EMD EA Operator Manual
B&O

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SECTION VI

AIR SYSTEM

SANDING

See Bulletin 1206 for recommendations. Follow instructions given by your railroad. The sand capacity is 15 cubic feet for the "A" unit, none for the "B" unit. (Approximately 100 lbs. per cubic foot is the weight of the sand). The operation of the sanding equipment should be checked every 10,000 miles.

AIR COMPRESSOR GOVERNOR

See Bulletin 1022 for maintenance.

The air compressor governor is set at the factory to maintain a main air reservoir pressure of 130-140#. This governor is sealed and the seal should not be broken by an unauthorized person as this will cancel any warranty on the air compressor. If it is suspected that the governor is stuck, and blowing it out by means of the pet cock at the bottom does not help, the condition should be reported.

Likewise the suction valves in the air compressor may be stuck which would require the help of the maintainer.

AIR COMPRESSOR - TYPE ADX

See Bulletin 1014 for maintenance.

The two stage, 2 cylinder air compressor is driven directly by the engine through a flexible coupling.

AIR COMPRESSOR FLEXIBLE COUPLING

See Bulletin 1010 for maintenance.

WINDSHIELD WIPERS

The speed of the wiper is controlled by the needle valve which turns it off and on. A new wiper blade should be installed when the rubber becomes worn or hard. Do not run the wiper on a dry window as dirt on the glass or blade will tend to scratch the glass.

Prestone is recommended as being best as a de-icing agent used in WINDSHIELD Wiper - Blades with fluid line. It flows readily and does not gum.

A mixture of one volume of Prestone to 4 volumes of water may be used as trial. However, if ice continues to form, use a more concentrated solution.

The application of de-icing agent is intended to be made through a squirt can and the tube within the cab.

HORNS

If the horns are disassembled, note that the diaphragms are bowed and that this convex surface is installed toward the nozzle. Clean the horns before they become inoperative. There are three diaphragms in each horn. The strainer in the horn air line should be cleaned annually.

CONTROL AIR PRESSURE

The electric air pressure gauge is mounted on top of the high voltage cabinet. The air is delivered from the main reservoir to the voltage cabinet through a reducing valve filter and small expansion tank. The air filter should be cleaned annually.

If the electric air pressure gauge shows main reservoir pressure, the reducing valve is probably stuck. Blowing out the filter and expansion tank and at the same time jarring the reducing valve, may correct this condition. If not, the maintainer should be called. The reducing valve is located to the rear of the engine room near the expansion tank. Control air pressure should be maintained at 80 plus or minus 3#.

BELL AND RINGER

The bell, located in the space adjacent to the shutters, (one bell per unit) is operated remotely by an air type bell ringer. The bell can be reached for servicing either by removing the roof hatch over the bell or by reaching through the hatch below the bell.

AIR BRAKE EQUIPMENT

Refer to the instruction pamphlet supplied by the Westinghouse Air Brake Company for instructions on the operation of air brake equipment. This pamphlet includes piping diagrams and sectional drawings. The clasp brake should be adjusted as indicated on Plate 2318, in Section VII.

Refer to the train control manufacturer's instruction bulletin covering this particular locomotive for

