G. Wilson

Budd

RAIL DIESEL CAR

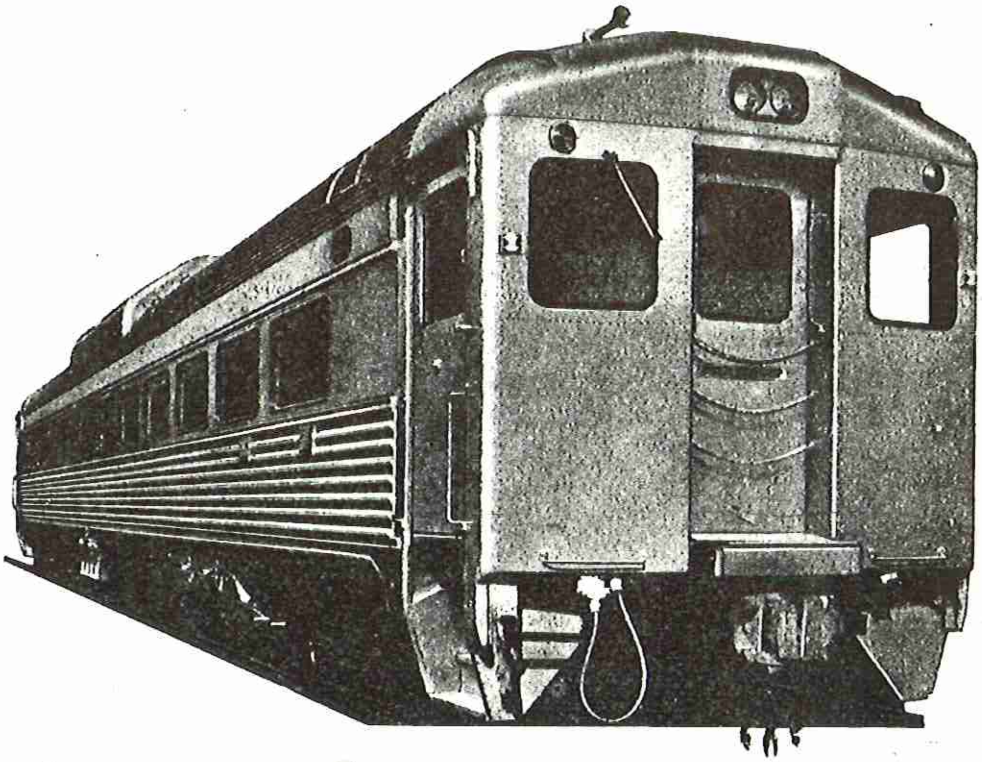
GENERAL MANUAL

THE BUDD COMPANY
RAILWAY SERVICE DEPARTMENT
RED LION PLANT
PHILADELPHIA 15, PENNA.

R.J. Davis

418

BUDD RAIL DIESEL CAR



GENERAL MANUAL

THE BUDD COMPANY
Railway Service Department
Red Lion Plant
Philadelphia 15, Penna.

March 1, 1953

FOREWORD

This illustrated Manual is supplied by The Budd Company for the Budd Rail Diesel Car and explains those service and preventative maintenance operations that logically fall within the scope of the Mechanical Department maintenance forces.

The Manual is divided into sections. Each section fully describes all systems and the necessary maintenance procedures.

Information concerning replacement parts can be obtained from The Railway Service Department, The Budd Company, Red Lion Plant, Philadelphia 15, Pennsylvania.

CONTENTS

SECTION 1

DESCRIPTION

All Budd Rail Diesel Cars are of stainless steel construction with fabricated four wheel trucks. The RDC-1, 2 and 3 is 85 feet long while the RDC-4 is 73 feet 10 inches long. Ready-to-run weight is approximately 120,000 pounds.

The end underframe is of a fabricated construction of NES 70 steel and incorporates a combined end sill, coupler carrier support, collision post stubs, and an integral type body center plate. Center sill, cross bearers and floor pans are of stainless steel.

The side frames are of modified girder construction with roof and floor assemblies serving as chord members; all stainless steel.

One car body jacking pad is provided at each end of each car body bolster, (4 per car).

The roof is essentially comprised of corrugated stainless steel sheathing reinforced by "Z" shaped stainless steel carlines.

An enclosure for the engine cooling radiators and fans is superimposed on the normal roof near the center of the car. End roofs are formed of stainless steel sheathing and the car end sheets are heavy gauge stainless steel.

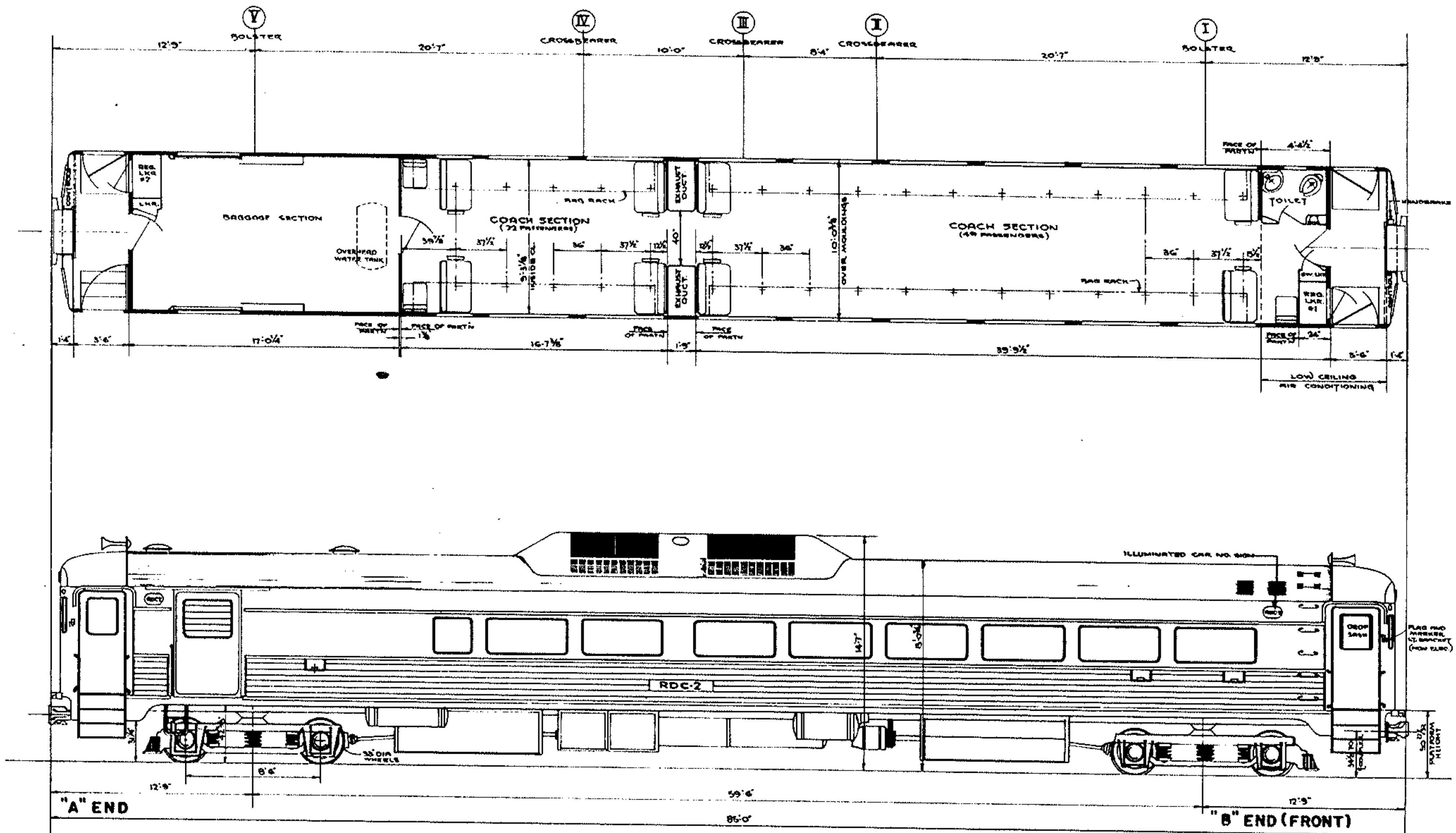
The trucks are equipped with Model CF Budd Disc Brakes. The brakes are operated by modified H.S.C. braking system with an M-23 brake valve, D-22-AR control valve and a B-3 relay valve.

Wheel slide is prevented by the Budd Rolokron system.

The car is built with the handbrake end designated as the "B" end and the opposite end as the "A" end. The letter "F", four inches high, indicating normal front end, is stencilled in black near the lower edge of the passengers' entrance door on both sides of car at the "B" end.

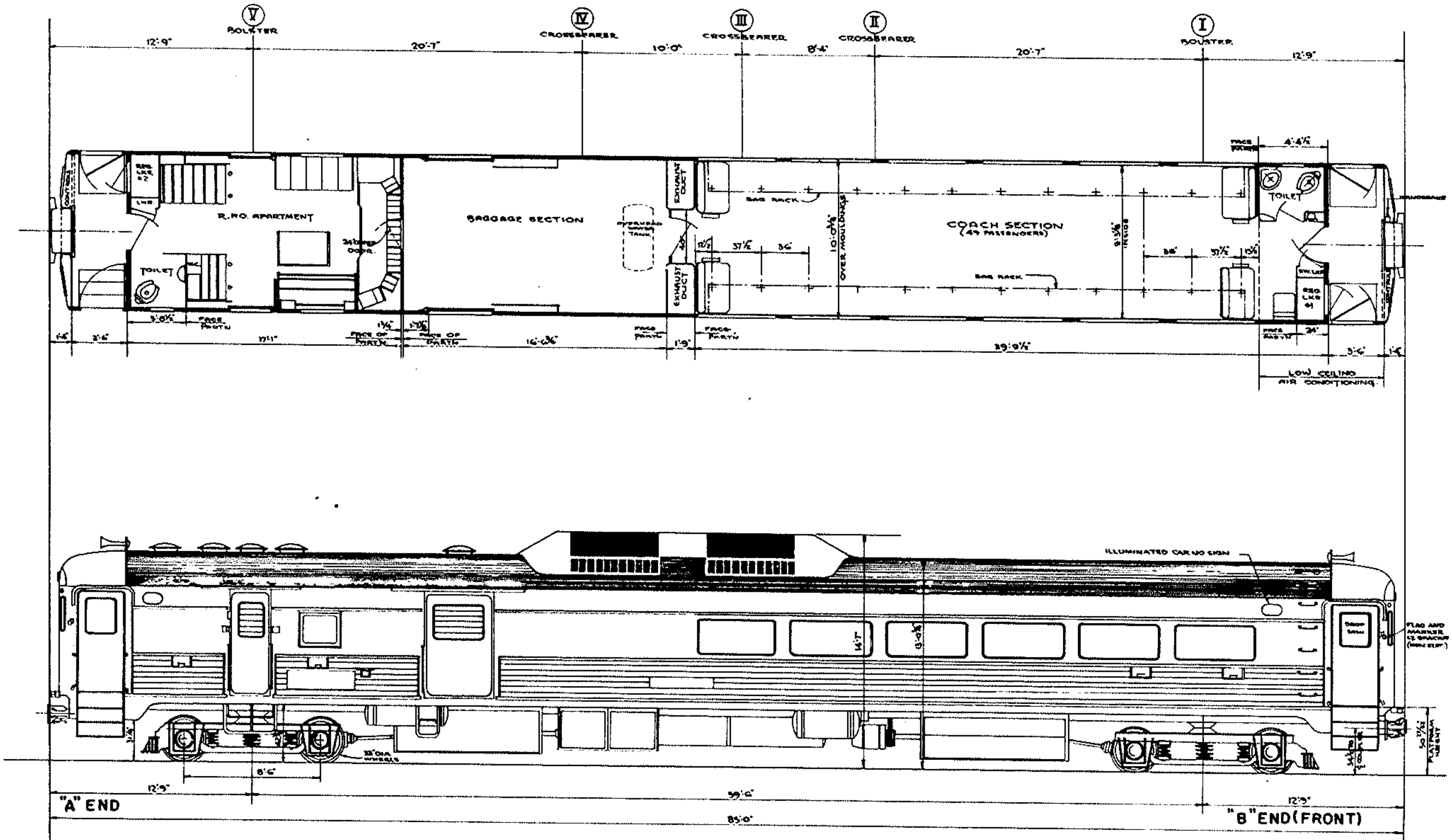
The engine toward the "B" end (front) is #1 and the engine toward the "A" end is #2.

See Figures 1, 2, 3 and 4 for plan views, elevations and overall dimensions for RDC's 1, 2, 3 and 4.



BAGGAGE COACH
R.D.C.-2
FIG. 2

SEC. 1

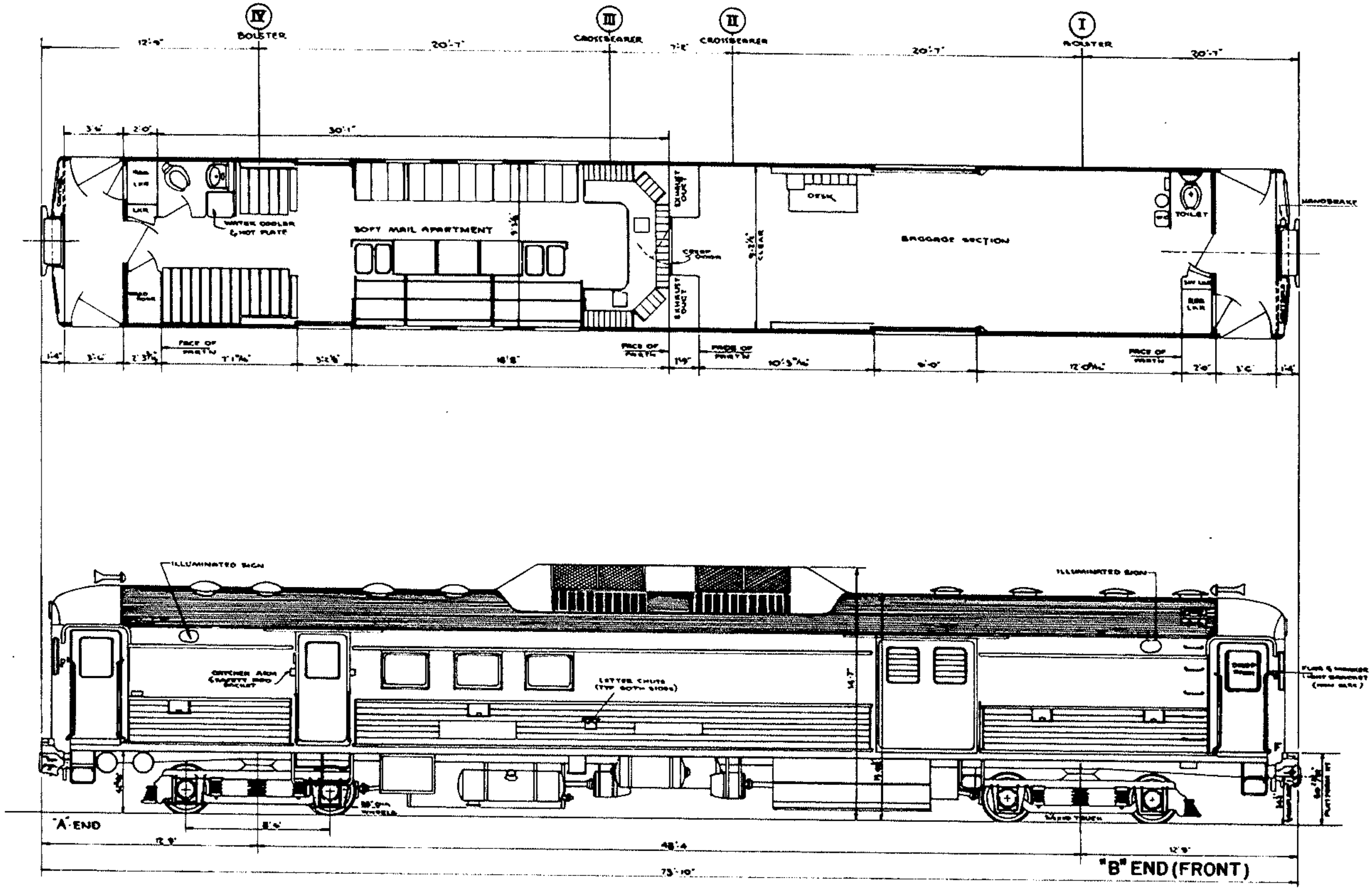


R.P.O. BAGGAGE COACH

R.D.C.—3

FIG. 3

SEC. I



R.P.O. BAGGAGE
R.D.C.-4
FIG. 4

SECTION 2

POWER UNIT

Each RDC is propelled by two 275 HP, 2 cycle, General Motors type 6-110 Diesel Engines. The power from the engines is transmitted through a torque converter, a reversing gear box, a propeller shaft and an axle mounted gear box to the wheels. The torque converter and reversing gear box are mounted on, and made a part of, the power unit. This unit is enclosed by a metal casing just inboard of each truck. The engine is inclined at an angle of 20° from horizontal and is suspended fore and aft by rubber pads as shown in Figures 1, 2 and 3.

