line to cab heaters.

28—After all the draining has been completed, all valves are to be left open except the following:

a—Steam generator water suction stop valve.
b—Steam generator stop valve in top of separator.
c—Manual steam train line shut-off valve.
d—Steam train line end valves.
e—Water supply line floor drain valves at "A" and "B" unit steam generators.
f—Water return line floor drain at "B" unit steam generator 200 gal. tank.

SECTION III

TROUBLE SHOOTING WITHIN THE SCOPE OF THE OPERATOR

ALARM AND WARNING SIGNAL LIGHT INDICATIONS

In event of steam generator shut down an alarm bell will ring, and the "Boiler 'Off'" Warning Signal Light

will flash "on", on the warning light panel of the unit involved.

To stop the alarm, turn the Control Swith to "OFF" on the steam generator involved. Then, investigate the cause of the difficulty, and remedy as indicated below.

NOTE: It is to be understood that strainers and other parts indicated as possibly clogged are to be removed, taken apart and cleaned.

Steam Generator Is Shut Down

Symptoms, Cause and Remedy

1. RESET BUTTON "OUT" ON STACK SWITCH: Shut down is due to excessive stack temperature brought about by the burning of excessive fuel because of improper adjustment of the Fuel Pressure Regulator or to other causes the remedy for which is not within the scope of the operator. To overcome difficulty, proceed as follows:

   (a) Open Separator Blowdown Valve to drain Separator, and reclose valve.

   (b) Reset stack Switch Button.

   (c) Turn Control Switch to "Fill" position, close Main Switch and refill the steam generator with water as indicated under "Starting Steam Generator" on page 5. This will cause the blower to cool down the stack.

   (d) Turn Control Switch to "Run" position, to restart the burner.

2. RESET BUTTON "OUT" ON STEAM GENERATOR CONTROL PANEL: Shut down is due to motor overload. Proceed as follows:

   (a) Turn control switch to "OFF" position. Check for cause of overload by turning pump by hand to see that it is not locked.

   (b) Press motor overload reset button to reset switch. Start steam generator in usual manner.

3. If both reset buttons are in, reset main switch, or breaker. Start steam generator in usual manner.

(a) **If motor and Burner Will not Restart:** (Circuit breaker may have tripped, if so lever will be in center position, move lever to full "off" position and then to the "on" position to reset. In those units using fuses instead of circuit breakers, main fuse(s) may be blown. Fuse† may be blown in circuits to motor. If not, check relay contacts.

(b) **If Motor Restarts but Burner Does Not and No Spark Shows Through Peep Sight Glass at Burner Spray Head:**

(1) Check fuses† on Control Panel in the Converter circuit to the Ignition Transformer.

(2) Check for loose or broken ignition cable connections.

(c) **If Motor Restarts but Burner Does Not and Spark Shows Through Peep Sight Glass:**

(1) Check atomizing air pressure; if less than * lbs., strainer may be clogged at Air Pressure Reducing Valve.

(2) If atomizing air pressure is satisfactory, air or fuel strainer at Burner Spray Head may be clogged and should be cleaned. The spray nozzle may be clogged; take out spray head, remove nozzle and clean it. Use a toothpick or a wooden splint to clean nozzle discharge orifices. Do NOT use a metal pick.

(3) If water pressure does not show on gauge, or if the pressure is low, the shut down is due to operation of the Servo-Fuel Control because of lack of water brought about by: lack of water in tanks, coil blowdown valve open, air leak in water suction line

* See Page 10 for pressure.

† A 15 ampere fuse is required in each of the four fuse locations.

(water treatment or strainer tank cover or suction line strainer tank cover loose, rubber breather hose loose in suction line, etc.), clogged strainer screen in water treatment tank or in line strainer tank.

(4) **Inoperative Water By-Pass Regulator:** Try closing the Water Inlet Valve to the Water By-Pass Regulator. If Burner starts at once: this is an indication that the Water By-Pass Regulator is inoperative. To set and manually regulate the steam train line pressure, open and operate the Manual Water By-Pass Valve.