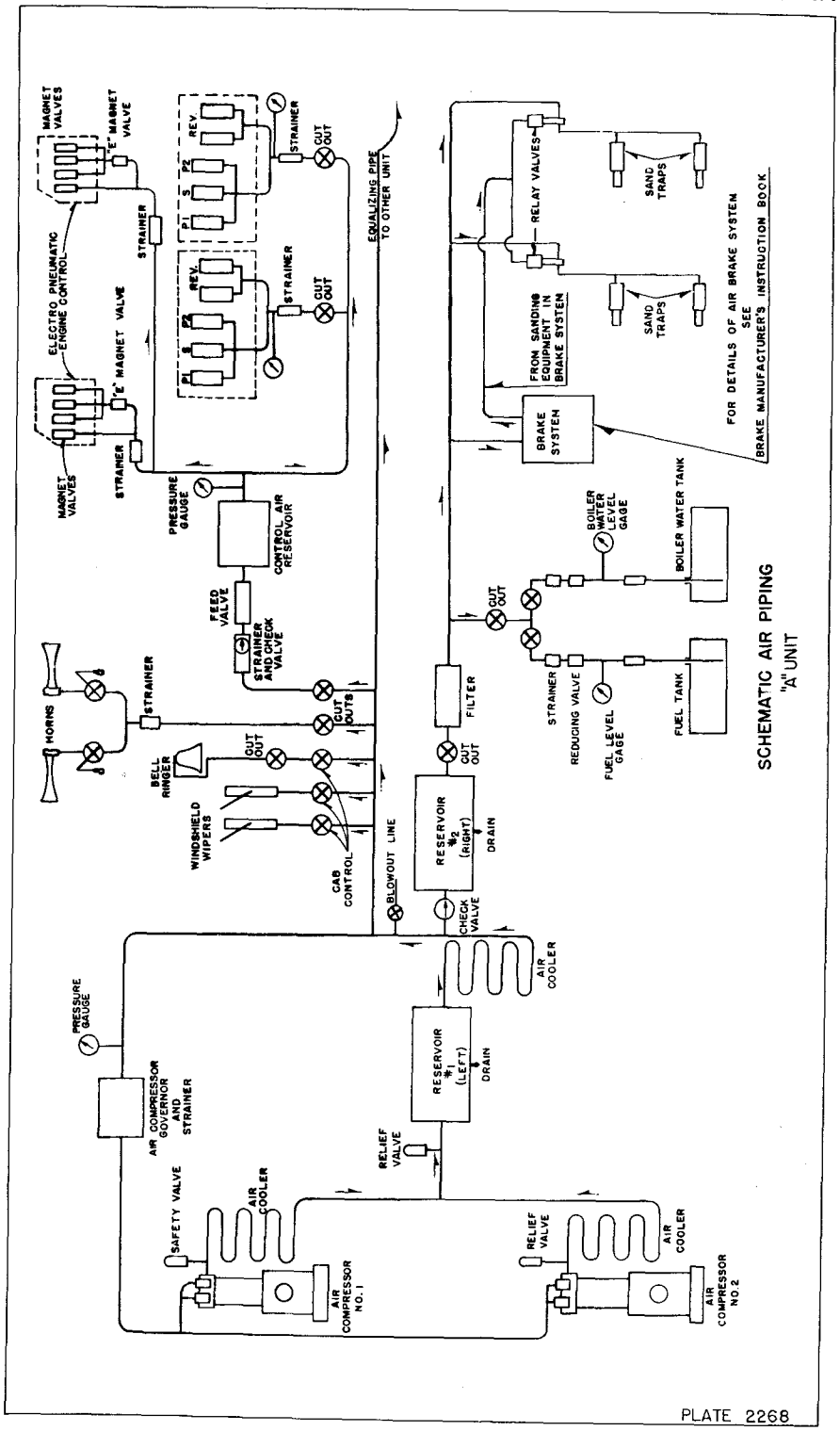


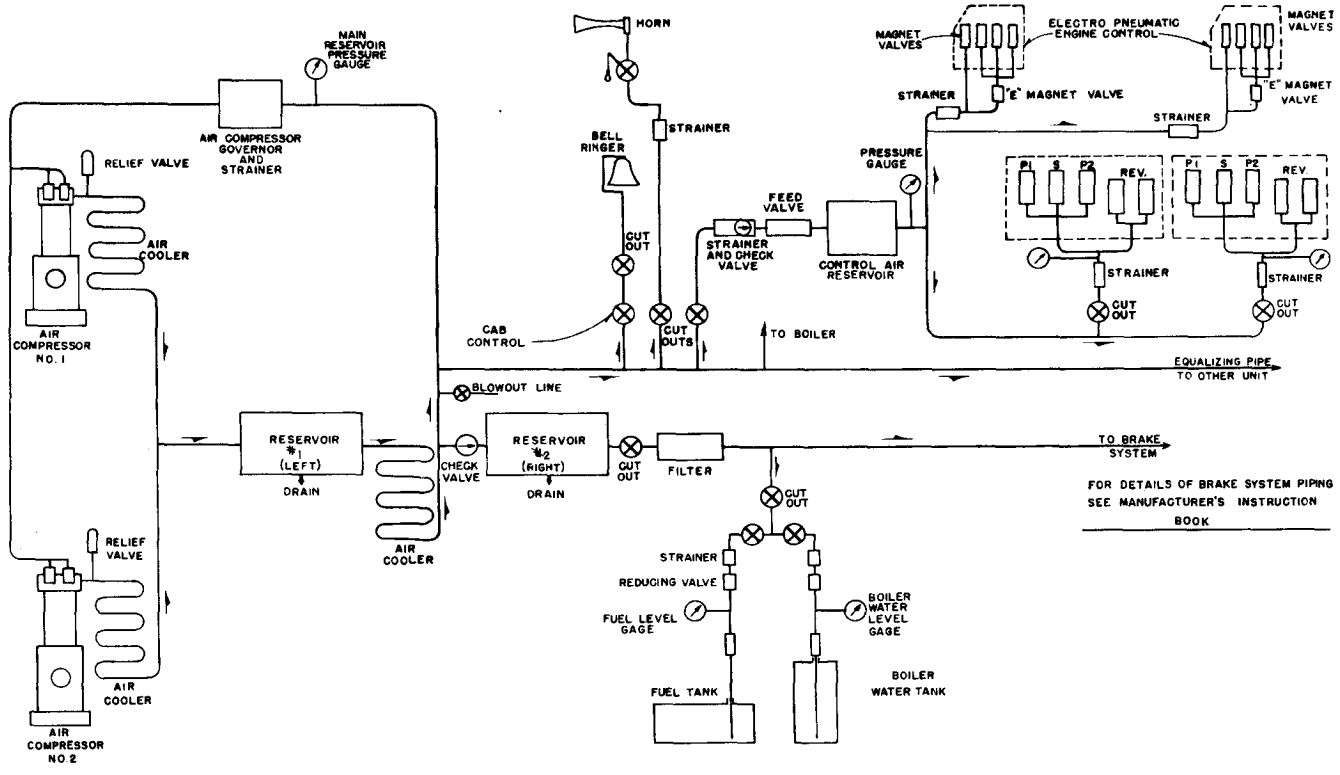
PLATE 2268

Automatic Train Control Instructions.

Every 10,000 miles check the condition of all air hoses and seals.

AIR FILTERS

Air filters and centrifugal dirt collections should be drained every 10,000 miles.



SCHEMATIC AIR PIPING
"B" UNIT

PLATE 2328

SECTION VII

BODY, CAB, TRUCK, AND MISCELLANEOUS EQUIPMENT

HAND BRAKE

The hand wheel is located to the left rear of each unit. To set the brake, hold down the foot pedal and turn the wheel. To release the brake, advance the wheel enough to release the foot pedal and then let go and stay clear of the wheel. Before moving the locomotive, be sure the brake is completely released. Whenever anyone is working around the locomotive trucks, have the hand brake on.

MOUNTING WHEELS AND GEARS ON AXLES

Wheel to axle.....80 - 100 tons
Gear to axle.....55 - 85 tons

Wheels and gears should be inspected every 10,000 miles for thermal checks, thermal cracks and wear.