1. FRONT ENGINE MOUNT

As shown in Figure 1, the front engine mount consists of a Torque Tube (G) and Stirrup (A), with a vibration absorbing rubber pad (D).

The torque tube (G) is permanently attached to the center sill and side sill of the car. The stirrup (A) is removable, being suspended from a pair of arms in the torque tube and held in place by a Pin (B), and prevented from rotating by a Stop Pin (C). A recess is provided in the lower surface of this stirrup to receive a rubber pad (D).

Under no load the rubber pad has a free height of 2″. However, under the load of the engine this is compressed to 1⅛″. If, on inspection, the distance "X" (shown in Fig. 2), is found to be less than ½″, the rubber pad should be replaced.

a. Replacement of Front Engine Rubber Pad

First, jack up the front of the engine. This can be done by means of the "Engine Dolly", (Fig. 4) or by a separate jack located under the front engine jacking pad. Raise the engine until the load is taken off the front rubber pad [(D) in Figs. 1 and 2]. Remove safety hook (F) and pull out stirrup pin (B). This will allow the stirrup (A) to drop. Insert a new rubber pad and reverse the above procedure. Be sure the safety hook (F) is properly placed.

2. REAR ENGINE MOUNT

As shown in Figure 3, the rear of the engine is provided with two wings or brackets (A): one on each side of the torque converter. A hole in these brackets matches with, and is bolted to, a load bar (B). The load bar is housed in an inverted channel (C), which is attached to the center sill and both side sills of the car body. Two rubber pads (D) are fitted into recesses cut into each end of the load bar (B). The rubber pads slide into a set of retainers welded to the inside of the channel (C) and are held in place by a stop and safety plate (F).

a. To Replace the Rear Engine Mount Pads

It is not necessary to remove the engine from the car to replace a defective rear engine rubber pad; however, it is recommended that the main drive shaft be disconnected at the engine flange in order to avoid inadvertent damage to this shaft. The rear of the engine should be jacked up by means of two jacks; one under each rear jacking pad. After the engine is raised high enough to take the load off the rubber pads (D), remove the six bolts holding the safety plate (F) on both sides of the engine. Lower the engine on the jacks and the rubber pads will slide down with the load bar (B). (It may be necessary to insert a pinch bar inside the channel (C) to start the pads if they stick). The rubber pad needing replacement should be lowered faster than the opposite side so that the opposite side will not drop out. Do not lower farther than necessary to remove the defective pad.

When inserting the new pad, be sure it fits properly into the recess in the load bar and that the edge of the metal plate marked "Top—Load Bar Contact Edge" is inserted correctly into the load bar recess. Jack up the engine and the pads should slide up into place in the retainer in the inverted channel. The use of a large C-clamp to squeeze the pad together will assist pad in entering the channel. After the engine has been jacked high enough, the safety plate (F) should be re-applied on both sides and the jacks removed.

b. Alignment of Engine

Whenever the power unit is installed in the car, or the rear rubber pads replaced, the alignment of the front engine bracket in the stirrup should be checked carefully (Dimensions "X" in Fig. 1). If this dimension is less than ½″ on either side, shims should be installed between the rear engine bracket (A) and the load bar (B) Figure 3, Section A-A, to properly center the front engine bracket in the stirrup. These shims should consist of a 3″ x 3″ square piece of ⅛″ or 1/16″ steel stock with a 1″ diameter hole. The insertion of a ⅛″ shim at the outboard side will move the front engine bracket approximately ¼″ toward the outboard side.

3. REMOVAL OF ENGINE

The power unit of the Rail Diesel Car can be removed and replaced in a very short time; however, in order to expedite the work, the proper tools and equipment must be on hand before starting the operation.

a. An engine dolly (Fig. 4), complete with guide points, jacks, roller tracks, tie bars, jack handles, and three wheel carriage.

b. One 18″ or 24″ ratchet bar with socket to fit hex nut 1-7/16″ across the flats.

c. One 36″ pinch bar.

d. A three pound rubber or plastic faced maul.

Drain the water from the engine cooling system by removing the master drain plug in sump tank bottom fitting, (See Fig. 5, Section 11). Use care not to lose the gasket on this drain plug.

Disconnect the following on the engine (See Fig. 5)

a. Fuel supply line (A).

b. Fuel return line (B). These lines are located on the left hand side of the engine casing and are provided with a wing nut type of quick disconnect. Tap the lug of the disconnect with a hammer to start it and then turn by hand. There is an automatic check valve in both ends of the fitting so it is not necessary to close any valves to prevent the loss of fuel oil.

c. Water-in line (C). Loosen the fire hose coupling located on the left side of the engine casing. Coupling can be turned by hand after being loosened with a hammer. Use care not to lose the gasket on this coupling.

d. Water-out line (D). Loosen coupling as in Item (C) above. This coupling is on the end of the 3⅛″ copper pipe at the top of the engine casing.

e. Exhaust Pipe (E). Remove bolt at elbow and drive pipe back to clear the manifold extension.

f. Air Intake Pipe (F). Loosen the "Marman" clamp.

g. Battery Cables (G). Break quick disconnect mounted on engine support.

h. Transmission Electrical Plug (H). To remove plug, rotate the outer shell 1/8 turn counterclockwise and pull out.

i. Throttle Electrical Plug (J). This plug is removed the same as in Item (h) above.

j. Breather Hose. This hose is a 2" OD hose inserted through a hole in the rear panel of the engine casing. It will pull out as the engine is rolled out.

k. Propeller or Main Drive Shaft (L). This shaft is attached to the engine driving flange by twelve 7/16" nuts, bolts and lockwashers.

l. Generator Drive Shaft (M). This shaft is attached to the front engine driving flange by four 1/2" nuts, bolts and lockwashers.

The bearings on the rollers of the three-wheel carriage or dolly should be well greased. The three jacks should be well oiled and both top and bottom threads run in and out approximately 1 1/2" by hand to see that there is no binding before the carriage is positioned under the engine.

To Properly locate the Engine Dolly:

a. Drop a plumb line from the rear face of the load bar (Fig. 3, Section-AA), of the rear engine mount and mark both rail heads.

b. Slide the tubular rails of the dolly under the engine and locate the center of the right hand dolly rail 19 1/2" to the right of the mark on the rail head (See Fig. 5).

c. Install the tie bars on the ends of the dolly rails and level up the rails by means of the leveling screws. (Be sure there are no bumps in the floor on which the carriage will catch when rolled out).

d. Slide the carriage under the engine, making sure the jack heads index with the recesses in the engine jacking pads. (The carriage can be slid fore and aft approximately 2" on the roller shafts thus making it unnecessary to move the tubular rails of the dolly).

e. Loosen the nuts on the rear engine support bolts until they can be turned by hand.

f. Raise all jacks together, (see that both upper and lower screw threads of each jack are ejected equally), until the load on the rubber pads of both fore and aft mounts is just beginning to be taken by the jacks.

g. Continue raising the rear jacks until they are extended far enough to take the load from the rear support bolts. Drive the bolts out of the support using the guide points provided in the clips on the dolly carriage. The guide points will protect the bolt threads. Lower the rear jacks approximately half way.

h. Raise the front jack far enough to take the load from the stirrup. Remove the safety hook and pull out the stirrup pin (B) Figs. 1 and 2. The stirrup and front engine mounting pad will drop.

i. Lower all three jacks together until they bottom. While the engine is being lowered, check the exhaust pipe connection to see that it is clear and does not bind and hang up as the engine is being lowered.

j. Roll the engine out on the carriage to a point where it can be picked up with a crane.

The power unit should always be lifted by means of a three point chain. One chain on the front lifting lug and one chain on each of the "eye" bolts screwed into the top surface of the torque converter. ***NEVER*** use the holes in the engine wing brackets for lifting.

4. INSTALLING A NEW ENGINE

The power plant is shipped from the manufacturer less certain accessories such as hoses, etc., which should be installed on the engine before it is rolled under the car. These items are as follows:

a. Water outlet hose with quick disconnect coupling.

b. Water inlet hose with quick disconnect coupling.

c. Inlet and outlet fuel hoses with quick disconnect coupling.

d. Air inlet elbow assembly including gaskets.

e. Two ¾″ shut off cocks with pipe plug and one ½″ nipple (crankcase and transmission sump drain).

f. Breather hose.

g. Starter cables with male plug assembly.

h. Weston Tachometer Generator.

j. Two ¼″ Air box drain hoses and hose clamps.

k. Exhaust manifold transition assembly, gaskets, bolts and nuts.

Piece numbers for above parts will be furnished upon request.

It is recommended that the above parts be installed while the engine is on the dolly and before it has been rolled under the car. This will save considerable time since some of these parts are inaccessible after the engine has been installed.

After the above accessories have been installed:

a. Locate the engine dolly under the car as instructed under REMOVAL OF ENGINE. See that all jacks are ¼ thread above bottomed position, (to prevent binding when the engine is lowered). Then lower the engine on the dolly.

b. See that the stirrup pin, [(B) in Fig. 1] of the front engine mount is pulled and the stirrup removed.

c. Roll the engine under the car. Feed the breather hose into the hole in the rear of engine casing as engine is rolled under.

d. Install the front rubber pad in the stirrup.

e. Raise all jacks together until the engine is raised to within 3 inches of its final position, then raise the front jack only until the stirrup can be moved into position and the stirrup pin driven home.

f. Lower the front jack until the rubber pad starts to compress.

g. Raise the two rear jacks together until the rear mounting bolts can be inserted. It is advisable to match up the exhaust pipe connection and install the "Marman" clamp while the rear of the engine is being raised.

h. Insert the rear mounting bolts, using the guide point, and tighten the elastic stop nuts.

i. Check clearance on front engine mount (Dimensions "X", Fig. 1) and add shims to the rear mount if necessary, as explained under ALIGNMENT OF ENGINE.

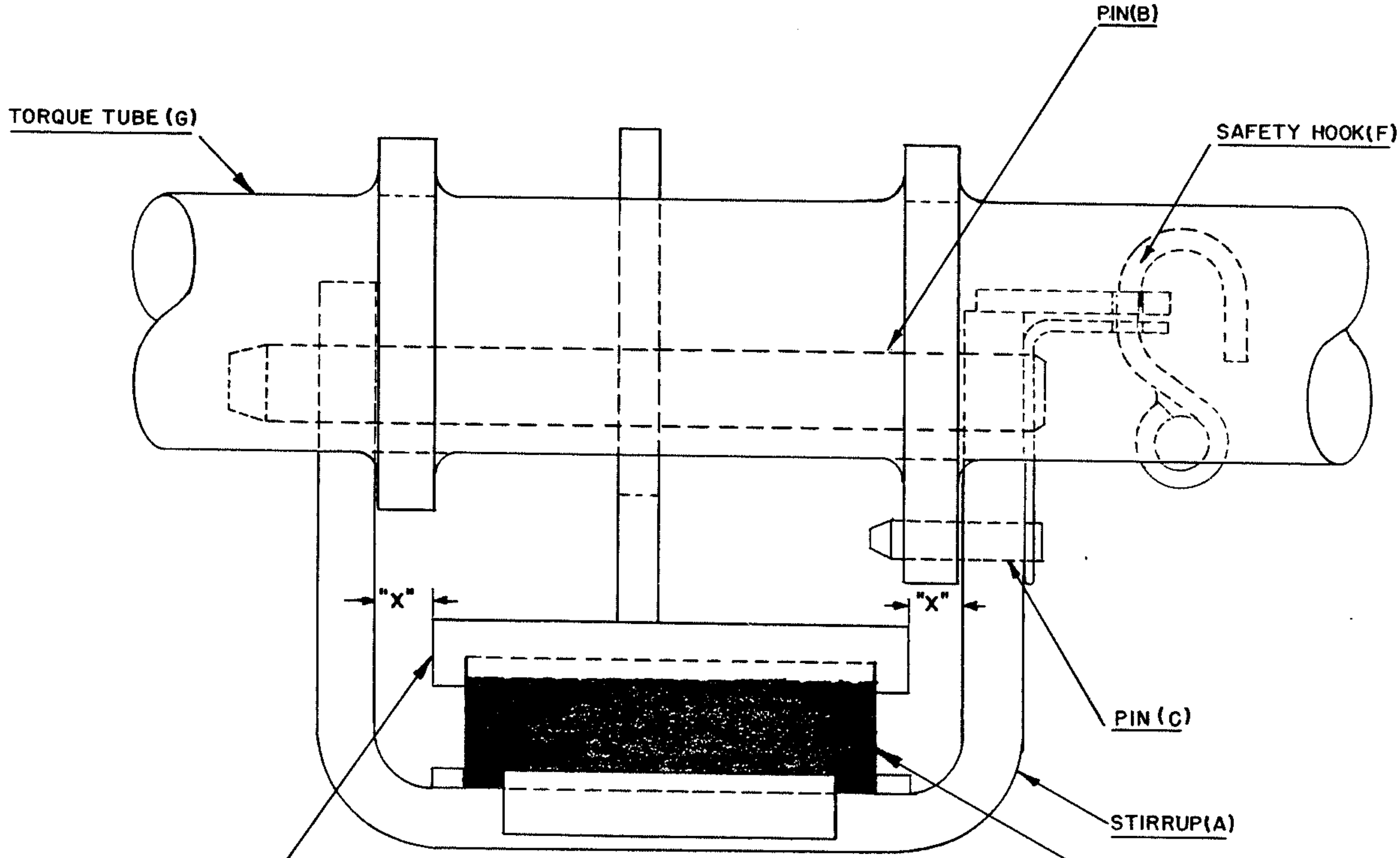
j. Lower all jacks and remove Engine Dolly.

k. Connect the following:

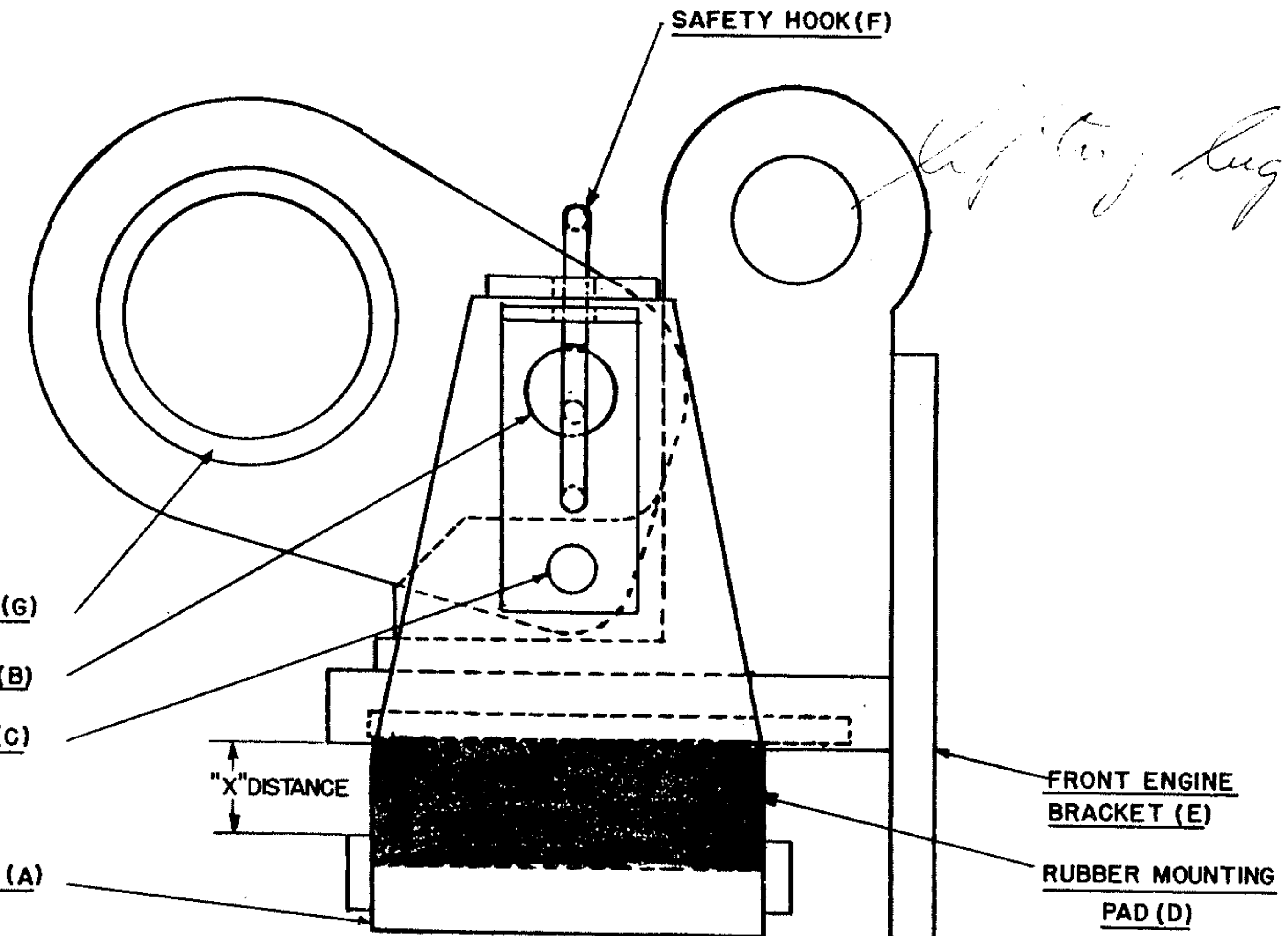
(1) Water-out hose
(2) Water-in hose
(3) Fuel supply line
(4) Fuel return line
(5) Air intake hose
(6) Exhaust pipe
(7) Transmission electrical plug
(8) Throttle electrical plug
(9) Battery cables
(10) Propeller drive shaft
(11) Auxiliary generator drive shaft
(12) Tachometer generator electrical plug.

l. Check that the safety hook is in place on the front engine mount and nuts on the rear mounting bolts are tight, (Figs. 1, 2 and 3).