(5) **If Burner does not Restart upon closing Water Inlet Valve to Water By-Pass Regulator:** If fuel pressure does not show on manifold pressure gauge while water pressure appears to be adquate: this is an indication that Purolator Oil Filter is clogged; turn handle on filter clockwise several times to free filter. If fuel pressure on nozzle pressure gauge is excessive while water pressure appears to be adequate: this is an indication of a clogged strainer or nozzle at Burner Fuel Spray Head. After determining cause of trouble and remedying it, **be sure to reopen Water Inlet Valve to Water By-Pass Regulator when restarting steam generator.**

Sharp Drop in Train Line Pressure

1. BURNER CYCLES "OFF" AND "ON"

This is an indication that burner is being shut down by the Steam Temperature Limit Control because of excessive steam temperature caused by insufficient water delivery and is also an indication that the Servo-Fuel Control may be out of adjustment. **Do not attempt to adjust the Fuel Control—this is a job for a qualified maintainer.**

NOTES:

1. Report any difficulty encountered during service upon arrival at destination, and indicate what corrective measures have been taken, if any.
2. Type DRK and OK steam generators have controls so arranged to shut down motor and pump when steam is not required and burner goes out.

May, 1950

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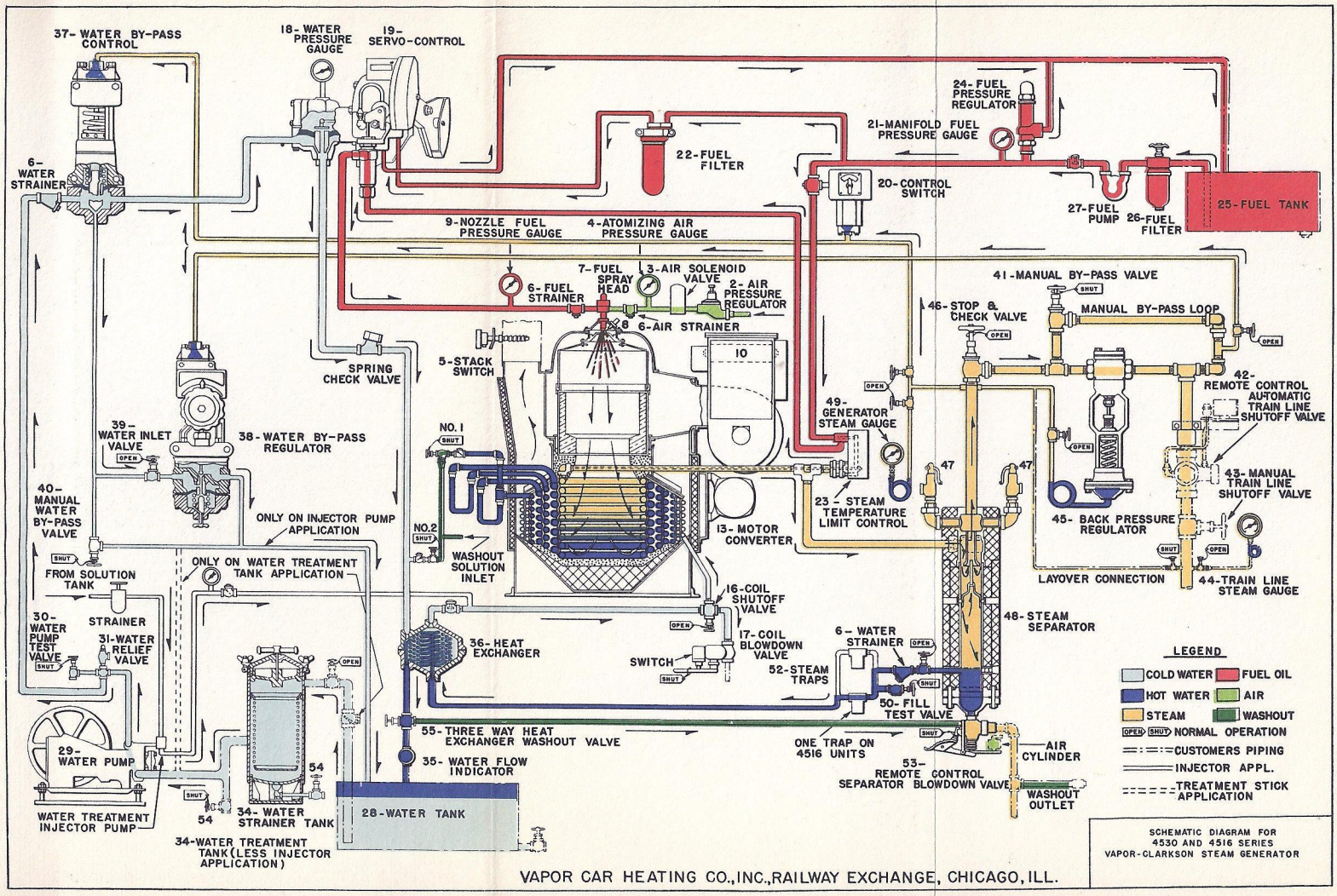
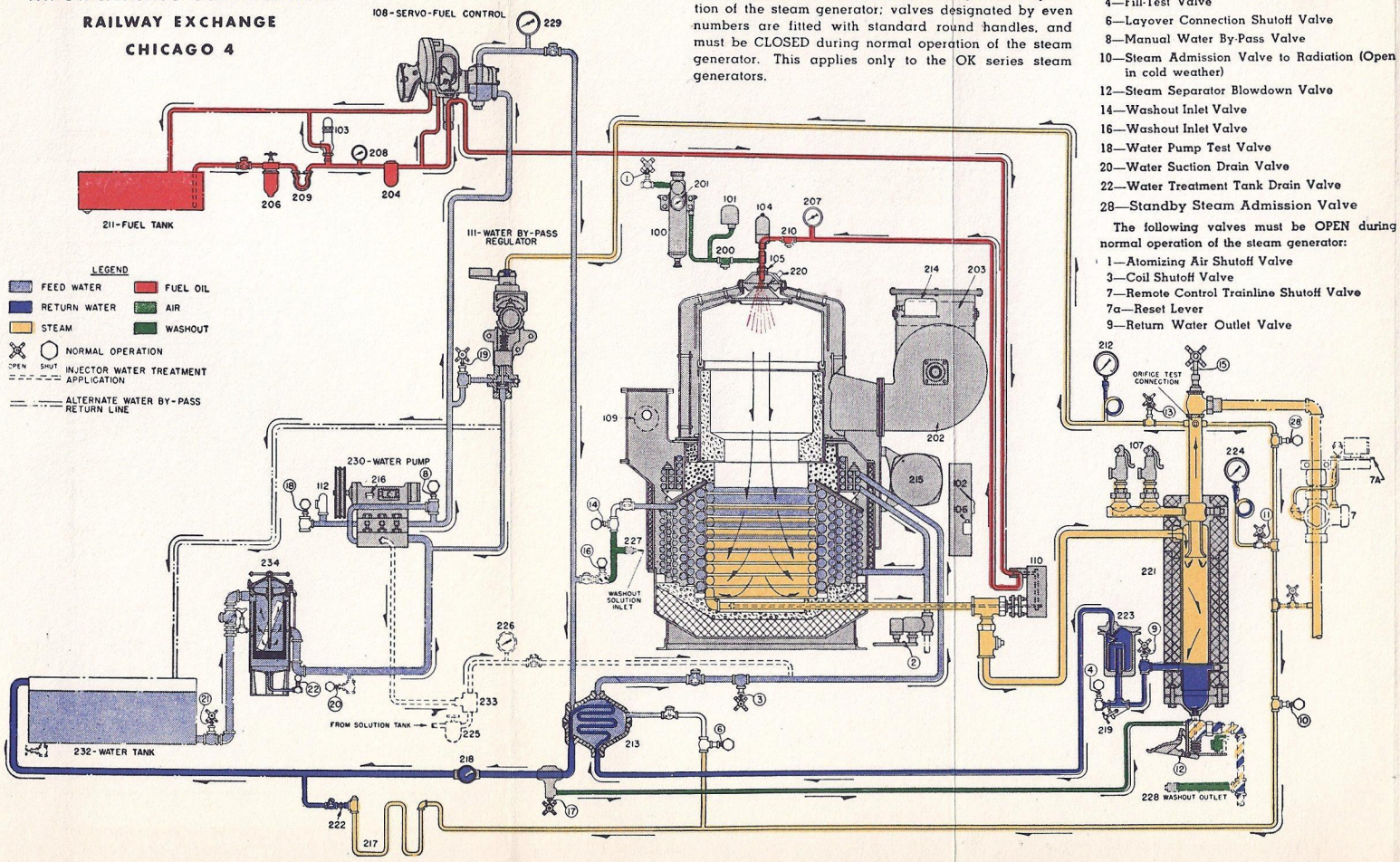