MOUNTING PINIONS ON TRACTION MOTORS

See the traction motor instruction bulletin 1119 for recommended procedure.

PULLING PINIONS

See Bulletin 1118 for recommended procedure.

DOOR SAFETY GATES

At each side door and end door is a bar which should be lowered and latched in place whenever the door is opened when the locomotive is in motion.

ENGINE SAFETY GRILLS

Along each side of each engine is a grillwork which serves two purposes. When raised and latched in place it offers protection from the hand hole covers blowing off if a crankcase explosion occurred. When lowered the grills raise the level of a workman to facilitate working on the cylinder heads.

BELT SAFETY GUARDS

"V" belt guards should be in place whenever a power plant is rotating. See that the guards do not rub on the belts or vibrate loose.

TRUCKS

The 6 wheel trucks should be inspected every 100,000 miles for wear as indicated on Plate 2317. Trucks are interchangeable. The end of the truck frame which has the drop in it is always toward the outside end of the unit. Axles and journal boxes are not all interchangeable due to speedometer and speed governor drives. The journal box covers must be exchanged if the trucks are moved from front to rear, or vice versa. Make a visual inspection of the trucks every 10,000 miles. See Bulletin 1702.5 for truck tools.

TRACTION MOTOR BLOWERS

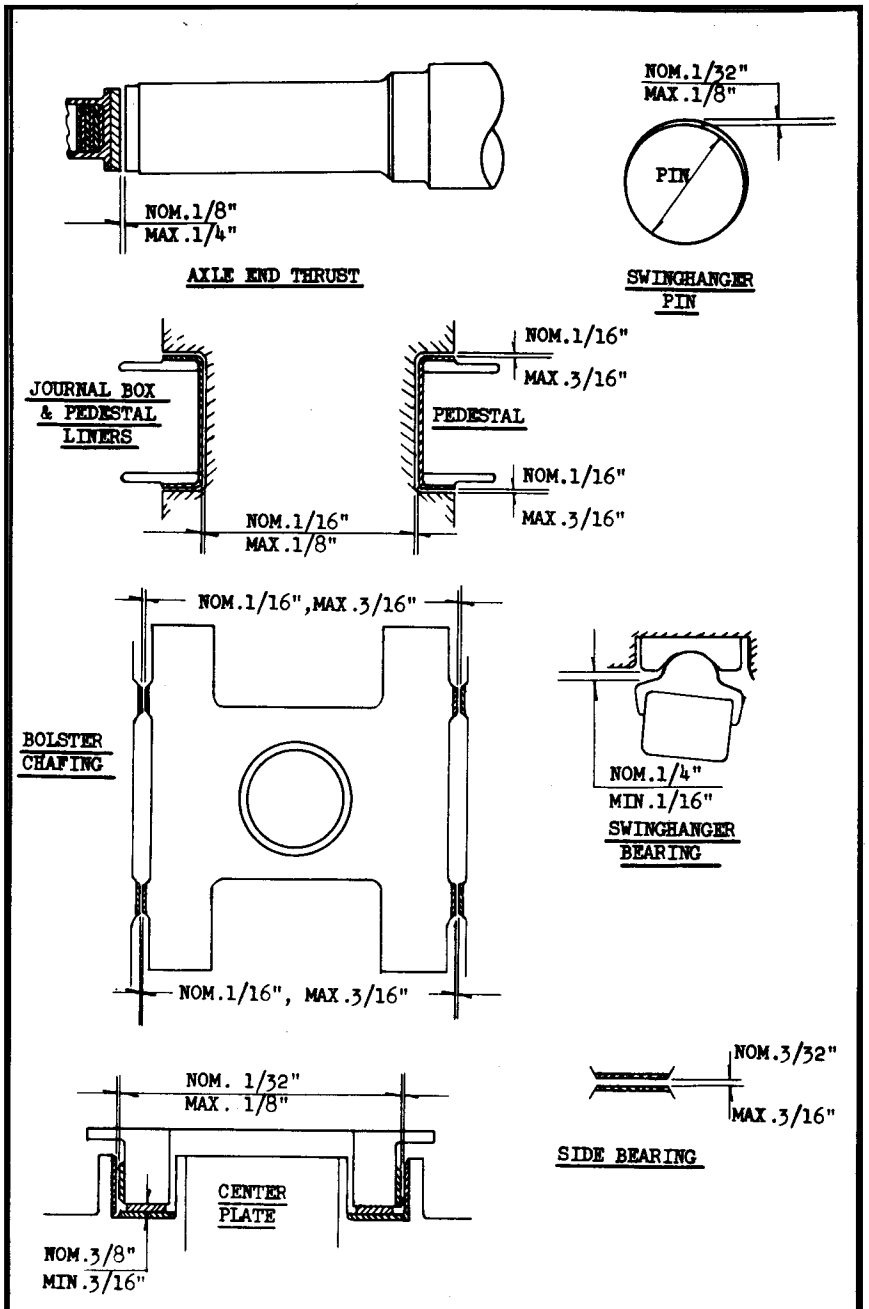
Since the traction motors depend on the traction motor blowers for ventilation, it is imperative that the traction motor blower drive belts be kept in good condition and under the proper tension.

Two traction motors depend on each blower and the cost of maintaining the belts is such a small item in comparison to the cost of repairing motors after they have been overheated and thrown solder, not to mention the damage to the winding, that particular attention should be paid to see that the belts are not slipping.

The blowers turn at 2583 R.P.M. when the engine is at 800 R.P.M.