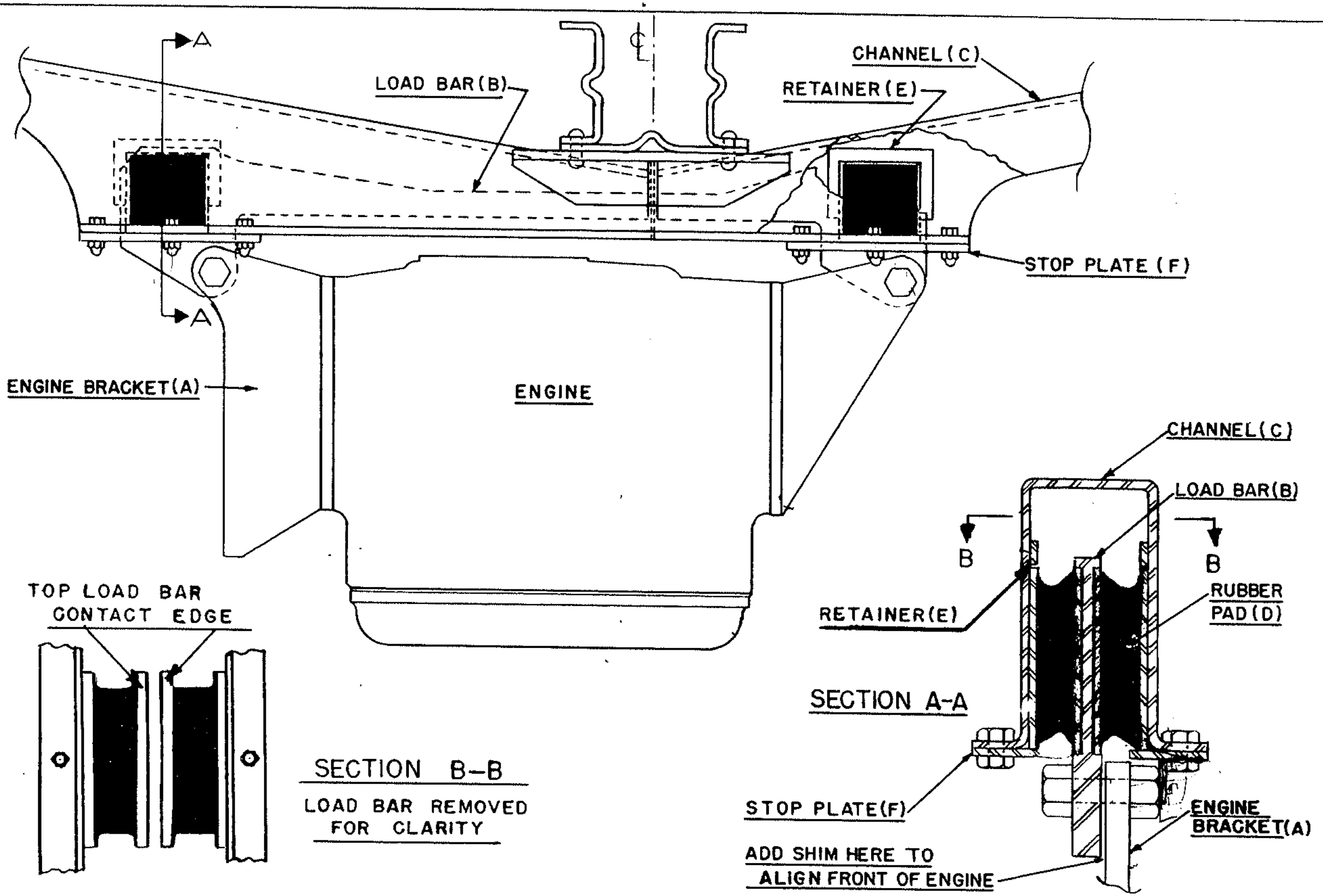
The engine cooling system should be filled with water and air-bled from the top of the fuel filters. Check the lube and transmission oil levels and the engine is ready to be started.



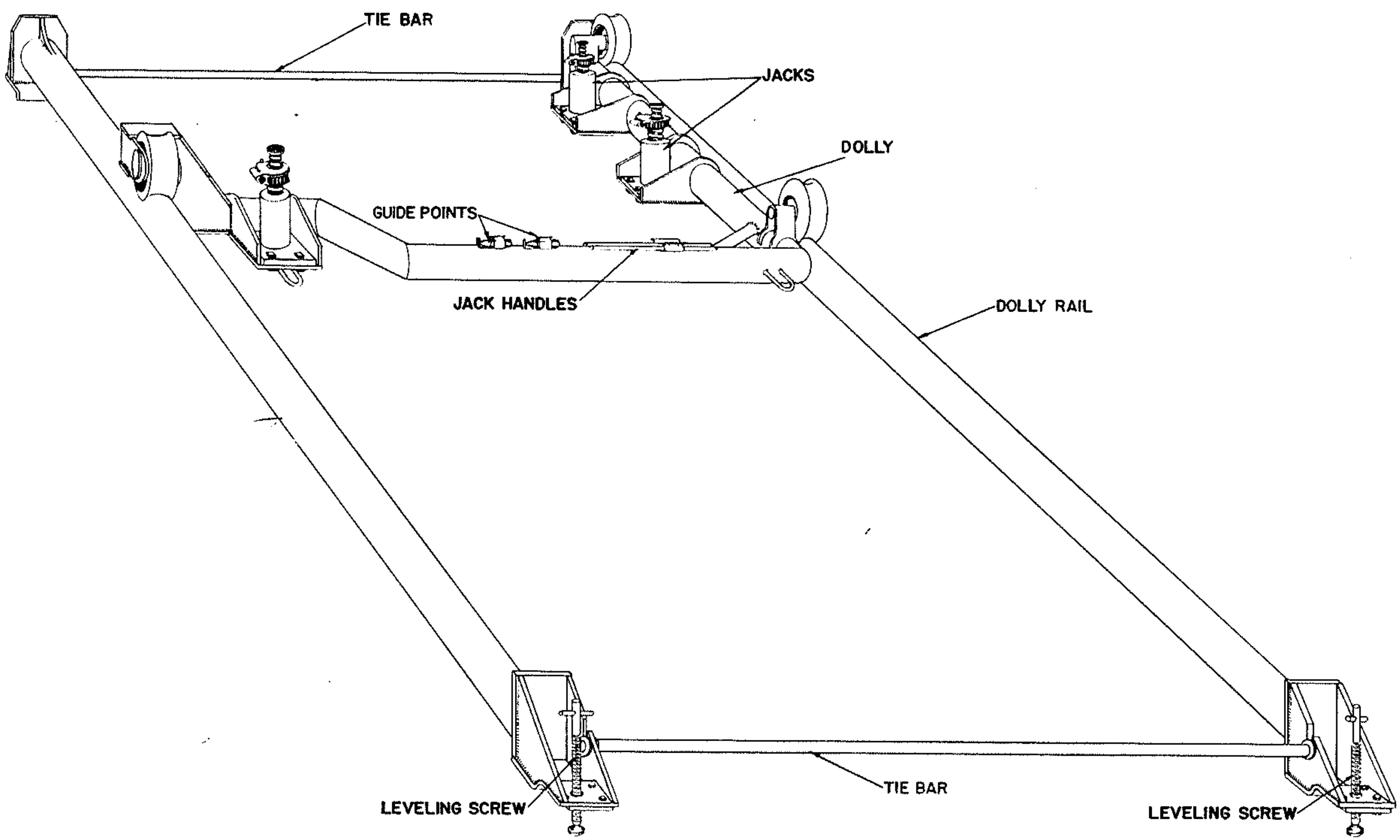
FRONT ENGINE STIRRUP
END VIEW
FIG. I



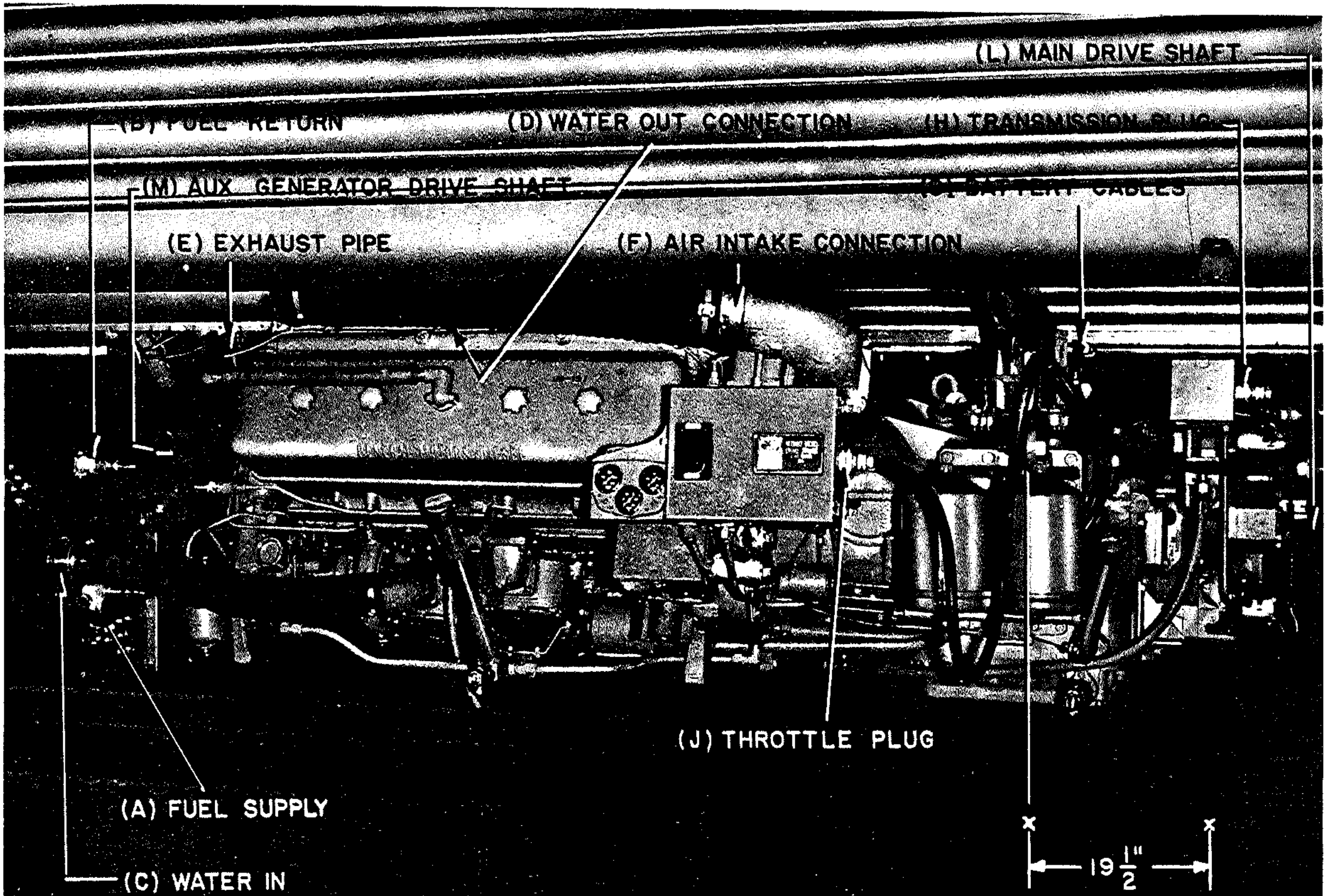
FRONT ENGINE STIRRUP
SIDE VIEW
FIG.2



REAR ENGINE SUPPORT — FIG.3



ENGINE DOLLY & RAIL
FIG. 4



LOCATION OF ITEMS TO BE DISCONNECTED FOR ENGINE REMOVAL
FIG.5

SECTION 3

TRUCK ASSEMBLY

DESCRIPTION

The RDC trucks are four wheel, single equalizer, single bolster, swing hanger type, equipped with coil equalizer and coil bolster springs, longitudinal bolster anchor rods and transverse spring plank stabilizing rods are provided. The truck frame is fabricated of steel plates, shapes and alloy steel castings welded together, then stress relieved. The pedestals are of fabricated construction and are equipped with manganese steel liners. The pedestals are attached to the truck pedestal supports with nickel steel shoulder bolts.

The truck bolsters and spring planks are fabricated of steel plates welded together then stress relieved. The bolster includes an integral center plate, spring pockets and anchor brackets; rubber cushioned friction type side bearings and provisions for self-locking center pins. The spring plank safety straps are bolted to the swing hanger supporting brackets.

The "I" beam shaped equalizer beams, swing hangers and swing hanger cross bars are forged alloy steel. The swing hangers are fitted with bushings for swing hanger pins. The cross bar bearings are of cast steel.

Two vertical shock absorbers are provided on each truck to dampen the vertical motion of the bolster.

The wheels are 33" diameter, high carbon steel, with 2½" rims, arranged for the attachment of the braking discs. Wheels are machined to a concentricity of .010" and a dynamic unbalance of 1½ pounds maximum.

Each wheel is equiped with a signal shunt block resiliently engaged with the wheel tread. An electrical bond is provided between the car body and each truck frame.

The axles are A.A.R. Standard. They are machined all over and ground at the journal sections for roller bearings. A splined bushing is provided at both ends of each axle for use with the Budd Rolokron, Anti-wheel slide equipment.

One axle per truck is machined with an involute spline in the center portion for engagement with the axle drive unit. The non-driven axle has a tapered center section.

The journal boxes (4 per truck) are equipped with manganese steel wear plates and are provided with enclosures to support the Budd disc brake. Two boxes per truck are provided with adapters for attachment of the Budd Rolokron axle unit (Anti-wheel slide equipment). One stench and one smoke bomb are also provided with each journal box.

Each axle is equipped with Budd disc brake equipment. Both disc brake assemblies of the "B" end truck are provided with a handbrake arrangement.

TRUCK REMOVAL

a. Cut off the air by means of the cut-out cock located to the right of the Rolokron control box.

b. Disconnect at the truck connection, the flexible air hoses (car body to truck).

c. Disconnect the shunt cable assemblies (car body to truck).

d. Remove the clevis pin attaching safety chain to gear box.

e. Disconnect the main propeller shaft.

f. When removing the handbrake truck at the "B" end of the car, release the handbrake and remove the clevis pin to disconnect the handbrake chain. Remove the handbrake rod support from the end underframe.

g. Remove the self-locking center pin. (See Fig. 5 for instructions for removal).

h. Disconnect the Rolokron cable assembly.

i. Disconnect the sand delivery hoses.

j. Position car body jacks at the jacking pads. (One car body jacking pad is provided at each end of each car body bolster). Raise car body high enough to enable truck to clear car structure when truck is rolled out.

1. TRUCK BOLSTER

The bolster center plate is protected from wear by a stainless steel wear liner welded to the outside diameter. At the time of overhaul, this liner should be inspected for excessive wear and cracks.

If replacement of this liner is necessary, refer to Figure 1 of this section for location and welding information.

Two bumper blocks are provided, one at each end of the truck bolster, to cushion the extreme lateral motion of the bolster. The bumper blocks consist of a rubber pad vulcanized to a steel backing plate. One bolt hole is provided in each block for attachment to the bolster. The steel backing plate is tack arc welded to the bolster.

Replacement of these blocks is necessary when the rubber pad becomes excessively worn, torn, distorted or is found to be tearing free from the steel backing plate.

To remove the bumper blocks, remove the nut and bolt, chip weld and lift block vertically from the truck. Access to the nut is through the opening at the inboard side of the bolster side bearing supports.