37- WATER BY-PASS CONTROL
18- WATER PRESSURE GAUGE
19- SERVO-CONTROL
6- WATER STRAINER
22- FUEL FILTER
24- FUEL PRESSURE REGULATOR
21- MANIFOLD FUEL PRESSURE GAUGE
20- CONTROL SWITCH
27- FUEL PUMP
26- FUEL FILTER
25- FUEL TANK
9- NOZZLE FUEL PRESSURE GAUGE
4- ATOMIZING AIR PRESSURE GAUGE
7- FUEL SPRAY HEAD
3- AIR SOLENOID VALVE
2- AIR PRESSURE REGULATOR
6- FUEL STRAINER
8
6- AIR STRAINER
41- MANUAL BY-PASS VALVE
SHUT
46- STOP & CHECK VALVE
MANUAL BY-PASS LOOP
OPEN
OPEN
5- STACK SWITCH
10
SPRING CHECK VALVE
42- REMOTE CONTROL AUTOMATIC TRAIN LINE SHUTOFF VALVE
49- GENERATOR STEAM GAUGE
39- WATER INLET VALVE
OPEN
38- WATER BY-PASS REGULATOR
NO. 1
SHUT
47
47
43- MANUAL TRAIN LINE SHUTOFF VALVE
40- MANUAL WATER BY-PASS VALVE
ONLY ON INJECTOR PUMP APPLICATION
23- STEAM TEMPERATURE LIMIT CONTROL
45- BACK PRESSURE REGULATOR
NO. 2
SHUT
13- MOTOR CONVERTER
SHUT
OPEN
WASHOUT SOLUTION INLET
ONLY ON WATER TREATMENT TANK APPLICATION
FROM SOLUTION TANK
LAYOVER CONNECTION
44- TRAIN LINE STEAM GAUGE
16- COIL SHUTOFF VALVE
30- WATER PUMP TEST VALVE
SHUT
STRAINER
31- WATER RELIEF VALVE
36- HEAT EXCHANGER
OPEN
17- COIL BLOWDOWN VALVE
48- STEAM SEPARATOR
6- WATER STRAINER
OPEN
SWITCH
SHUT
52- STEAM TRAPS
SHUT
50- FILL TEST VALVE
OPEN
55- THREE WAY HEAT EXCHANGER WASHOUT VALVE
ONE TRAP ON 4516 UNITS
SHUT
AIR CYLINDER
29- WATER PUMP
35- WATER FLOW INDICATOR
54
53- REMOTE CONTROL SEPARATOR BLOWDOWN VALVE
WASHOUT OUTLET
SHUT
54
34- WATER STRAINER TANK
28- WATER TANK
WATER TREATMENT INJECTOR PUMP
34- WATER TREATMENT TANK (LESS INJECTOR APPLICATION)
LEGEND
COLD WATER
FUEL OIL
HOT WATER
AIR
STEAM
WASHOUT
OPEN SHUT NORMAL OPERATION
CUSTOMERS PIPING
INJECTOR APPL.
TREATMENT STICK APPLICATION
SCHEMATIC DIAGRAM FOR 4530 AND 4516 SERIES VAPOR-CLARKSON STEAM GENERATOR
VAPOR CAR HEATING CO., INC., RAILWAY EXCHANGE, CHICAGO, ILL.