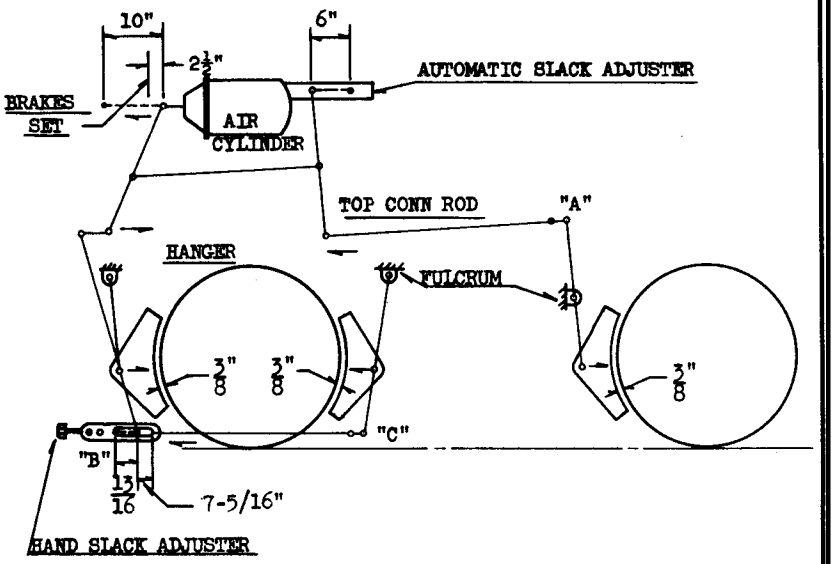
"V" BELTS

All "V" belts should be inspected every 10,000 miles for wear and adjusted to the proper tension if necessary. The belts must not ride on the bottom of the groove or be loose enough to slip or whip. See Bulletin 904 for repair information on belts.



WEAR LIMITS - SIX WHEEL TRUCK WITH EMC-HYATT JOURNAL BOXES

PLATE 2317



Above diagram shows conditions for New Wheels and Shoes.

AT ROUND HOUSE

As wear occurs, shift Pin at "A" from OUTSIDE to INSIDE hole and at "B" from OUTSIDE to INSIDE hole.

ON ROAD

As wear occurs, this should still leave full slack-adjuster travel for the automatic take up and most of the hand slackadjuster take up.

It is important that allowance be made for take up on road at these two points.

When wheels are turned, adjust at point "C" from OUTSIDE to INSIDE hole, and others to suit as above.

NOTE:- Point "C" can not readly be adjusted on road or at roundhouse.

At hand slackadjuster "B" 13/16" is required for applying new shoes.

BRAKE ADJUSTMENT - 6 WHEEL TRUCK

PLATE 2318

SECTION VIII

LUBRICATION POINTS

DIESEL ENGINE

LUBRICANT:	Engine Oil.
QUANTITY & FREQUENCY:	Add oil as required to keep proper level in tank. Change oil every 25,000 miles of service.
CAPACITY:	Completely dry system.....110 gallons. Required to change oil....100 gallons.
INSTR. BUL.:	150.

ENGINE AIR FILTER

LUBRICANT:	Engine Oil.
QUANTITY & FREQUENCY:	Wash element in a petroleum solvent and blow dry with compressed air. Dip in clean engine oil and drain for 12 hours in a warm room. Repeat whenever dirt is noticeable. Once a week should be enough.
INSTR. BUL.:	150.

ENGINE GOVERNOR

LUBRICANT:	Engine Oil.
QUANTITY & FREQUENCY:	Add oil as required to keep level to mark on sight glass. Change oil every six months.
CAPACITY:	3 Pints.
INSTR. BUL.:	150.

ENGINE WATER PUMP

LUBRICANT:	Engine Oil.
QUANTITY & FREQUENCY:	Fill the oil cup once each month.
INSTR. BUL.:	150.

GOVERNOR CONTROL

LUBRICANT:	Engine Oil.
QUANTITY & FREQUENCY:	Keep waste saturated in oil reservoir.
INSTR. BUL.:	150.

AIR COMPRESSOR

LUBRICANT:	Engine Oil.
QUANTITY & FREQUENCY:	Add oil as required to keep proper level in crankcase. Change oil every 2,000 hours of operation.
CAPACITY:	14 Quarts.
INSTR. BUL.:	1014.

COOLING FANS

LUBRICANT:	Engine Oil.
QUANTITY & FREQUENCY:	Remove top (breather) and side (level) plugs. Fill through top plug until oil runs out of side plug. This should be done monthly.
CAPACITY:	1-1/2 Pints (approx.)

AIR COMPRESSOR FILTERS

LUBRICANT:	Engine Oil.
QUANTITY & FREQUENCY:	Wash in a petroleum solvent and dip in new oil as inspection indicates.
INSTR. BUL.:	1014.

GOVERNOR LINKAGE

LUBRICANT:	Ball Bearing Grease.
QUANTITY & FREQUENCY:	Lubricate sparingly each week.

MAIN GENERATOR

LUBRICANT:	Lubrico M-6 and Texaco Marfax No. 3.

(Cont'd.)

QUANTITY & FREQUENCY:	Add not more than one ounce of grease per month or 2 oz. every 15,000 miles. Do not over-lubricate. Texaco Marfax No. 3 for grooves in bearing cap.
CAPACITY:	34 ounces (approximately).
INSTR. BUL.:	422.

TRACTION MOTOR ARMATURE BEARINGS

LUBRICANT:	Lubrico M-6.
QUANTITY & FREQUENCY:	Add not over 2 ounces of grease per bearing every 25,000 miles. Base amount by experience. Do not over-lubricate.
CAPACITY:	Pinion end 20 ounces. Commutator end 15 ounces.
INSTR. BUL.:	1119.