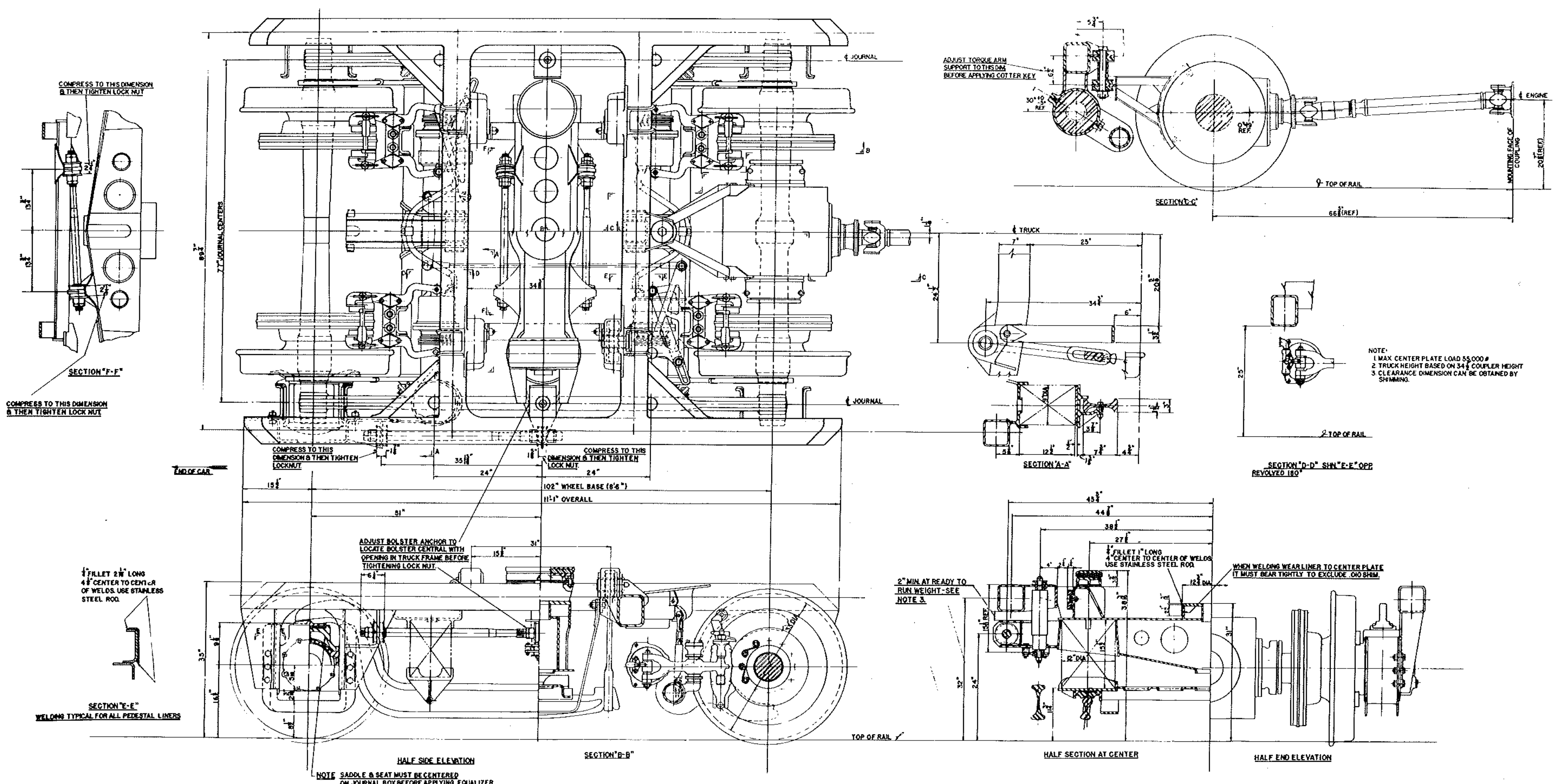
2. SIDE BEARINGS (TRUCK)

Each side bearing consists of a base, rubber sound deadening pads and a cap. The top of the base is divided into four sections by a cross shaped web. Each section contains one rubber sound deadening pad. The rubber pads and cross web are covered by the loose fitting side bearing cap. The top surface of the side bearing cap contacts the car body side bearings, which are equipped with stainless steel wear liners welded in place.

The bases of the side bearings are slotted (one slot at each end) to receive a square head bolt for attachment to the trucks.

a. Adjusting side bearings

The adjustment of the side bearings should result in each body side bearing making light contact with the truck side bearings. The side bearing cap should move slightly when pried with a screw driver. This adjustment is obtained by either adding or removing shims from between the base and the side bearing supports. The amount of shimming should be approximately equal on both ends and on the same side of the car. Shims are available in $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$ and $\frac{1}{2}$ inch thicknesses. Side bearing shimming should not be used as a means of leveling the car. The condition of the rubber sound deadening pads should be determined before making adjustments. If, on inspection, the pads are found to be deteriorated, or to have become set so as to permit metal to metal contact between the cross shaped web and the under side of the side bearing cap, the pads should be replaced. Also, it is important that the car be level and on level track before making adjustments to the side bearings.



R.D.C. TRUCK ASSEMBLY
FIG.- 1

SEC.3

b. Removing and installing shims

Loosen the side bearing retaining nuts sufficiently to permit free movement of the shims. Each shim is provided with one long and one short slot. Slide the shim to be removed in the direction of the end with the longer slot. This will allow the shim to be rotated clear of the opposite bolt. The shim can now be removed. To add shims, reverse the above procedure. It is important that the side bearing retaining nuts be tightened securely to prevent creeping of the side bearings and shims.

c. Replacing side bearing sound deadening pads

Raise car body sufficiently high to permit removal of the side bearing cap. Remove the four rubber pads and insert replacements. Replace the cap and lower the car body.

3. BOLSTER SPRINGS

The bolster springing consists of two nests of coil springs, one at each end of the truck bolster. Each nest is made up of three coil springs, one inner coil, one middle coil and one outer coil.

The ***RDC-1*** Bolster Springs for the "A" and "B" end trucks are alike. The free height of each coil spring is as follows: Inner coil—18.66", middle coil—19.28" and the outer coil—18.66".

The ***RDC-2*** Bolster Springs for the "A" and "B" end trucks differ in free heights, due to the weight distribution of this type car. The free height of each coil spring is as follows: For the "A" end truck, inner coil—18.26", middle coil—18.88" and the outer coil—18.26". For the "B" end truck, inner coil—18.66", middle coil—19.28" and the outer coil—18.66".

The ***RDC-3*** Bolster Springs for the "A" and "B" end trucks also differ in free heights, due to the weight distribution of this type car. The free height for each coil spring is as follows: For the "A" end truck, inner coil—18.26", middle coil—18.88", and the outer coil—18.26". For the "B" end truck, inner coil—18.66", middle coil—19.28", and the outer coil—18.66".

The ***RDC-4*** Bolster Springs for the "A" and "B" end trucks differ in free heights, due to weight distribution of this type of car. The free height for each coil spring is as follows: For the "A" end truck, inner coil—18.66", middle coil—19.28" and the outer coil—18.66". For the "B" end truck, inner coil—17.28", middle coil—17.28" and the outer coil—17.28".

Removing Bolster Springs

a. Insert blocks between the truck frame and the ends of the truck bolster.

b. Support both ends of the truck bolster.

c. Jack the car body approximately 3/8" to remove weight from the truck bolster. If 3/8" dimension is exceeded, the clearance between the center pin spacers and the bolster will be taken up, lifting the truck frame.

d. Remove the lateral stabilizer rods from the spring plank and bolster.

e. Remove the two swing hanger safety straps.

f. Position jacks near the ends of the spring plank and raise the jacks uniformly until the cross bars, cross bar bearings and sound deadening pads can be removed.

g. Lower the spring plank until there is sufficient clearance to allow the springs to be removed from the bolster and spring plank pockets.

NOTE: When installing new springs, refer to paragraph "General" Page 6.

4. SWING HANGER ASSEMBLY

The four swing hanger assemblies are fitted with bushings for swing hanger pins. If bushings become worn, out of round, or loose in the swing hanger, they must be replaced.

Bushings are press fitted into the swing hanger with a minimum of four tons pressure.

Swing hanger pins should be replaced if they are found to be badly worn or out of round.

Excessive wear at the cross bar seat of the swing hanger is reason for replacement.

5. INSTALLING AND ADUSTING LATERAL STABILIZING RODS (Bolster to Spring Plank)

One end of the stabilizing rod is undercut at the inner end of the threaded portion to permit the locknut and adjusting nut to be slid toward the center of the rod after being turned clear of the threads. The opposite end of the rod is provided with a flat washer welded in place.

The following procedure must be performed on both rods:

a. Turn the locknut and adjusting nut onto the threaded portion of the undercut end of the rod. Run the nuts clear of the threads and slide toward the center of the rod. Apply one flat washer and one rubber cushion to the undercut portion of the rod.

b. Apply one rubber cushion to the opposite end of the rod.

c. Insert the undercut end of the rod into the lug provided on the spring plank far enough to permit the opposite end to be inserted into the lug on the bolster.

d. Apply one rubber cushion, one flat washer, one adjusting nut and one locknut at each end of the rod. (Do not tighten these nuts.)

e. Center the spring plank with the bolster (See 13¾″ dimension shown on Fig. 1.).

f. Run the three adjusting nuts up and tighten uniformly to compress the rubber cushions to 2¼″ as shown on Fig. 1. Care must be taken to see that the 13¾″ dimensions are maintained at both rods. Tighten all locknuts.

6. INSTALLING AND ADJUSTING BOLSTER ANCHOR RODS (Bolster to Frame)

One end of the anchor rod is undercut at the inner end of the threaded portion to permit the locknut and adjusting nut to be slid toward the center of the rod after being turned clear of the threads. The opposite end of the rod is provided with a flat washer welded in place.

The following procedure must be performed on both rods:

a. Turn the locknut and adjusting nut onto the threaded portion of the undercut end of the rod. Run the nuts clear of the threads and slide toward the center of the rod. Apply one flat washer and one rubber cushion to the undercut portion of the rod.

b. Apply one rubber cushion to the opposite end of the rod.

c. Insert the undercut end of the rod into the lug provided on the bolster far enough to permit the opposite end to be inserted into the lug on the truck frame.

d. Apply one rubber cushion, one flat washer, one adjusting nut and one locknut at each end of the rod. (Do not tighten these nuts.)

e. Tighten the adjusting nut at the truck frame lug and compress the rubber cushions to 1⅞″, as shown on Fig. 1, and tighten the locknut.

f. Run up the adjusting nuts to obtain the 35-13/16" dimension shown on Fig. 1. This will center the bolster. Tighten the adjusting nuts, uniformly, compressing the rubber cushions to 1⅝" as shown on Fig. 1. Tighten both locknuts.

7. EQUALIZER SPRINGS

The equalizer springs consist of four nests of coil springs, two nests located between the equalizer beam and the frame at each side of the truck. Each nest is made up of two coil springs, one inner coil and one outer coil.

The *RDC-1* equalizer springs for the "A" and "B" end trucks are alike. The free height of each coil spring is as follows: Inner coil—15.38" and the outer coil—15.70".

The *RDC-2* equalizer springs for the "A" and "B" end trucks differ in free heights, due to the weight distribution of this type car, the free height of each coil spring being as follows: For the "A" end truck, inner coil—14.67" and the outer coil—15.19". For the "B" end truck, inner coil—15.38" and the outer coil—15.70".

The *RDC-3* equalizer springs for the "A" and "B" end trucks also differ in free heights, due to the weight distribution of this type car. The free height for each coil spring is as follows: For the "A" end truck, inner coil—14.67" and the outer coil—15.19". For the "B" end truck, inner coil—15.38" and the outer coil—15.70".

The *RDC-4* equalizer springs for the "A" and "B" end trucks also differ in free heights, due to the weight distribution of this type of car. The free height for each coil spring is as follows: For the "A" end truck, inner coil—15.38" and the outer coil—15.70". For the "B" end truck, inner coil—14.17" and the outer coil—14.17".

Removing Equalizer Springs

a. Position car over a drop table.

b. Disconnect the sanding hoses at the pedestals.

c. Remove the pedestals by removing the six nuts and bolts. To remove the bolts, turn the nut, not the bolts, as the bolts are shouldered and damage will result if rotated in the hole. Care must be taken to avoid damage to the bolt body and threads due to hammering. It is suggested that a wood block be used to cushion the hammer blows.

d. Support the truck frame.

e. Disconnect the main propeller shaft at the axle gear unit flange. The 12 bolts are special and must not be replaced by a substitute.

f. Remove the bolts attaching the disc brake safety chain shackles to the truck frame.

g. Attach the disc brake support cables to the cable loops on the brake frame and to the cable lugs on the truck frame. The support cables must be attached to both sides before attempting to lower wheels.

h. Disconnect Rolokron cable assembly.

i. If the flexible hose from the car body to the truck is too short for clearance break the connection.

j. On the handbrake truck, disconnect the handbrake link or rod assembly from the handbrake crank assembly of the pair of wheels to be lowered.

k. Disconnect the axle gear unit torque arm from the truck frame by removing the cotter key, slotted nut, flat washer and rubber cushion.

l. Lower the wheel and axle Assembly sufficiently to permit removal of the springs from the spring pockets. Observe the axle gear unit torque arm bolt when lowering the axle assembly to see that there is no binding or fouling at this point.

NOTE: When installing new springs refer to Paragraph "General".

8. ADJUSTMENT OF SPRING HEIGHTS

With wheels of 33″ diameter, approximately ⅞″ of shimming space is available to compensate for wheel wear. Correction is normally accomplished at the equalizer springs.

The truck has available 5¼″ shim space distributed as follows:

Center Plate 1″

Bolster Springs 1″

Swing Hanger Bearings—¾″ including sound deadening pad

Equalizer Springs—2½″ Maximum, divided 1¼″ at the top and 1¼″ at the bottom.

A ½″ shim is provided at the bolster springs which may be removed to lower the car.

The 2″ minimum dimension between the bolster and frame must be maintained. Any variation in this dimension can be corrected at the bolster springs and swing hanger bearings by adding or removing shims.

General

Spring heights vary in accordance with tolerances. This must be taken into consideration while assembling the truck. For a car well balanced laterally, the springs must be grouped so that all the high or low springs are not located on one side. For a car which is known to be off-balance laterally, it is advantageous to place the high springs on the heavy side of the car.

To correct for Lean

Normally balanced cars should not lean more than ½″ in 10′ to either side of normal. It must be kept in mind that while the car is normally designed to be level with full service load, there are cases where the live load may be off center.

a. The ¼″ shim under the swing hanger bearings, if shim is provided, may be removed. Shims may be added to the low side under the bolster springs and swing hanger bearing or removed under the high side. The amount of shimming should be approximately equal at both ends and on the same side of the car.

b. The correct space between the bolster and truck frame may be obtained by adding or subtracting shims at the bolster springs. Some correction of lean is possible by adding a ¼″ shim in the pocket retaining the rubber pad under the bolster spring. This must be applied on the other side of the rubber pad from the shim which is already there. On the opposite side of the car, the ¼″ shim provided may be removed. Only if further correction is required should shims be added under the equalizer springs.

NOTE: No alteration of shims under the side bearings will be allowed for leveling purposes.

9. SHOCK ABSORBERS

Inspection and Maintenance

It is recommended that the units be periodically inspected at intervals of approximately 50,000 miles to make sure that they are operating properly. This need be only a minor inspection and should be made to determine whether or not the shock absorbers have become damaged in any way and whether or not they are still in good operating condition.

Inspections

This inspection should be made as follows:

a. Check for Control

Remove the upper mounting nut and cotter pin, the upper rubber mounting block and mounting cap. Compress the unit an inch or two and then pull upward on the outer tube. Repeat two or three times. These units should extend or pull with a great deal of resistance and push together much more easily than they extend. If the unit should pull or extend quite easily, loss of control is indicated and it should be removed from the car for more accurate test.

b. Check for Leakage

A light film of oil or small amount of fluid on the lower tube does not signify serious trouble with the unit. A considerable quantity of fluid on the lower tube indicates serious leakage and the unit should be removed and replaced.

c. Check for Binds

Turn the outer tube completely around. It should turn without appreciable resistance. If a point is found beyond which the unit cannot be turned, or where extreme resistance to turning is encountered, a major bind is indicated and the unit should be replaced. A minor bind where some resistance to turning is found, but the unit can be turned through this point without too much difficulty, may be regarded as not serious.

d. Check Condition of Mounting Rubbers

Make sure that the rubber mounting blocks on both ends of the unit are in good condition. If they have become badly worn or have deteriorated appreciably, they should be replaced with new parts.

IMPORTANT: The amount of compression on the rubbers is determined by the shoulder on the stem at each end of the shock absorber. Make sure that the mounting nuts are tightened securely against the shoulder before installing the cotter pin.

Important Foreword

Shock absorber repairing is a costly and generally unsatisfactory procedure, as the expense involved in producing a good repair is usually as much or more than the cost of a new unit, and of course any repaired unit is still not as satisfactory from a life standpoint as a new one.