Schematic Piping Diagram, OK-4625 Series Vapor-Clarkson Steam Generator.

VAPOR HEATING CORPORATION
RAILWAY EXCHANGE
CHICAGO 4

VALVES Valves designated by odd numbers are fitted with cross type handles, and must be OPEN during normal operation of the steam generator; valves designated by even numbers are fitted with standard round handles, and must be CLOSED during normal operation of the steam generator. This applies only to the OK series steam generators.



The following valves must be CLOSED during normal operation of the steam generator:

2—Coil Blowdown Valve and Switch
4—Fill-Test Valve
6—Layover Connection Shutoff Valve
8—Manual Water By-Pass Valve
10—Steam Admission Valve to Radiation (Open in cold weather)
12—Steam Separator Blowdown Valve
14—Washout Inlet Valve
16—Washout Inlet Valve
18—Water Pump Test Valve
20—Water Suction Drain Valve
22—Water Treatment Tank Drain Valve
28—Standby Steam Admission Valve

The following valves must be OPEN during normal operation of the steam generator:

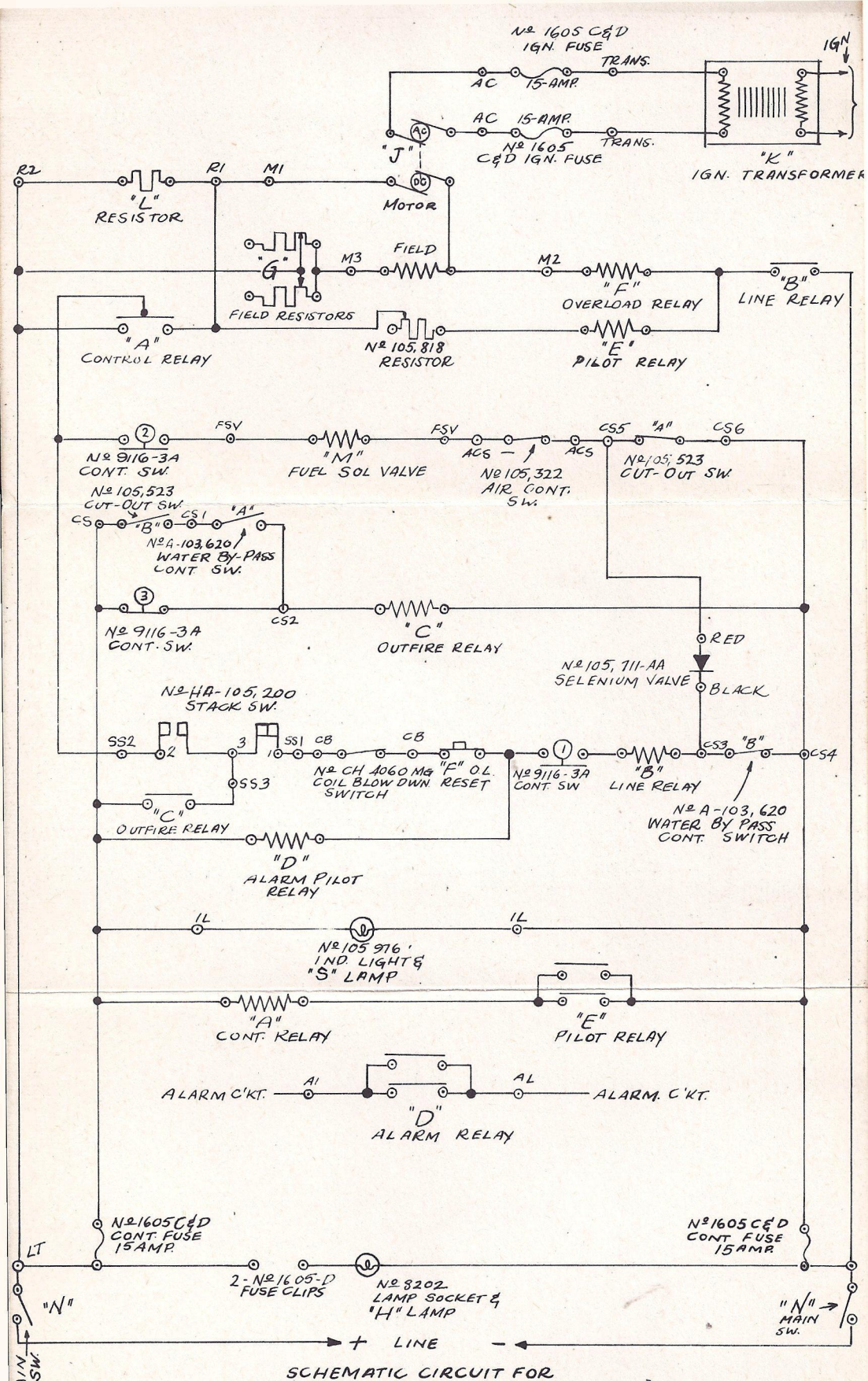
1—Atomizing Air Shutoff Valve
3—Coil Shutoff Valve
7—Remote Control Trainline Shutoff Valve
7a—Reset Lever
9—Return Water Outlet Valve
11—Steam Admission Valve to Trainline Pressure Gauge
13—Steam Admission Valve to Water By-Pass Regulator
15—Stop and Check Valve (Closed during start or shut down procedure)
17—Three-Way Washout Valve
19—Water By-Pass Regulator Shutoff Valve.
21—Water Supply Stop Valve