TRACTION MOTOR AXLE BEARINGS

LUBRICANT:	Electric Car Oil - Heavy for summer - Light for winter.
QUANTITY & FREQUENCY:	Add every 2,500 miles to keep level between 2" - 5".
CAPACITY:	5 Quarts.
INSTR. BUL.:	1119.

TRACTION MOTOR GEARS

LUBRICANT:	Texaco Crater Compound #2 for winter, #5 for summer or National Refining Winter or Summer grade.
QUANTITY & FREQUENCY:	Keep bottom teeth of driver gear covered to a depth of 3". Determine by inspection.
CAPACITY:	14 lbs.
INSTR. BUL.:	1119.

TRACTION MOTOR BLOWER

LUBRICANT:	Ball Bearing Grease.
QUANTITY & FREQUENCY:	Add small quantity monthly.

JOURNAL BOXES

LUBRICANT:	Journal box oil.
QUANTITY & FREQUENCY:	Fill to filler hole level every week.
INSTR. BUL.:	1209.

AUXILIARY GENERATOR

LUBRICANT:	Ball Bearing Grease.
QUANTITY & FREQUENCY:	Once a year disassemble and repack 1/2 full.
CAPACITY:	3-1/2 oz. each bearing.
INSTR. BUL.:	421.

TRUCK CENTER BEARINGS

LUBRICANT:	A.R.A. Specifications M-906.
QUANTITY & FREQUENCY:	Weekly add enough oil to soak up waste.

COUPLERS

LUBRICANT:	Light Oil.
QUANTITY & FREQUENCY:	Oil to keep parts working and prevent rust.

SHOCK ABSORBER

LUBRICANT:	Delco Shock Absorber Fluid.
QUANTITY & FREQUENCY:	Keep filled to overflow plug.

SHOCK ABSORBER LINKAGE

LUBRICANT:	Graphite Grease.
QUANTITY & FREQUENCY:	Lubricate monthly.

CONTROL STATION BEARINGS

LUBRICANT:	Light Oil.
QUANTITY & FREQUENCY:	Apply a few drops monthly to oil cups and bearings. Keep clean.

CONTROL STATION CONTACT FINGERS
REVERSER CONTACT FINGERS

LUBRICANT:	Petroleum Jelly.
QUANTITY & FREQUENCY:	Apply a small amount during break-in period.

AIR SHUTTERS & LINKAGE

LUBRICANT:	Light Oil.
QUANTITY & FREQUENCY:	Lubricate sparingly each month. Keep clean.

FUEL PUMP MOTOR

LUBRICANT:	Ball Bearing Grease.
QUANTITY & FREQUENCY:	Once a year disassemble and repack 1/2 full.
INSTR. BUL.:	806.

BOILER ROTARY CONVERTER

LUBRICANT:	Ball Bearing Grease.
QUANTITY & FREQUENCY:	Grease slightly each month.

BOILER PUMP MOTOR

LUBRICANT:	Ball Bearing Grease.
QUANTITY & FREQUENCY:	Turn grease cup one turn monthly.

BOILER BLOWER BEARING

LUBRICANT:	Ball Bearing Grease.
QUANTITY & FREQUENCY:	Turn grease cup one turn monthly.

HEADLIGHT DYNAMOTOR

LUBRICANT:	Ball Bearing Grease.
QUANTITY & FREQUENCY:	Once a year disassemble and repack 1/2 full.
INSTR. BUL.:	423.

BOILER MAGNETO CAM & BEARINGS

LUBRICANT:	U. S. 505 Bosch.
QUANTITY & FREQUENCY:	Lubricate only when repairing or annually.

BOILER WATER PUMP

LUBRICANT:	Marine Oil.
QUANTITY & FREQUENCY:	Keep filled to height of petcock. Change oil monthly.
CAPACITY:	2 Quarts.

BOILER PRESSURE SWITCH

LUBRICANT:	Light Oil.
QUANTITY & FREQUENCY:	Oil moving parts every 3 months.

HAND BRAKE WHEEL

LUBRICANT:	Light Oil.
QUANTITY & FREQUENCY:	Put a few drops on moving parts and through oil hole in top cover. Keep clean.

BRAKE CYLINDERS

LUBRICANT:	Brake cylinder lubricant.
QUANTITY & FREQUENCY:	Add a small amount of lubricant through filler plug every six months.

WINDSHIELD WIPERS

LUBRICANT:	Air Engine Oil.
QUANTITY & FREQUENCY:	Every 90 days lubricate the parts in the air chamber.

WINDSHIELD DEFROSTER

LUBRICANT:	Light Oil.
QUANTITY & FREQUENCY:	Oil wick in motor every 50-100 hours of operation.

SPEEDOMETER GENERATOR

LUBRICANT:	Ball Bearing Grease.
QUANTITY & FREQUENCY:	Annually insert small quantity in grease plug opening.

SLACK ADJUSTERS

LUBRICANT:	Lubrico M-6 and Engine Oil.
QUANTITY & FREQUENCY:	Keep mechanism well lubricated and working freely. Apply grease to grease fitting and oil through oil hole.

COMPRESSOR DRIVE COUPLING

LUBRICANT:	Velox Grease No. 2.
QUANTITY & FREQUENCY:	Add grease monthly. Keep coupling filled. Repack coupling annually.
INSTR. BUL.:	1010.

FAN IDLER

LUBRICANT:	Ball Bearing Grease.
QUANTITY & FREQUENCY:	Add small quantity monthly. Do not over-lubricate.

FAN JACK SHAFT

LUBRICANT:	Engine Oil.
QUANTITY & FREQUENCY:	Keep level to side plug.