Defective shock absorbers may be returned to the factory for repair or service. This is considered to be the most satisfactory method of repair. Nevertheless, experience has proven that in general, it is more economical to discard a defective unit and replace it with a new one. It is then only necessary for the storekeeper to maintain a small stock of replacement units and rubber mounting blocks, instead of a large number of repair parts, replacement units, mounting rubbers, service tools and servicing equipment.

Refilling

These shock absorbers are sealed at the factory and cannot be dismantled or refilled. The seals are of an improved design built to last the life of the unit, and since the fluid will not break down or deteriorate with use, it is, therefore, unnecessary to refill these units. Should a unit ever develop serious leakage, it should be replaced.

10. JOURNAL BEARINGS

General inspections in Terminals, Roundhouses and Coach Yards

Following a run, give journal boxes a close visual inspection. Examine the exterior of the box for oil leakage . . . damage from striking objects on the right of way . . . loose nuts or pipe plugs . . . and signs of abnormal heat.

Oil leakage around the gaskets, at the lids, at back covers, or at joints in the box should be immediately investigated and corrected. A slight amount of oil may be noticed at the bottom of the drains in the covers. This can be considered as normal operation as overfilling the housing will cause the excess oil to drain out at these points.

Nuts, bolts and pipe plugs should be properly tightened and in place. Pipe plugs should be securely wired to prevent their loss.

Running temperatures from 15° to 50° F. above atmosphere are to be expected. Any indications on the outside portions of the box of excessive heat should be immediately investigated.

Check oil levels at inspection periods established by the railroad. Working level is given on Reference Chart (Fig. 2). For outside journal bearings a visual check of oil levels should suffice, since large inspection plug openings are provided and the oil level is clearly visible with the plug removed.

Oil levels may be checked after every run if it is the established railroad practice. However, experience has shown that it is seldom necessary to add oil more frequently than at monthly inspection. When oil level gets close to minimum, add sufficient oil to bring the level to maximum. At four to six weeks intervals, check boxes for water content. This can be done by slightly opening the drain plug and allowing condensed water to escape. If, on inspection, the oil appears discolored or indicates the presence of dirt or foreign matter, drain the lubricant and flush out the box with hot oil or kerosene. Apply clean oil to the required capacity as shown on Reference Chart (Fig. 2).

General inspection of SKF Spherical Roller Bearings

When roller bearing equipped wheel and axle assemblies are removed from trucks for any reason, it is recommended that the front covers be removed permitting a visual inspection of the roller assembly and the oil sump. Discolored oil or the presence of flaked metal should be further investigated by the removal of the entire housing from the bearing assembly. It is not necessary to remove the bearings themselves from the journals as an examination can be made with the bearings in place. Although all boxes and parts are interchangeable, it has been found good practice to mark all box locations and parts in

BUDD RAIL DIESEL CAR

REFERENCE CHART FOR CAR EQUIPMENT

FOR INFORMATION ON CONSTRUCTION OF BEARINGS AND BOXES AND FOR GUIDANCE IN FOLLOWING INSTRUCTIONS REFER TO TYPICAL ILLUSTRATIONS AND DRAWING NUMBERS TABULATED BELOW. PRINTS WILL BE SUPPLIED TO RAILROAD AS REQUIRED. BILL OF MATERIAL INCLUDES ALL PARTS SHOWN ON DRAWINGS.

CLASS OF EQUIPMENT	PASSENGER
CAR OR TRUCK NUMBERS	
S K F ASSEMBLY DRAWING	Z-4506-A
A.A.R. NOMINAL JOURNAL SIZE	$5\frac{1}{2}$" X 10"
OIL CAPACITY	4 PINTS
OIL GAUGE DETAIL	--
OIL LEVEL RANGE- INCHES	$\frac{5}{8}$"
ROLLER BEARING NUMBER	466628 CY/C3
AXLE DETAIL	Z-4506-A
ADAPTER SLEEVE	--
LOCKNUT	--
BOX WRENCH	--
REMOVAL NUT	--
MINIMUM RADIAL CLEARANCE BEFORE MOUNTING	.005"
INNER RACE EXPANSION:— (A) BY ADJUSTMENT OF ADAPTER SLEEVE	--
INNER RACE EXPANSION:— (B) BY SHRINK FIT OR PRESS FIT. ADHERE TO AXLE DETAIL FOR JOURNAL SIZE.	.0014" TO .003

IMPORTANT: WHEN ORDERING OR REQUISITIONING ANY PARTS MADE BY S K F INDUSTRIES GIVE ASSEMBLY DRAWING Nº. THEN PART Nº OR DETAIL DRAWING Nº FROM BILL OF MATERIAL ON ASSEMBLY DRAWING.

FIG. 2

a suitable manner so that they can be returned to the same locations from which they were removed. Boxes and parts may be put in the potash tank for cleaning but the roller bearings should never be cleaned in this manner because of the possibility of corrosion.

Before examination of the bearings can be made, all grease and oil should be removed from the races and rollers by washing in clean kerosene or light mineral oil. The bearing inner race, flingers, and spacing collars should be tight on the journal. Any indications of slipping or rotation should be investigated before the equipment is returned to service. The outer races of the bearings can be swiveled over, exposing a large portion of the rollers in one row. The rollers themselves should be carefully examined for any indication of a break in the surface. Any flaking or cracking of either the inner or outer races would be reflected on the surfaces of the rollers by dents or scores due to the rollers passing over such areas and such indications should be investigated by removal and dismantling of the bearing. Flaked areas, cracks in rings, rollers or cage, or any interruption which will prevent the smooth movement of rollers is sufficient cause for removal of the bearing. In many cases, slight flaking can be repaired by replacing the parts affected.

Under no condition should repairs be attempted to the cage or to any parts of the roller bearing. This is a factory job and the whole bearing should be returned to S.K.F. Industries, Inc., for reconditioning. The outside surface of the outer race may become eroded and pitted after considerable service. This in no way will interfere with the successful operation of the bearing. It is recommended, however, that such areas be smoothed over with emery cloth and the corresponding pad in the journal box also polished before reassembling.

Roller bearings should not be left exposed unnecessarily at any time. Every precaution should be exercised to prevent the introduction of dirt, grit or foreign matter into the internal portions of the bearings. If allowed to stand in the shop for any length of time, all surfaces should be liberally coated with heavy machine oil and the bearings covered with clean, lint-free rags. The use of waste in wiping or cleaning bearings should be avoided because of the danger of leaving threads or lint on the rollers. Under no circumstances should the bearings be struck with hammers or mauls or forced in any way during the process of mounting or dismounting.

Maintenance instructions for servicing Car Equipment

When cars are shopped for repairs, or at any time at which the dismantling of the roller bearing journal assemblies is necessary, the procedure outlined below should be followed.

At wheel turning, it is not necessary to remove the journal bearings. The boxes also, if possible, should be left on as protection. It will be found more convenient from the standpoint of handling such equipment to make alterations or additions to the existing wheel lathe which will permit supporting the axle by its center and avoid disturbing either the roller bearing or box assembly. To accomplish this, the lid or the Budd Rolokron Axle Unit are removed and centers long enough to extend through the box opening are employed. The bearing is protected during this operation by applying temporary covers in order to exclude chips and dirt. Drivers having a greater extension may be necessary and, owing to the longer centers used, the turrets are displaced to the right of their usual positions to line up with the wheel treads.

With the usual lathe equipment, it is necessary to strip the journal of all bearing parts as described below. The axle is then supported in the usual manner on centers or centering cones, the latter being applied in the same manner as with A.A.R. friction journal.

For the removal of bearing boxes, first draw out oil. Detach journal box from back cover and remove box being careful not to damage gasket. When journal bearings are to be removed, without disturbing the wheels, the illustrated puller tool (Fig. 3) is recommended. This puller tool as shown, consists of a pressure plate secured to the rear cover by eight bolts. Through the center of the pressure plate, a driving screw of suitable size is threaded. Between the end of the axle and the driving screw, a copper plate and steel block are placed. The copper plate protects the end of the axle. By turning the driving screw in, using a wrench of adequate size, the bearings can be removed from the journal.

In reapplying the bearings, one of the following three methods can be used: (1) Place the bearings and spacer in the box and press the entire assembly on the journal as a unit using a proper pilot and pressing sleeve. See Fig. 4. (2) Press each bearing and spacer on the journal individually and apply the box after bearings are in position. (3) If preferred, the bearings may be heated in clean oil to a temperature of 250° F and shrunk on the journal. If this procedure is used, the bearings should be held in place until they have contracted sufficiently to maintain their proper positions. Bearings should be allowed to cool completely before application of boxes. When using wheel press for applying bearings, journals and bores of bearings should be lightly coated with a mixture of white lead and machine oil. All excess white lead should be wiped from the surfaces of the bearings after they are positioned and tonnage of the press should not exceed 50 to 60 tons.

After exposure to dust and handling, the bearings and parts should be washed thoroughly with kerosene. Every precaution should be taken to insure that the bearings are clean when they go back into service. Apply the box without delay and after the truck is wheeled, add oil in the amount given on the reference tabulation (Fig. 2) to bring up the level to maximum.

In new applications, the axle dimensions at the bearing seat should be checked with the axle detail drawing and the radial clearance of the bearings should be measured before assembly. Bearings with less than the minimum radial clearance specified should not be mounted.

11. SOUND DEADENING

Rubber pads are placed under the side bearing caps, at the ends of the bolster anchor and transverse spring plank stabilizing rods and at the axle gear unit torque arm supports. Rubberized fabric pads are provided at the equalizer seats on the journal boxes, at the swing hanger bearings and at the equalizer spring seats.

A composition thermoid pad is provided between the surfaces of the body bolster and the truck bolster center plates.

12. SIGNAL SHUNTING EQUIPMENT

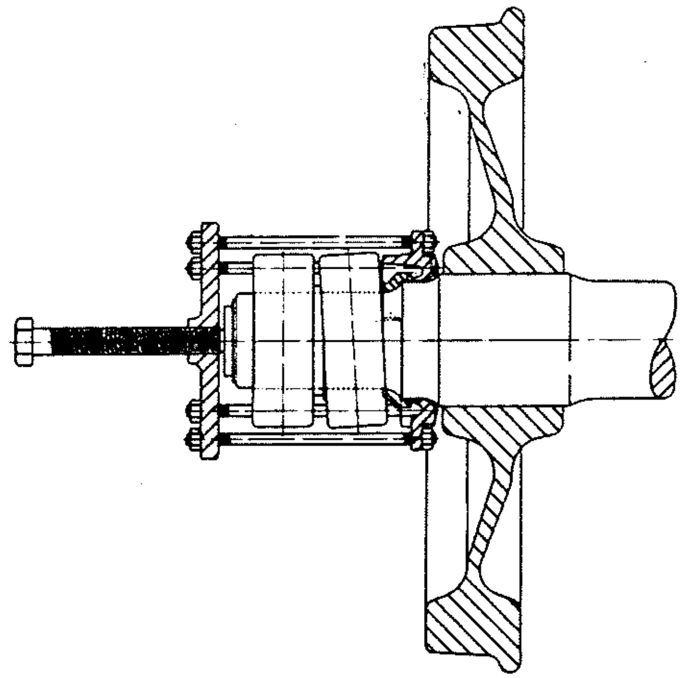
Description

The equipment for each wheel consists of one copper shunt block attached to a torsion bar. The bar is supported at two points on brackets welded to the center transom of the truck frame. At each point of support a sound deadening bushing is provided.

Pressure adjustment to the block is made by means of an adjusting eye bolt located at the extreme end of the torsion bar.

A cable assembly, one end attached to the shunt block and the opposite end attached to the truck frame, is supported on the torsion bar by means of two metal clamps.

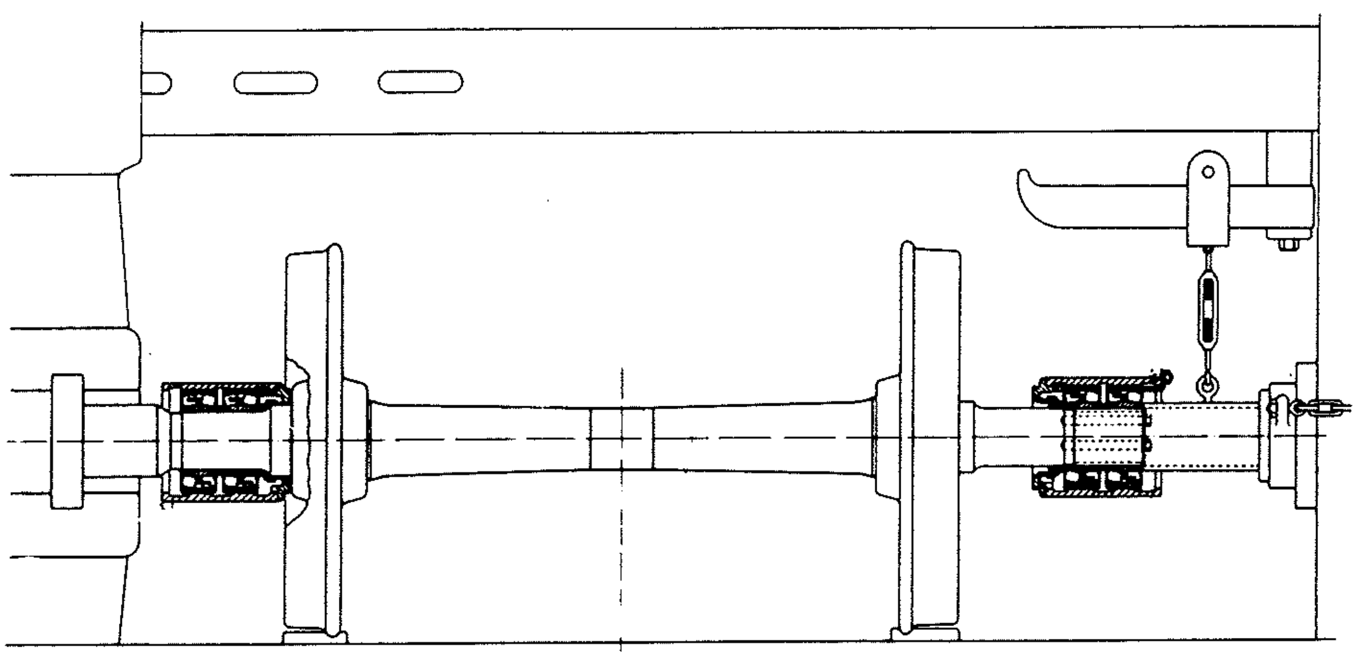
The copper shunt block is designed with four 3/4" deep slots running across the face. The slotted face contacts the tread of the wheel scraping off any accumulation of foreign matter which might tend to insulate the wheel from the rail. Also, a copper film is deposited on the wheel tread by the rubbing action of the block. The copper deposit improves the shunting of the signal currents between the wheel and the rail.



JOURNAL BEARING PULLER TOOL ARRANGEMENT

FIG. 3

SEC. 3



UNIT METHOD OF MOUNTING

FIG. 4

SEC. 3

Inspection and adjustment

Blocks should be periodically inspected for wear. The block is designed for a maximum of ¾ inch of wear which would be indicated when the block is worn down the depth of the slots.

a. Check that the cotter key which retains the shoe to the torsion bar is secure.

b. Check that the torsion bar bearing clamp attaching bolts are secure and the rubber bushing is in good condition.

c. Check that the adjusting nut is properly tightened and it's associated rubber bushing has approximately 1/16 inch compression.

d. Check that the cable terminal bolts are tight and the cable is properly secured to the torsion bar by the metal clamps.

e. The block must be held against the wheel tread by a pressure of 20 pounds with a tolerance of plus or minus 5 pounds. To check this pressure, attach a spring scale to the torsion bar at the block. Apply tension to the scale and observe the reading just as the block starts to lift away from the wheel tread.

f. Check that the dimension from the outside face of the wheel to the outside edge of the shunt block reads 1-5/16 inches. The tolerance for this dimension is plus 0, minus ¼ inch.

To remove a shunt block

Loosen the elastic stop nut, at the adjusting eye bolt, until the top face of the nut is flush with the end of the bolt; relieving the pressure on the block. Disconnect the cable at the block and remove the cotter key retaining the shunt block to the torsion bar. Raise the torsion bar to permit the removal of the block.