CONTROLS

100—Atomizing Air Pressure Regulator
101—Atomizing Air Switch
102—Control Switch
103—Fuel Pressure Regulator
104—Fuel Solenoid Valve
105—Fuel Spray Head
106—Overload Reset Button, Motor
107—Safety Valves
108—Servo-Fuel Control and Switch
109—Stack Switch
110—Steam Temperature Limit Control
111—Water By-Pass Regulator and Switch
112—Water Pressure Relief Valve

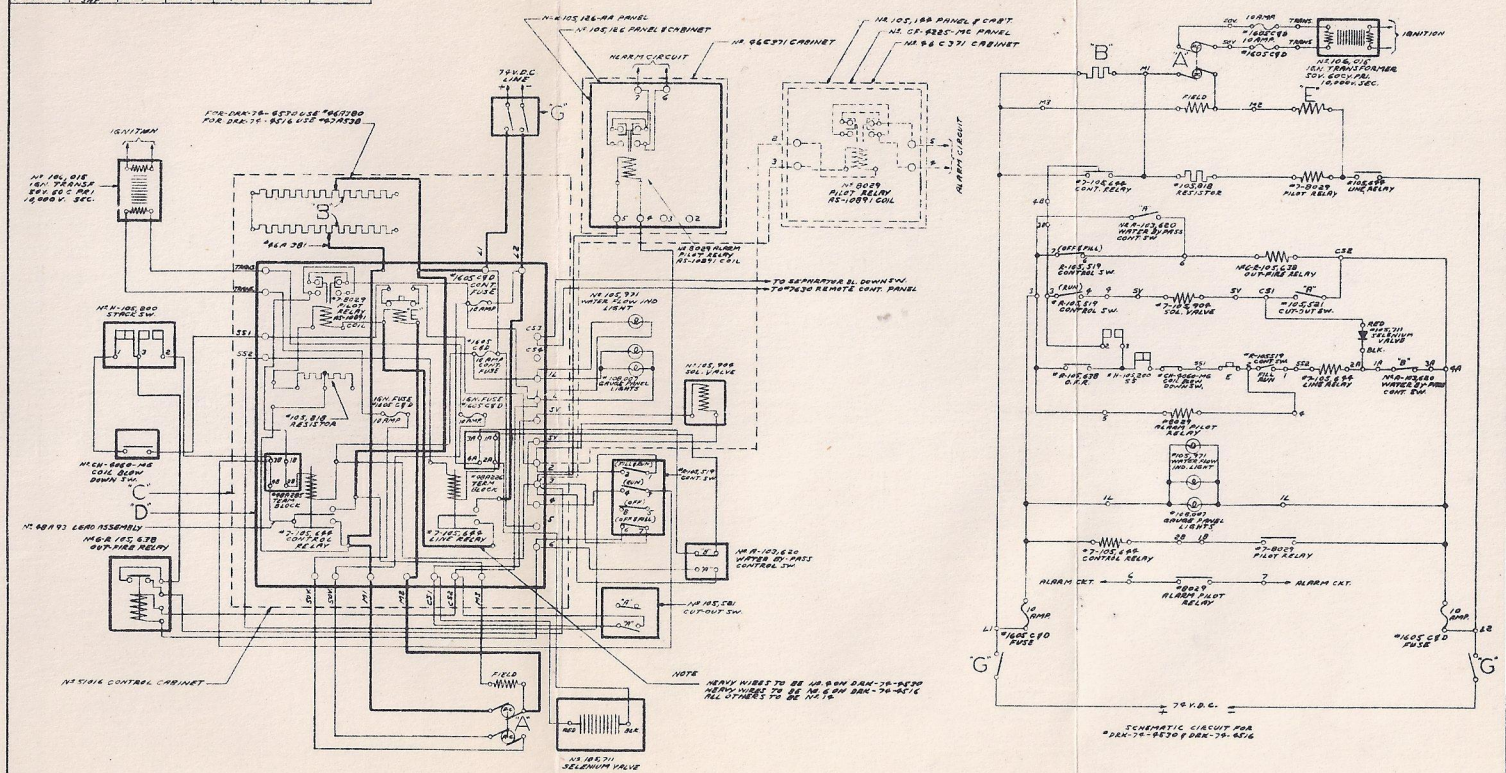
APPURTENANCES

200—Atomizing Air Strainer
201—Atomizing Air Pressure Gauge
202—Blower
203—Damper
204—Fuel Filter (Pressure line)
206—Fuel Filter (Suction line)
207—Fuel Nozzle Pressure Gauge
208—Fuel Pressure Gauge (At fuel pressure regulator)
209—Fuel Pump
210—Fuel Strainer
211—Fuel Tank
212—Generator Steam Pressure Gauge
213—Heat Exchanger
214—Ignition Transformer
215—Motor Converter
216—Oil Filter Cap
217—Radiation
218—Return Water Flow Indicator
219—Return Water Strainer
220—Spark Plugs
221—Steam Separator
222—Orifice Nipple (Radiation)
223—Steam Trap (Return water line)
224—Trainline Steam Pressure Gauge