REVERSER

LUBRICANT:	Ball Bearing Grease, Air Engine Grease, S.A.E. 30 Oil and Petroleum Jelly.
QUANTITY & FREQUENCY:	Add Ball Bearing Grease sparingly annually at two grease points. Add S.A.E. 30 oil sparingly every 3 months at oil reservoir. Apply air engine grease on cylinder walls when overhauling. Wipe petroleum jelly on main contacts to prevent cutting.
INSTR. BUL.:	1316.

POWER SWITCHES

LUBRICANT: Air engine grease, and light oil.

QUANTITY & FREQUENCY: Apply grease on cylinder walls annually, add few drops of oil when push rod comes out of cylinder.

INSTR. BUL.: 573.

VOLTAGE REGULATOR

LUBRICANT: Light Oil.

QUANTITY & FREQUENCY: Do not lubricate the commutator or the sector. Each of the two sector bearings requires one drop of oil approximately once in two months. The torque motor ball bearings should be oiled, once in six months.

Check the dashpot periodically to be sure it is free of dirt which might cause friction.

INSTR. BUL.: 570.

MISCELLANEOUS HARDWARE

LUBRICANT: Light Oil.

QUANTITY & FREQUENCY: Keep cab seat, door latches, windows, etc., oiled but clean.

BATTERY TERMINALS

LUBRICANT: Petroleum Jelly.

QUANTITY & FREQUENCY: Keep terminals from corroding by covering them with Petroleum Jelly.

DIAPHRAGM CENTERING DEVICE

LUBRICANT: Pressure Gun Grease.

QUANTITY & FREQUENCY: Lubricate daily the two pin type grease fittings. One fitting is in end of bolt on diaphragm end of spring plunger. Second fitting is back of spring seat.

BOILER FUEL CONTROL SWITCH

LUBRICANT: Dashpot Oil.

QUANTITY & FREQUENCY: Clean out dashpot and change oil monthly.

LOWER CENTER STEM

LUBRICANT: Pressure Gun Grease.

QUANTITY & FREQUENCY: Lubricate daily. Do not allow dust to accumulate. Two pin type grease fittings; one in side of outer tube, second in outside end.

TEMPERATURE AND PRESSURE SWITCHES

The mechanism in these switches should be kept clean and free from dirt, dust, and any other accumulation. If any lubricant is used, it should be light oil (S.A.E. 10). However, it is of the utmost importance that these switches be kept absolutely clean at all times.

BELL RINGER

LUBRICANT: Thin Oil.

QUANTITY & FREQUENCY: Put a few drops of oil in oil holes monthly.

SPEED RECORDER

LUBRICANT: Fill oil cups (2) monthly with SAE 10 oil.

QUANTITY & FREQUENCY: Fill sight glass oil cup to 1/8" below top with circulation oil. Check weekly. Use wrench #779435 to remove cap.

Fill conduit oil cup with "Car Oil". Use warm oil for filling empty cable. Keep filled. Grease button head fittings on drive unit weekly.

SUMMARY OF LUBRICANTS USED

The following list gives the part numbers of lubricants called for on the preceding pages.

E. M. C. NUMBER	LUBRICANT
8047696	Lubrico M-6 Pressure Gun Grease
	BALL BEARING GREASE (Any of the following five greases can be used here)
8035762	Socony BRB-2 Ball Bearing Grease
8035763	Superla #2-X Ball Bearing Grease
8035764	Starfax #2
8035765	Keystone #45
8035766	Na-Re-Co "B"
8067551	Dashpot Oil
8047695	Air Engine Oil or Neatsfoot Oil
8027472	Petroleum Jelly
8047698	Texaco Marfax #3
8047699	Texaco Crater Compound #2 (Winter)
8041410	Texaco Crater Compound #5 (Summer)
8067348	National Refining "Na-Re-Co El. Ry. Gear" Grease (Winter)
8067349	National Refining "Na-Re-Co El. Ry. Gear" Grease (Summer)
8042777	Velox Grease #2
8047794	Graphite Grease
8044505	U. S. 505 Bosch Grease
8047792	Delco-Shock Absorber Fluid
8039278	Electric Car Oil
8035357	Marine Oil
8035772	Journal Box Oil-Socony AYCA-Y, or
8047717	Journal Box Oil-Texaco-1559

COMMERCIAL MARKET

Engine Oil (For Specification see Bulletins 150, 115A or 118A)
SAE 10 Oil
SAE 20 Oil
Light Oil
Brake Cylinder Oil

SECTION IX

QUESTIONS AND ANSWERS

COOLING SYSTEM

Q. How is the engine cooling system filled?

A. The engine cooling system is filled through the filler pipe in the car roof, or through one of two filler pipes, or along the side.

Q. How much water should be carried in the engine cooling system?

A. Fill until overflow from stand pipe appears when operating in warm weather. Approximately 190 gallons will be required per engine at "high level". In freezing weather, open the "low level" valves and fill the cooling system until water runs out. Approximately 160 gallons will be required for the "low level".

Q. How can it be determined if water is circulating properly?

A. The engine water thermometers and temperature gauges provide an excellent means of showing a faulty water circulation or lack of water. Behavior of the water column in the water tank glass with engine running also provides indication of poor water circulation. For a given engine speed this water should show no spasmodic changes in the glass. Poor water circulation is also indicated by excessive localized heating at various points in the cooling system. This may be determined by holding hand at various points in question and making comparison in degree of heat at various places.

Q. What is the proper operating temperature for the cooling water?

A. 165° F.

Q. What precautions should be taken during layover periods in freezing weather?

A. During layover periods in freezing weather, particular precaution should be taken that the engine cooling water is heated or drained.