To install a shunt block

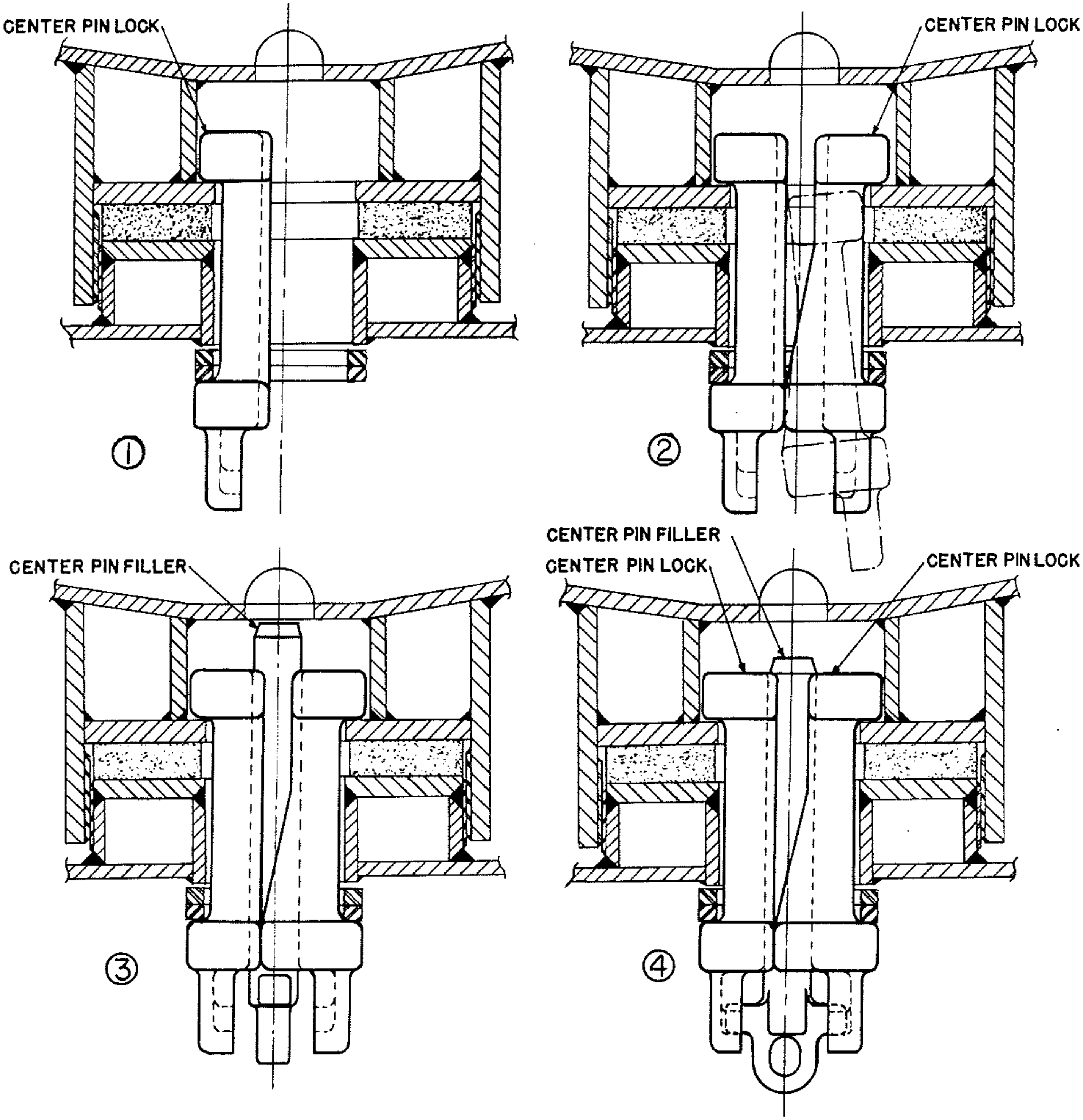
Raise the torsion bar sufficiently to allow the positioning of the block. Care must be taken to see that the block is in position with the holes for the cable attachment at the proper end. Lower the torsion bar into the yoke and apply the cotter key. Apply cable terminal and tighten the nuts securely. Peen the end of the bolt over the nut.

Tighten the adjusting eye bolt nut to obtain the required pressure on the shunt block as outlined under "Inspection and Adjustment."

13. CENTER PIN

Description

The center pin is a three piece interlocking type inserted through an opening at the underside of the truck bolster. For instructions for removal and installation see Fig. 5.



DIRECTIONS FOR APPLYING CENTER PIN.

1. INSERT LOCK IN BOLSTER OPENING.
2. INSERT THE OTHER LOCK IN OPENING.
3. INSERT CENTER PIN FILLER BETWEEN THE TWO LOCK CASTINGS.
4. ROTATE THE CENTER PIN ONE QUARTER TURN (90°). SHOULDERS OF FILLER WILL ENTER OPENINGS IN LOCK CASTINGS. FILLER IS THEN DROPPED INTO POSITION IN POCKETS PROVIDED IN LOCK CASTINGS.

TO REMOVE CENTER PIN, REVERSE ABOVE PROCEDURE.

FIG. 5

SECTION 4

HANDBRAKE

DESCRIPTION

There is one handbrake per car, located on "B" end and mounted on a collision post inside of the vestibule.

This handbrake is a Peacock 24" lever type operating on one brake disc on each axle of the truck on the "B" end of the car. It is designed for 25% breaking of the loaded weight of the car.

The handbrake chain operates through a series of sheave wheels and is attached to an operating rod and lever assembly. The operating rod has a maximum movement of 13 inches and is equipped with a release spring.

SETTING HANDBRAKE

To set the handbrake it is only necessary to operate hand lever upward (pumping action) until the brake it set. It is not necessary to manipulate the trip lever in any way while handbrake is being set.

RELEASING HANDBRAKE

To release the handbrake, return hand lever to its retainer spring clip, push the hand lever as far back as it will go and leave there, but do not push against handle with the foot as this retards the releasing action. Then pull upward and outward on the trip lever, holding it only until the chain weight and its rubber snubber come up against bottom of brake housing. If chain weight and its rubber snubber do not return up to bottom of housing, reset the handbrake and repeat release.

VISUAL CHECK FOR FULL RELEASE

Car should never be operated with handbrake partially applied. To insure this, all operating personnel should make sure the chain weight and its rubber snubber are up against the bottom of the housing. If not, the handbrake should again be fully set and then released.

SCREWS, NUTS, BOLTS, ETC.

Handbrakes should be periodically inspected for, and all loose screws, nuts or bolts should, of course, be tightened. EXCEPTION — Hand lever adjusting screw, located in the front edge of the hand lever near the top, should not be turned except as outlined in the following paragraph.

HAND LEVER CLEARANCE

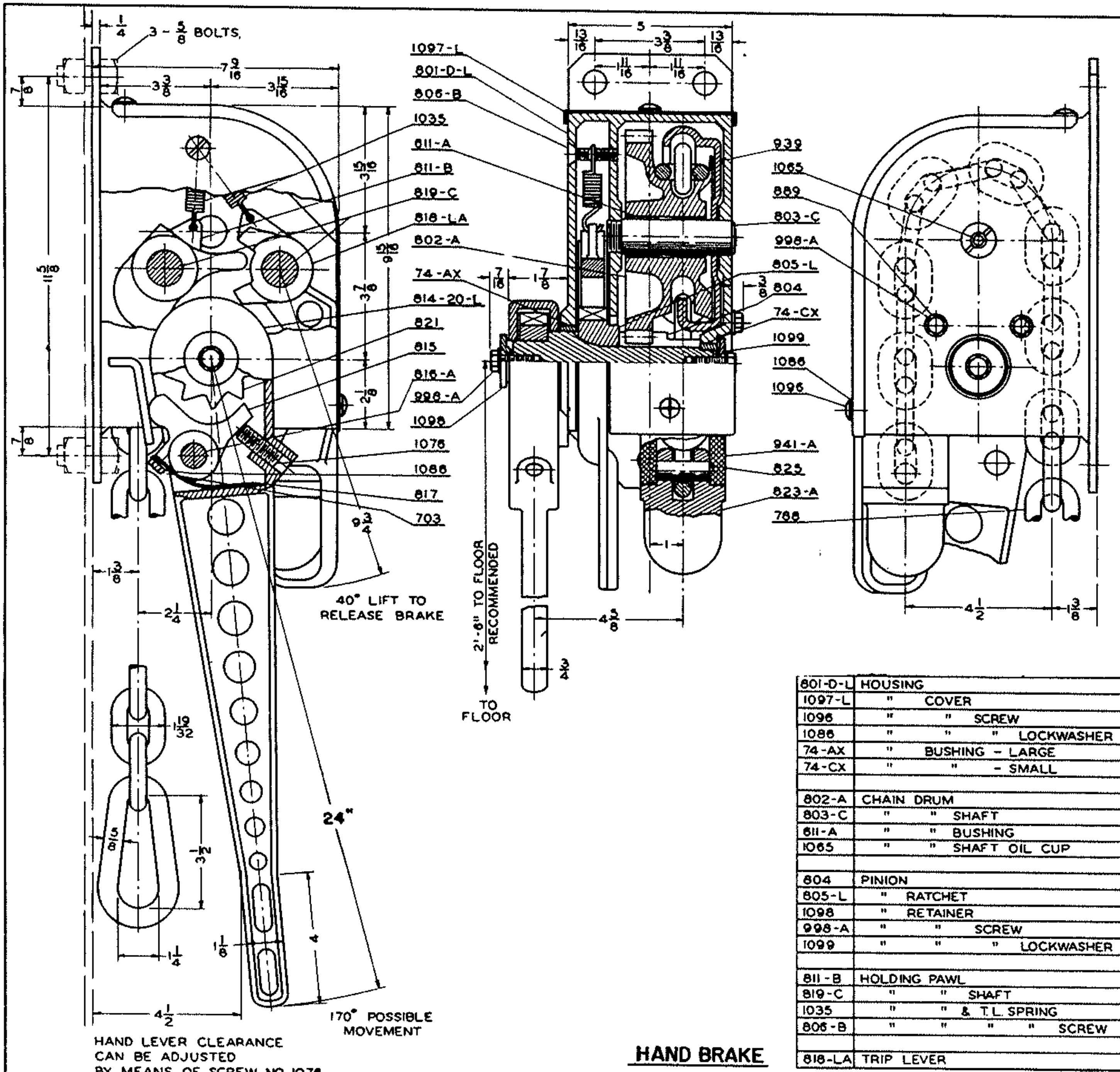
All late models are equipped with a hand lever adjusting screw located in the front edge of the hand lever near the top, which by turning, adjusts the hand lever clearance between the handle and the nearest part of the car structure. Turning this screw clockwise increases the clearance and counterclockwise decreases it. It will seldom, if ever, be necessary to move this screw. However, should it be necessary, the screw should be respiked by center punching the threads into the slot extending across the head of the screw.

REPLACEMENT OF CHAIN

See Figure 3.

LUBRICATION

All rotating or moving parts should be periodically lubricated, (See Budd Rail Diesel Car Lubrication and Fuel Chart). Length of time between lubrications will depend on use of the handbrake, operating conditions, climate, etc., but, in any event, lubrication should be attended to at the same time periodic inspection and attention as given to air brakes as required by A.A.R. rules.



GENERAL DATA

WEIGHT - MALL & STEEL CONSTR.
24" HAND LEVER - 75 LBS

GEAR RATIO — 5:1

CHAIN TRAVEL — UNLIMITED

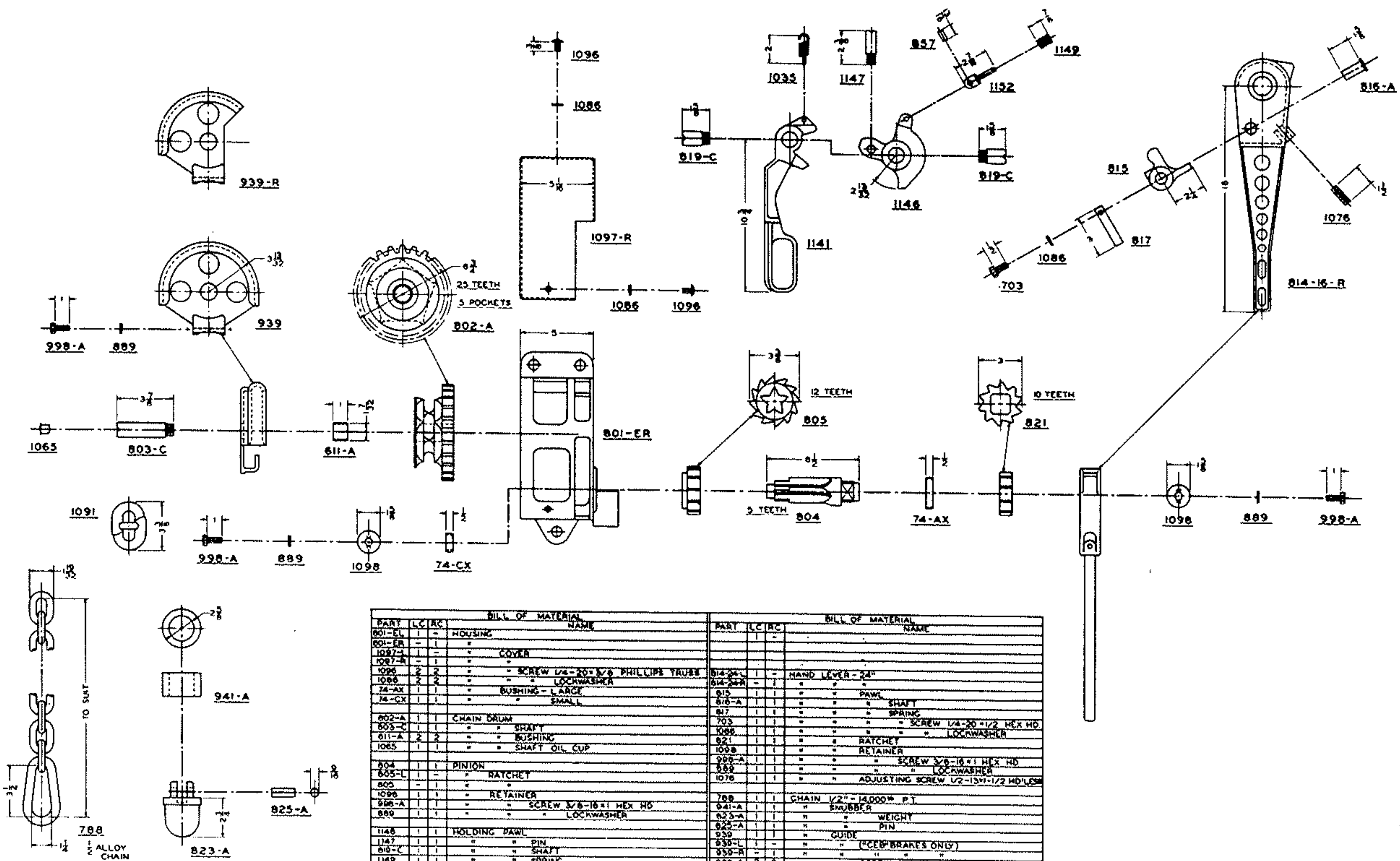
FORCES

	HAND LEVERS		
THEORETICAL	16"	20"	24"
A.A.R.	3600#	4720#	5840#
ACTUAL-125# ON HANDLE	3000#	3800#	4180#
ACTUAL-BY AVERAGE MAN	3800#	4900#	6000#

801-D-L	HOUSING	819-C	TRIP LEVER SHAFT
1097-L	" COVER		
1096	" " SCREW		
1086	" " " LOCKWASHER		
74-AX	" BUSHING - LARGE	814-24-L	" " 24"
74-CX	" " - SMALL	815	" " PAWL
		816-A	" " " SHAFT
802-A	CHAIN DRUM	817	" " " SPRING
803-C	" " SHAFT	703	" " " " SCREW
811-A	" " BUSHING	1086	" " " " " LOCKW'R.
1065	" " SHAFT OIL CUP	821	" " RATCHET
		1098	" " RETAINER
804	PINION	998-A	" " " SCREW
805-L	" RATCHET	1099	" " " " LOCKW'R.
1098	" RETAINER	1076	" " ADJUSTING SCREW
998-A	" " SCREW		
1099	" " " LOCKWASHER	788	CHAIN 1/2" - 14,000# P.T. x 8'-0" O.A.
		941-A	" SNUBBER
811-B	HOLDING PAWL	823-A	" " WEIGHT
819-C	" " SHAFT	825	" " PIN
1035	" " & T.L. SPRING	939	" GUIDE
806-B	" " " " SCREW	998-A	" " SCREW
		889	" " " LOCKWASHER
818-LA	TRIP LEVER		