225—Treatment Injector Filter
226—Treatment Injector Gauge
227—Washout Solution Inlet
228—Washout Solution Outlet
229—Water Pressure Gauge
230—Water Pump
232—Water Tank
233—Water Treatment Injector Pump
234—Water Treatment Tank (Strainer tank only if injector system is used)



SCHEMATIC CIRCUIT FOR
OK-4625-DN- TYPE
BOILER

BOILER	F	B	C	D	E	G
	MOTOR CONTROL & CABINET	RESISTOR	CUT-OUT SWITCH & CABINET	CONT. PANEL	WATER LEVEL CONTROL	MAIN SW.
DRK-76-8530	7-105-836 7-105-837	7-105-810	7-105-811	7-105-1128	7-105-1126	CB-9225-MA
DRK-79-8516	7-105-837	7-105-811	7-105-111	7-105-1128	7-105-681	CB-9120-MA


IGNITION
NO. 106,616 10A TRANSF. 220V. 60CY. PRI. 10,000V. SEC.
NO. N-106,880 STACK SW.
NO. EN-6860-MA COIL BLOW DOWN SW.
NO. 48A 93 LEAD ASSEMBLY
NO. G.R. 105,628 OVER-HEAD RELAY
NO. 5/016 CONTROL CABINET
FOR DRK-76-8530 USE #0671180
FOR DRK-79-8516 USE #0674530
#66A 381
#7-8029 PILOT RELAY RS-10891
#105,810 RESISTOR
#7-105,666 CONTROL RELAY
#7-105,666 LINE RELAY
#105,680 CONT. FUSE
#105,681 WATER LEVEL FUSE
#105,681 FUSE
#105,681 FUSE
#105,681