Q. If the engine should overheat on account of insufficient water in the cooling system, what should be done?

A. The engine should be allowed to idle and hot water, if possible, should be added. If it is necessary to add cold water, it should be added very slowly.

LUBRICATING OIL SYSTEM

How much oil should be carried in the engine lubricating system? How low can the level go in emergencies?

A. The tank should be full to at least the "½" full mark on the bayonet gauge when the engine is running. In emergencies the level can go to the low mark on the bayonet gauge.

Q. What special method is used to assist piston cooling? How is the wrist pin lubricated?

A. Cooling oil for the piston is delivered by a nozzle at the bottom of the liner. In addition to cooling the ribbed bottom surface of the piston head the oil drains down and lubricates the wrist pin roller bearing and the wrist pin bushings in the piston.

Q. What trouble should be looked for if oil pressure does not build up to proper pressure after engine is started?

A. Check to determine if oil supply is low. Examine pressure regulating by-pass valve, pressure gauge, and oil pump.

FUEL OIL SYSTEM

Q. When and how should fuel oil strainers, on the engine, be cleaned?

A. They should be cleaned about every three months, by washing them in a petroleum solvent, forcing clean, dry compressed air through the screens, and wiping with lint-free rags.

Q. Describe how the fuel is delivered from the tanks under the car to the unit injectors on the engine.

A. Fuel is taken from the main tank under the floor through a line to a wire-wound filter mounted under the fuel pump in the engine room. It flows through this filter to the intake side of the fuel pump, then out of the discharge side of the pump to the duplex cloth fuel filter; through filters in a manifold mounted on each bank; then to the unit injector where it goes through another filter located inside the injector body.

Q. If fuel should not get to the injector, what trouble should be looked for?

A. See that there is sufficient fuel in the tanks. See that the fuel pump is running and fuel pressure is up. Check battery and fuel pump fuses. Check to see if the lines are leaking air or fuel. Check oil filters and strainers.

Q. How is the fuel supply shut off in case of accident or fire?

A. Fuel supply is shut off by pulling one of the emergency fuel cut-off pull rings.

ELECTRICAL SYSTEM

Q. What is the purpose of the reverse current relay?

A. To connect the auxiliary generator to the battery for charging and to prevent the battery from feeding back into the auxiliary generator if the generator voltage falls below battery voltage.

Q. What is the battery voltage?

A. Approximately 64 volts (when not charging).

Q. How can it be determined when a traction motor is damaged, burned out, or short-circuited?

A. Lack of power, jerking, ground relay opens a burning smell can be detected, or the load regulator is in the extreme minimum field position.

Q. Should the reverser handle be in any position other than that of the locomotive direction?

A. No. At no time should the reverser handle be shifted until the locomotive has come to a complete stop.

Q. What is the meaning of transition?

A. This term applies to the changing of the traction motor electrical connections from series to parallel or to shunt. This is done to obtain the desired tractive effort and speed within the voltage operating limit of the generator.

Q. In what electrical connection are the traction motors at various speeds?

A. Up to approximately 34 M.P.H. the motors are in series. From approximately 34 M.P.H. to approximately 80 M.P.H. the motors are in parallel. Above 80 M.P.H. the motors are still in parallel but their fields are shunted by resistors. This is called the shunt position.

Q. How is the main generator excited?

A. The main generator has a battery field which is connected to the battery for excitation. It also has a shunt field which uses the generator armature voltage. The generator will not operate unless these fields are connected to their respective sources of power.

Q. How is the auxiliary generator excited?

A. The auxiliary generator is a self excited machine, with a shunt field; that is the field is in parallel with the armature.

Q. How many traction motors are there per engine and how many per locomotive unit?

A. There are two traction motors per engine and four per locomotive unit.

Q. Which side of the battery is grounded?

A. Neither side of the battery is grounded.

Q. What is the difference between the signal relay and the journal signal relay?

A. The signal relay operates when the *journal, boiler out, hot engine, and low oil alarms* function. The journal signal relay operates only when there is a hot journal box.

Q. What is the time delay relay?

A. The time delay delays the closing of the "P1" contactor when transition occurs, giving the generator voltage time to stop, thus preventing arcing of contacts and generator commutator.

Q. What is the isolation switch?

A. The isolation switch is a two position control for each engine. In "start" position the engine is isolated from the traction motors making it possible to start or stop it. When in "run" position the engine is "on the line", supplying power to the traction motors and being controlled from the control station in the cab.

Q. Can an engine be stopped in an emergency by pulling the battery switch?

A. No. Pulling the battery switch will not cause the electrical equipment to become inoperative. The quickest way to stop an engine is by placing the isolation switch in "start" position and pushing the "stop" button. To stop the engines from the cab place throttle in stop position or pull the fuel cut-off pull rings in emergency.

Q. What connection does the throttle and reversing handles have with the engine or electrical equipment?

A. The throttle handle simply makes electrical contacts to wires leading to the electro-pneumatic governor control. The throttle cannot affect engine speed unless control air pressure is up and the electrical circuits closed. The reversing handle simply connects to wires leading to the forward and reverse magnet valves on the reverser. Unless control air pressure is up and the electrical circuit closed, moving the reversing handle will have no effect on the locomotive.

Q. What is the load control?

A. The load control is a combination of a two way oil valve known as the pilot valve, a rheostat operated by an oil piston known as the load regulator and a bank of resistor tubes known as load regulator resistors. Through the operation of the governor and governor control, the pilot valve allows oil to flow to the load regulator which inserts or cuts out resistance in the generator battery field circuit. This varies the load on the engine according to the demand or according to the engine's ability.