HAND BRAKE

FIG. I



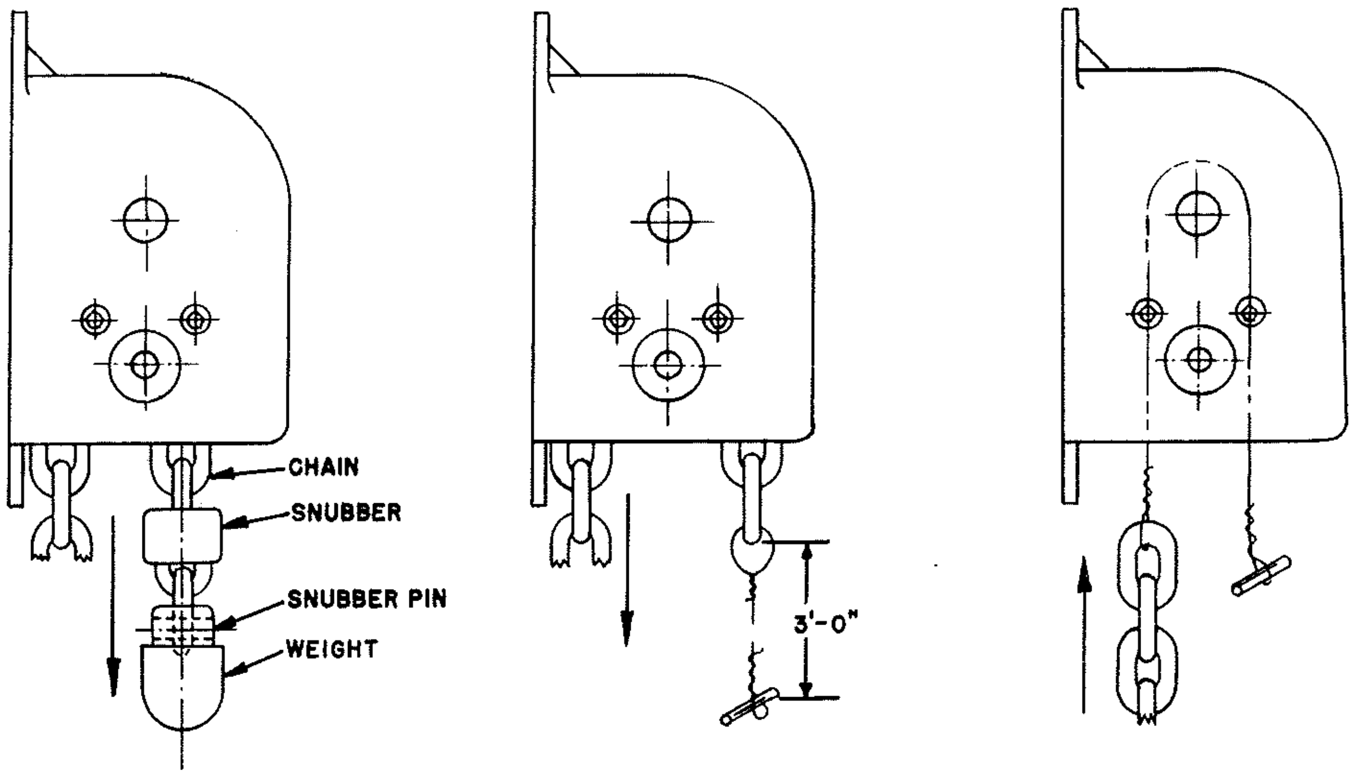
PART	LC	RC	BILL OF MATERIAL NAME
801-EL	1	–	HOUSING
801-ER	–	1	"
1097-L	1	–	" COVER
1097-R	–	1	" "
1096	2	2	" " SCREW 1/4-20×3/8 PHILLIPS TRUSS
1086	2	2	" " " LOCKWASHER
74-AX	1	1	" BUSHING - LARGE
74-CX	1	1	" " SMALL
802-A	1	1	CHAIN DRUM
803-C	1	1	" " SHAFT
611-A	2	2	" " BUSHING
1065	1	1	" " SHAFT OIL CUP
804	1	1	PINION
805-L	1	–	" RATCHET
805	–	1	" "
1098	1	1	" RETAINER
998-A	1	1	" " SCREW 3/8-16×1 HEX HD
889	1	1	" " " LOCKWASHER
1146	1	1	HOLDING PAWL
1147	1	1	" " PIN
819-C	1	1	" " SHAFT
1149	1	1	" " SPRING
1152	1	1	" " " SPINDLE
857	1	1	" " " " PIN
1141	1	1	TRIP LEVER
819-C	1	1	" " SHAFT
1035	1	1	" " SPRING

PART	LC	RC	BILL OF MATERIAL NAME
	1	–	
814-24-L	1	–	HAND LEVER - 24"
814-24-R	–	1	" " "
815	1	1	" " PAWL
816-A	1	1	" " " SHAFT
817	1	1	" " " SPRING
703	1	1	" " " " SCREW 1/4-20×1/2 HEX HD
1086	1	1	" " " " " LOCKWASHER
821	1	1	" " RATCHET
1098	1	1	" " RETAINER
998-A	1	1	" " " SCREW 3/8-16×1 HEX HD
889	1	1	" " " " LOCKWASHER
1076	1	1	" " ADJUSTING SCREW 1/2-13×1-1/2 HD'LESS
788	1	1	CHAIN 1/2" - 14,000# P.T.
941-A	1	1	" SNUBBER
823-A	1	1	" " WEIGHT
825-A	1	1	" " PIN
939	1	1	" GUIDE
939-L	1	–	" " ("CEB" BRAKES ONLY)
939-R	–	1	" " " " "
998-A	2	2	" " SCREW 3/8-16×1 HEX HD
889	2	2	" " " LOCKWASHER
1091	1	1	JOINER

PATENTED AND PATENTS PENDING

HANDBRAKE PARTS

FIG. 2



SKETCH Nº 1. SKETCH Nº 2. SKETCH Nº 3.

REMOVING CHAIN

1. PULL DOWN WEIGHTED END OF CHAIN.
2. SLIDE RUBBER SNUBBER UP CHAIN AS SHOWN IN SKETCH Nº 1.
3. REMOVE CHAIN SNUBBER PIN.
4. ATTACH PIECE OF BALE WIRE APPROXIMATLY 3 FEET LONG TO LOOSE END OF CHAIN WITH A LOOP OR OTHER MEANS OF PREVENTING THE WIRE FROM PASSING THROUGH THE HOUSING.(SEE SKETCH Nº 2.)

REAPPLYING CHAIN (SEE SKETCH Nº 3.)

1. PULL DOWN ON CHAIN UNTIL WIRE HANGS EVENLY ON BOTH SIDES OF DRUM AS SHOWN.
2. DISCONNECT WIRE FROM OLD CHAIN AND ATTACH TO NEW CHAIN.
3. PULL DOWN HANDLE END OF WIRE AT THE SAME TIME ASSISTING THE OPERATION BY RAISING CHAIN UP AND STARTING IT THROUGH THE HOUSING. CONTINUE THIS OPERATION UNTIL CHAIN HAS BEEN DRAWN ENTIRELY THROUGH HOUSING AND HANGING AS SHOWN IN SKETCH Nº 1.
4. SLIDE SNUBBER UP CHAIN.
5. ATTACH WEIGHT BY INSERTING PIN.
6. SLIDE SNUBBER DOWN OVER THE END OF THE WEIGHT AND CONNECT THE FAR END OF CHAIN TO BRAKE RIGGING.

METHOD OF CHANGING CHAINS

FIG. 3

SECTION 5

COUPLERS, DRAFT GEAR, BUFFER SILLS AND WALKWAY PLATES

DESCRIPTION

The couplers are AAR type H short shank supported vertically by a carrier assembly provided with 3 coil springs. Each spring is seated in a pocket in the end under frame. (See Fig. 1.)

The uncoupling mechanism operates from one side of the car only and is accessible at the left hand side when facing the end of the car.

A draft gear of the Waugh type is provided with each coupler and consists of five Waughmat units in the buff section and six units in the draft section. Each Waughmat unit is made up of a steel plate and two rubber mats; a mat attached to each face of the steel plate. Each unit is then separated by a steel dividing plate. (See Fig. 1.)

A buffer sill mounted on spring loaded, rubber bushed, side stems, is located at each end of the car. The spring pressure applied against the spring retainer, causes the buffer sill to extend in an outward direction.

A sliding foot plate is hinged from the outer edge of the buffer sill assembly.

A walkway plate having an anti-slip surface, with one end hinged to the threshold and the other end bearing on the top of the sliding foot plate, is provided at each end of the car.

ADJUSTING COUPLER HEIGHT

The couplers should be adjusted so that the distance between the centerline of the coupler and the top of the running rail is between 34 and 35 inches.

To make this adjustment, check that there is no binding at the truck pedestals or elsewhere. Jack up the coupler until sufficient clearance is obtained between the coupler shank and the wear plate of the coupler carrier assembly. Pry up the carrier wear plate and insert a shim. Shims are available in 1/8, 1/4, and 1/2 inch thicknesses.

Remove the jack and recheck the coupler height.

REPLACING COUPLER CARRIER SPRINGS

1. Remove the coupler.
2. Compress the coupler carrier by means of a jack.
3. Remove the two coupler stop lugs.
4. Release the pressure on the coupler carrier and remove the jack.
5. Remove the coupler support assembly and springs.

To install springs, reverse the above procedure.

When coupler carrier is dismantled check the free height of each coil spring. The free height should be 8 inches. If found to be less tan 7-27/32 inches, the spring must be replaced.

REMOVING AND INSTALLING WAUGHMAT TWIN CUSHION

For method of removing and installing Waughmat twin cushion see Fig. 1.

INSPECTION OF BUFFER SILL ASSEMBLY

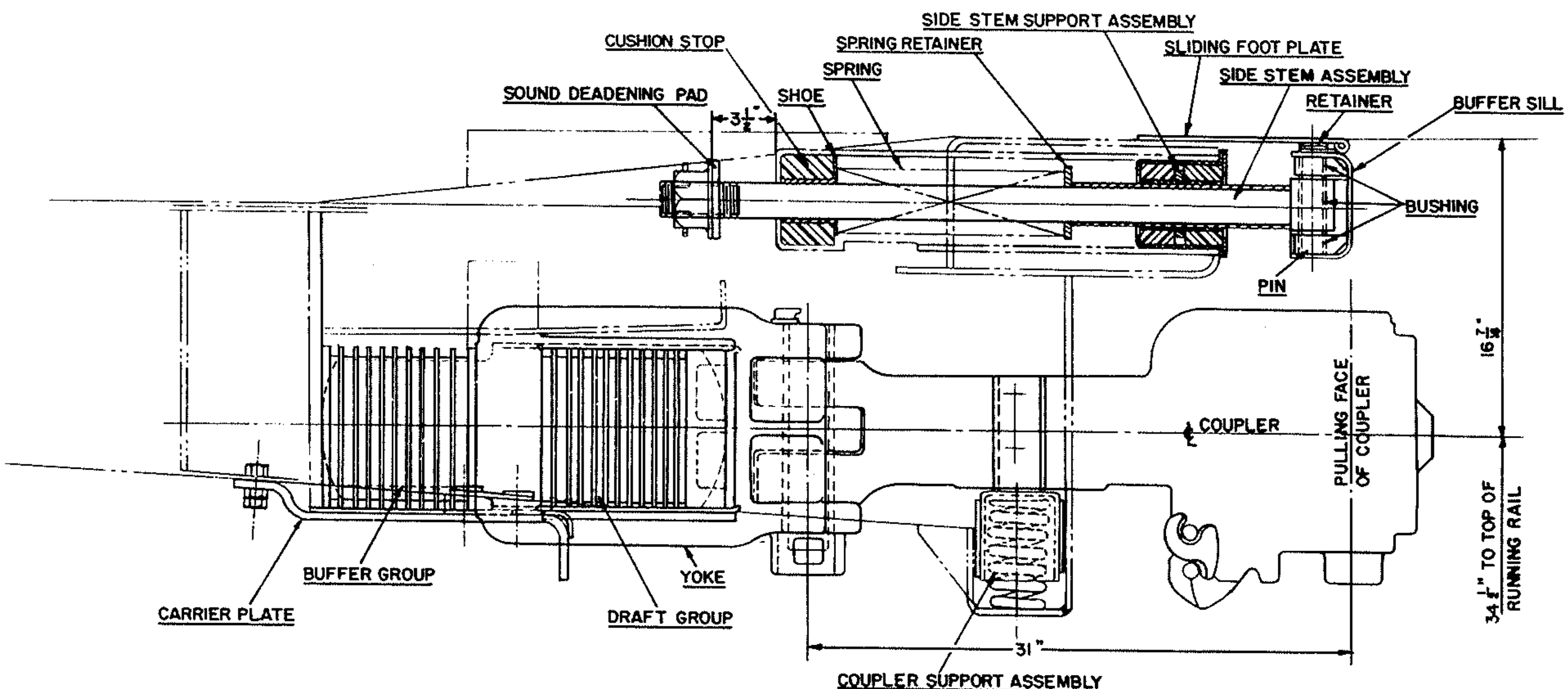
The top surface of the sliding foot plate must be 16-7/16 inches from the centerline of the coupler, when the centerline of the coupler is 34½ inches above the top of the running rail. (See Fig. 1.)

If any variation in the height of the buffer sill requires an adjustment, dismantle and inspect the unit as follows:

1. Compress the buffer sill assembly.
2. Remove the cotter keys, slotted hex. nuts and sound deadening pad.
3. Remove the four hex. head bolts and lockwashers which retain each support assembly.
4. Gradually release the compression from the buffer sill assembly to release the pressure from the side stem springs.
5. Slide the buffer sill assembly forward and remove from the car.
6. Remove the support assemblies, spring retainers, and springs.
7. Remove shoes and cushion stops.
8. Clean and examine all metal parts for excessive wear and rubber parts for distortion.
9. Clean and inspect side stem springs for 17.50" free height.
10. Remove side stems from the buffer sill as follows:
    a. Lift the hinged foot plate to expose side stem pin retainers.
    b. Remove retainers.
    c. Drive out side stem pins.
    d. Clean and examine pins and bushings for excessive wear. Replace any worn parts.

REINSTALLING BUFFER SILL ASSEMBLY

1. Apply a *light* coat of lubricant to all pins, bushings, wear surfaces of side stems and inside diameter of the support assemblies and shoes.
2. Place side stems into the buffer sill and insert side stem pins.
3. Apply the side stem pin retainers and securely tighten the attaching bolts.
4. Slide the support assemblies, with the bolting flange toward the buffer sill, onto the side stems. Slide the spring retainers and springs onto the side stems.
5. Apply the shoes to the cushion stops and insert in the side stem pockets in the end underframe. The shoe flange must be positioned as shown in Fig. 1.
6. Insert side stems into the end underframe.
7. Apply pressure while guiding the side stems through the openings in the shoes.
8. Apply the sound deadening pad and turn the slotted hex. nut onto the side stem several turns.
9. The two support assemblies are contoured on one side to compensate for angling. This side is indicated by the arrows stenciled on the face of the back plate. Position the support assemblies with the arrows pointing toward the centerline of the car. Apply the eight hex. head bolts and lockwashers and securely tighten.
10. Position the face of the buffer sill to the pulling face of the coupler and adjust the slotted hex. nuts to the 3½ inch dimension as shown on Fig. 1. Insert the cotter keys and spread the ends.



REMOVAL OF TWIN CUSHION

1. REMOVE COUPLER FROM YOKE.
2. PLACE A WOOD PLANK UNDER BUFF GROUP & A PLANK UNDER DRAFT GROUP YOKE WITH CAR JACKS FOR SUPPORT.
3. REMOVE CARRIER PLATE.
4. LOWER JACK UNDER BUFF GROUP FIRST.
5. LOWER JACK UNDER DRAFT GROUP.

INSTALLATION OF TWIN CUSHION

1. ASSEMBLE DRAFT GROUP UNIT IN YOKE, PLACE UNDER POCKET AND JACK IN POSITION SO THAT FOLLOWER CONTACTS FRONT STOPS.
2. ASSEMBLE BUFF GROUP UNDER THE REMAINING PORTION OF POCKET AND JACK IN POSITION, IF GROUP IS LOOSE SHIM TO SUIT.
3. ATTACH CARRIER PLATE.
4. REMOVE JACKS UNDER BOTH GROUPS.
5. ATTACH COUPLER TO YOKE.

BUFFER SILL AND DRAFT GEAR

FIG.1

SECTION 6

MAIN PROPELLER SHAFT

Power is transmitted from the engine to the axle gear unit, by means of a propeller shaft. This shaft, as shown in Fig. 1, is of tubular construction with a Universal joint on each end. A twelve bolt flange is provided on each end for attachment to the engine and axle gear unit flanges. The bolts are special and should ***NEVER*** be replaced with a substitute.

The tubular portion of this propeller shaft is of special construction having a rubber insert to absorb the shocks inherent to a drive of this type. This rubber insert can be inserted and removed only with special tools and equipment, so in the event of its failure, the complete shaft should be returned to the Spicer Manufacturing Div., Dana Corporation, for repairs.

A spline (slip joint) is provided on one end together with seals and grease retainers.

The shaft should be installed with the slip joint at the axle gear unit. This makes the lubrication fitting most accessible so as to insure proper lubrication. Also, this arrangement allows the smooth tubular section to rotate and angle in the rubber sealing member of the engine casing.

LUBRICATION

The slip joint and each journal cross is equipped with a Zerk fitting. The slip joint and Crosses should be lubricated as specified in The Budd Company Rail Diesel Car Lubrication and Fuel Chart. Failure to maintain proper lubrication in these units will cause an early failure of joint and bearings.

A Relief Valve assembled to the central chamber of the Journal Cross prevents damage to the oil seals or gaskets when extremely high pressure is used to force in the lubricant. The Relief Valve also serves as an indicator to show when the joint is completely filled.