Q. What is the voltage relay?

A. The voltage relay (transition relay) causes the traction motors to make a transition. This relay operates on main generator voltage.

ENGINE OPERATION

Q. Explain the manner in which the engine is started by the battery.

A. It is merely a case of using the generator temporarily as a series wound motor with the storage battery furnishing the required energy.

Q. What is the reason for carrying a bar on a locomotive which can be used for slowly turning the engine over by hand and what precautions must be observed when it is used?

A. This bar or lever is used in turning the engine over when checking for condensation or adjusting valve lash adjustors, and injector timing.

Care should be taken in using this bar to prevent

injury due to "back-kick" resulting from engine compression. Extreme care should always be taken to remove this bar before starting the engine. Open cylinder compression test valves before barring over engine. These must be reset when engine is started. Have fuel pump off.

Q. If engine rotates, but does not fire, how should one proceed to determine the trouble?

A. See that there is sufficient fuel in the supply tanks. See that fuel pump switch is "in", that the pump is running and the pressures are correct on the fuel gauges. See that fuel is actually getting to the injector. Be sure compression valves are closed.

Q. After engine has started, what precautions should the fireman take?

A. Be sure that engine oil pressures come up. If no pressure shows on a gauge, stop engine immediately. Be sure that engine cooling water is circulating properly. Do not attempt to load engine by moving train until the engine has been thoroughly warmed up and the water outlet manifold temperature has reached 125° F.

Q. What precautions should be taken in stopping engine?

A. Before stopping the engine it is good practice to let the engine idle for about one minute or until the water temperature begins to drop.

Q. How is the engine stopped?

A. The engine will be stopped if the isolation switch is placed on "start" and the "stop" button is pushed. Hold button until engine comes to a complete stop.

Q. Explain how the exhaust valves are operated and give their functions.

A. There are four exhaust valves to each cylinder. Their purpose is that of releasing the burned gases from the cylinder. They are operated by the camshaft through rocker arms. Their proper adjustment is held with the automatic lash adjusters which eliminate the necessity of checking valve clearance manually.

Q. Explain what should be done if an exhaust valve spring breaks on the road.

A. Install injector hold down clip. Tie valve having broken spring to rocker arm shaft with wire. If tools and spare springs are on the car, replace spring at terminal. Be sure when changing a valve spring to place piston on top center to prevent valve from dropping inside of cylinder.

Q. What precautions should be taken when installing a new exhaust spring or in freeing up a sticky valve stem? How is a sticky valve stem freed up?

A. The engine should be turned over until the piston in the cylinder with the broken valve spring or sticky valve stem is on its top center. This is to prevent valve from dropping into cylinder when spring is released. Use distillate or kerosene on valve stem that is stuck and work stem around up and down. For a badly stuck valve stem, it is advisable to remove valve spring as this makes valve stem more accessible. In order to remove a valve spring it is necessary to first remove the rocker arm and valve bridge assembly.

Q. Explain the purpose of the cylinder test valve.

A. The purpose of this valve is to test for an accumulation of oil or water in the cylinder.

Q. How and when should cylinders be checked for accumulation of water or fuel oil? If there is any water or fuel oil in cylinders, what should be done?

A. If the engine has been idle for 8 hours or more all cylinder test valves should be opened and the engine turned over by hand at least one turn. Throttle must be closed and fuel shut off. In case any accumulation of water or fuel oil should be found in any cylinder, cause must be found before starting engine.

Q. How is the movement of the hand throttle transmitted to the injector valves?

A. Movement of the engineer's main throttle is transmitted to the governor control electrically. The governor control then operates the governor. The governor then controls the injector layshaft, which movement is transmitted to the injector control racks.

Q. Explain the action of the governor.

A. The governor gives the engine a definite speed for each throttle position.

LOCOMOTIVE OPERATION AND LUBRICATION POINTS

Q. Regardless of the completeness of the system of maintenance and inspection existing on the car, what inspection should be made by the fireman prior to starting?

A. Check the following:

Supply of fuel, water, oil, and sand.
The various valves in the engine cooling and fuel systems for open or closed position in accordance with instructions.
Engine oil, air, and fuel pressure.
Brakes: Is hand brake released? Do air brakes work properly?

Q. What is the last thing that an engineer should do before leaving the locomotive at the completion of his run when car is not to be moved immediately under its own power?

A. The hand brakes should be set. All switches should be pulled, including all lights. The main battery switch should be pulled. This must not be forgotten.

Q. What should be done if there is possibility of car being handled by other power, such as switch engine, or being towed in train?

A. Main battery switch on panel board should be opened; close double head cut-out cock in brake system; and open "dead engine" 3/8 cut-out cock, put brake handle in running position.

Q. Explain what should be done in case a traction motor axle bearing runs excessively hot; and when it continues to run hot.

A. Check oil level, adding oil if necessary, at the oil well and also pouring considerable oil directly on top of the waste. Work waste about and over against the axle. If bearing continues to run hot, back off nuts a slight amount on axle bearing cap bolts. See that packing is in good condition and not charred.

Q. What troubles may cause fans not to operate?

A. V-belts broken or too loose. Broken fan bearing or idler bearing.

Q. What troubles may cause the air compressor not to operate?

A. Internal trouble in the compressor, sticky valves, air compressor governor failure or a broken coupling.

Q. When should sand be used to stop a locomotive? Is sand harmful to the equipment? Why?

A. Sand should be used to stop a train only when rail conditions make its use absolutely necessary. This sand is harmful to the equipment inasmuch as a portion of it may be blown back and carried into the traction motors. The abrasive action of this sand is highly detrimental to the traction motors.