DO NOT USE GREASE in Needle Bearing Joints as grease will clog the oil passages.

SERVICE INFORMATION

Main propeller shaft needle bearing joints are simple in construction, easily removed from the car, readily disassembled and reassembled without the use of any special tools or any special mechanical knowledge. Repair kits of parts are available. See Page 3.

1. REMOVAL FROM THE CAR

Main propeller shafts are removed as complete assemblies by removal of the Companion Flange Bolts, Nuts and Lockwashers, which allow the assemblies to slip out from between the Companion Flanges.

2. REMOVAL OF THE SLIP JOINT

(a) Unscrew the Dust Cap from the Sleeve Yoke and slide the Joint off from the Propeller Shaft.

(b) Arrow Marks — Make sure arrow marks are stamped on the Shaft and Sleeve Yoke before removing the Slip Joint. If arrow marks are not readily seen, mark both members so that when reassembled they will be in exactly the same relative position, as the Sleeve Yoke Lugs must be in the same plane as the Stub Ball Yokes to prevent excessive vibration in operation.

3. DISASSEMBLING UNIVERSAL JOINT

Bearing Cap Construction

(a) Lock Strap — Bend down the locking lugs with a screwdriver and remove the Cap Screws and the Bearing Caps.

(b) Needle Bearings — Remove by first tapping with a soft round drift on the exposed face of the Needle Bearing until the opposite Needle Bearing comes out. Turn the Joint over and tap the exposed end of the Journal Cross until the opposite Needle Bearing is free. Use a soft round drift with a flat face about 1/32" smaller in diameter than the hole in the Yoke, otherwise there is danger of damaging the Bearing.

(c) Journal Cross — Remove by sliding it to one side of the Yoke and tilting it over the top of the Yoke Lug.

4. CLEANING AND INSPECTION

(a) Clean all parts — Use a suitable cleaning fluid. Allow the parts to remain in the cleaner for some time to loosen up any particles of grease or foreign matter. Remove an burrs or rough spots from all machined surfaces.

(b) Needle Bearing — Do not disassemble. Clean with a short stiff brush and blow out with compressed air. Work a small quantity of lubricant, (See The Budd Company Rail Diesel Car Lubrication and Fuel Chart), into each Needle Bearing and turn the Bearing on the trunion to check wear. Replace if worn.

(c) Journal Cross — Because worn Needle Bearings used with a new Journal Cross or new Needle Bearings used with a worn Journal Cross will wear more rapidly making another replacement necessary in a short time, always replace the Journal Cross and four Needle Bearings as a unit.

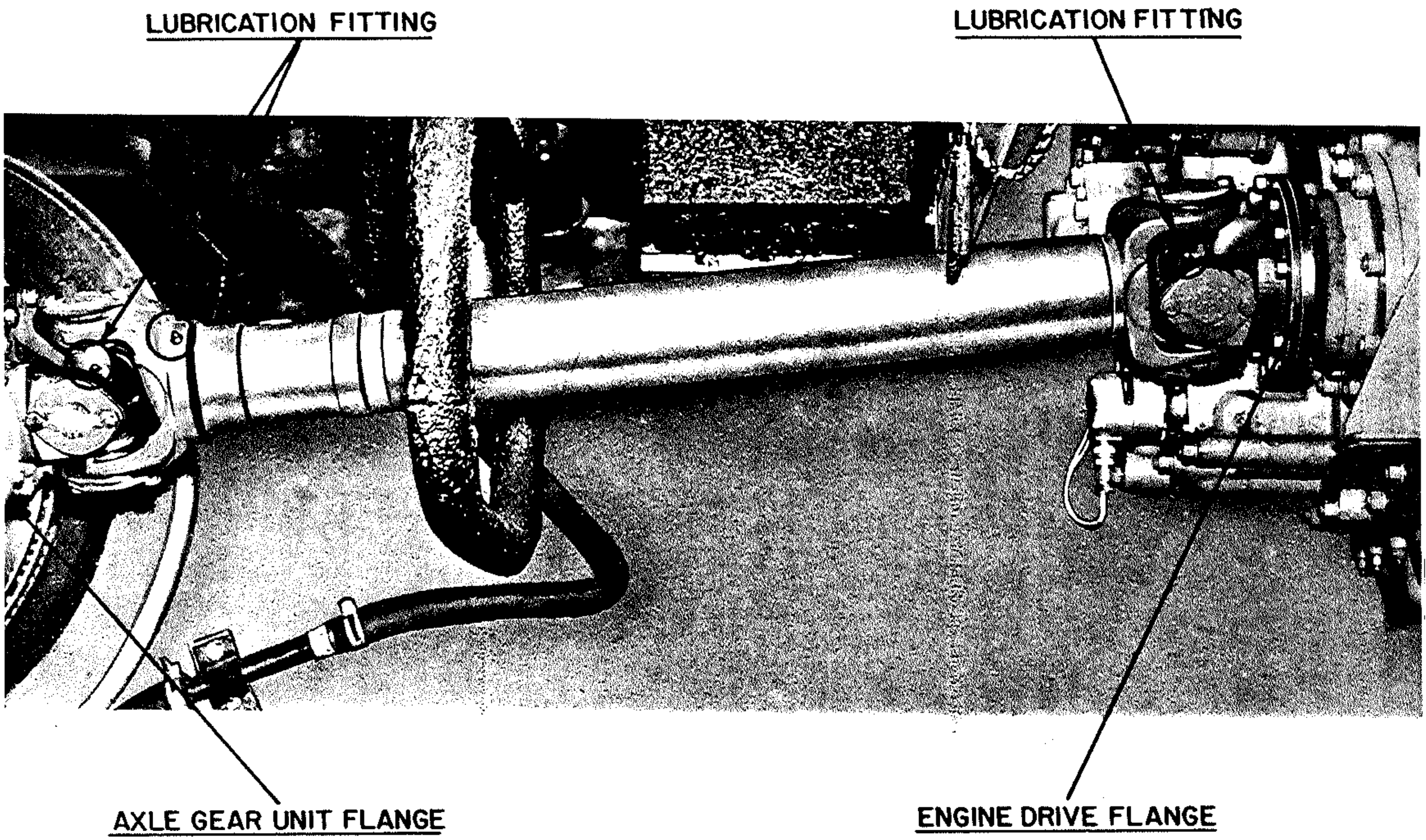
(d) Journal and Bearing Kit — To facilitate the replacement of Journals and Bearings, a Journal and Bearing Kit is available. The use of the Kit insures having the correct individual parts when required and saves valuable time.

5. ASSEMBLING UNIVERSAL JOINT

(a) Gasket — If unnecessary to install a New Kit, make sure four New Gaskets are installed in the Journal Retainers.

(b) Journal Cross — With the Relief Valve facing the Flange Yoke, insert one trunion of the Journal Cross into the bearing hole in the Yoke Lug from the inside between the lugs and tilt until the trunion of the Journal Cross will enter the hole in the opposite Yoke Lug.

(c) Needle Bearing — Insert from the outside of the Yoke. Press into place with an arbor press or tap with a soft round drift so as not to mar any surfaces.



MAIN PROPELLER SHAFT

FIG. I

(d) Bearing Cap — Make sure that the key on the Bearing Cap fits into its keyway on the back of the Needle Bearing. This is ***VERY IMPORTANT.***

(e) Lock Strap and Cap Screws — Assemble and bend the lugs of the Lock Strap up against the flat of the Cap Screw. If the Joint appears to bind, tap the lugs lightly to relieve any pressure of the Bearing on the end of the Journal.

6. ASSEMBLING THE SLIP JOINT ON THE SHAFT

(a) Slip Joint — Lubricate the splines thoroughly, (See The Budd Company Rail Diesel Car Lubrication and Fuel Chart), and assemble on the Shaft. ***BE SURE*** that the arrows or marks on the Shaft and Slip Joint are in line, since the Sleeve Yoke Lugs must be in the same plane as the Stub Ball Yoke Lugs to prevent excessive vibration.

(b) Cork Washer — Renew if necessary before assembling with the Dust Cap and Steel Washer on the Sleeve Yoke.

7. INSTALLING PROPELLER SHAFT

(a) Propeller Shaft Assembly — Place in a pair of centers and check the Shaft for runout. The runout on the Tube should not be more than .020" indicator reading, and on the neck of the Slip Stub Shaft the runout should not be more than .005" indicator reading. Mark the high and low points on the shaft with chalk and straighten if necessary.

(b) Double Flange Yoke Type — Tighten the Flange Bolts evenly after the Nuts and New Lockwashers are in place.

For protection against out of service failures, it is recommended that one or more spare sets of Journal and Bearing Kits Spicer #5-24X be kept on hand.

The Journal and Bearing Kit consists of:

1 — Journal Cross Assembly
4 — Bearing Assemblies
4 — Bearing Caps
4 — Lock Straps
8 — Bearing Cap Screws
1 — Zerk Nipple
4 — Journal Gasket Retainers
4 — Journal Gaskets
1 — Journal Relief Valve

SECTION 7

AXLE GEAR UNIT

CONSTRUCTION

The drive is designed as a self-contained unit in which gear and bearing alignment is not affected by outside factors.

The unit is composed of one set of ground tooth spiral bevel gears mounted on anti-friction bearings in a self-contained housing. All wearing parts are running in a constant bath of oil completely sealed and protected from ballast, dirt, water, snow, etc. Oil channels, baffles, etc., are designed so that all parts receive adequate lubrication with either direction of rotation.

The complete unit is mounted on rubber to reduce shock loading to a minimum. The only metal to metal contact is between the driving splines on the quill of the unit and the axle. The rubber mounts between the axle and quill serve the additional purpose of aligning the unit on the axle.

Torque reaction is taken through an arm attached directly to the large outside diameter of the case and supported in rubber cushion on the truck frame.

QUIETNESS

Spiral bevel gears are used because of their high efficiency and inherent quiet operating characteristics. All gears and bearings are adjusted with precision gauges and fixtures and each unit is tested for noise before being shipped from the factory. No disassembly or additional adjustments are required when mounting the unit on the axle.

MAINTENANCE

A very minimum amount of maintenance is required. The oil level should be checked at reasonable intervals. This is easily and quickly accomplished by removing the filler plug. The same lubricant is used for summer and winter operation and for all localities. Serviceable parts, such as oil seals and rubber mountings, have been so designed that they may be easily replaced under shop supervision when necessary.

AXLE MOUNTING

The gear unit is attached to the axle by rubber mountings on each end of the quill. These are tapered and split to provide a convenient means of assembly, disassembly, and alignment. This rubber acts only as a mounting and the torque is transmitted from the gear unit to the axle shaft by splines in the quill and on the axle. The rubber absorbs shocks and vibrations due to both torque and weight loads and acts as a noise dampener.

TORQUE ARM

The torque reaction of the gears is taken by the torque arm, one end being fastened to the gear housing and the other to the truck center frame. The torque arm is attached to the gear unit by four screws on each side and is attached to the truck center frame support by a torque arm end plate.

SERVICE

Although the Drives require only a minimum amount of attention it is important that all items of service including installation, maintenance and repairs be correctly and promptly made if satisfactory performance and long life is to be assured. These instructions, based on many years of experience and practice, have been carefully prepared as a guide to show what should be done and when and how it should be done to obtain the maximum reliable service from each Drive at the minimum cost.

INSTALLATION

All major units of the Drive have been designed so that they may be completely assembled and all bearing and gear adjustments made, checked, and running tests conducted before leaving the factory. No parts, that might affect the adjustment or performance of any unit, need be disassembled or readjusted when installing under the car.

INSTALLING THE GEAR UNIT

Press one wheel on the axle. Insert the axle through the quill and press the other wheel on. The axle mountings are shipped separate from the gear unit. These are loosely assembled with the rubbers and compression rings in place and the two halves bolted together. The size of the axle center 5½x10 is stamped on the mounting. The halves are mated and the same mating number stamped on each half.

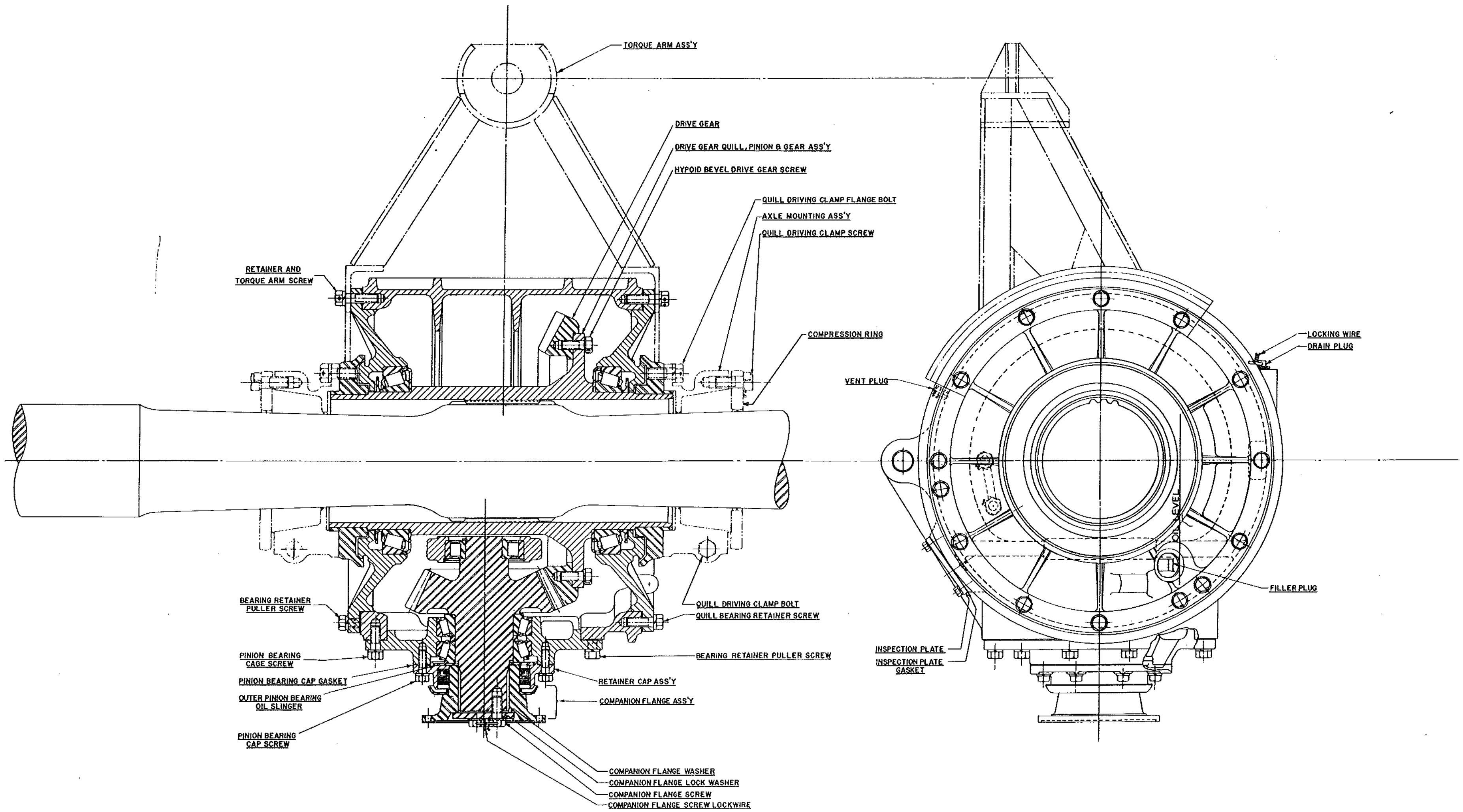
These should be kept mated at all times. The rubber halves have also been selected, mated and marked. Only halves marked with the same number should be used together. Miscellaneous loose parts, such as nuts, screws, cotters, washers, leather shims, etc., are shipped in a bag attached.

Disassemble the mounting parts. Fasten the two halves of the clamp to the quill flange loosely with bolts. Insert the clamp and pull tight. Then tighten the quill flange screws. Before proceeding further, assemble the other clamp to the opposite end of the quill in the same manner.

Insert the rubbers in the clamps at both ends. Center the gear unit on the axle in relation to the wheels. If the unit is too far off center, the rubber mountings will not pull up evenly, as one set will be high on the taper of the axle and the other low on the taper. Block the gear unit against both wheels so that it cannot be shifted off center when applying the remaining parts.

Force the rubbers into the clamps, keeping both halves of the rubber the same distance from the clamp. If there is any space at the ends of the rubbers between the two halves, this space should be filled with leather shims. Apply the compression rings and the compression screws and lock straps, pulling the compression screws up evenly on each end. It is important that both sets be pulled up gradually at the same time. Do not tighten one end ahead of the other. This may best be controlled by using a torque wrench. Tighten each screw one half turn at a time, until an average of *60 ft. lbs.* per screw is reached. At this point, a check should be made to see if the small end of the rubber has bottomed by using a thin narrow shim through the inspection hole. If the rubber does not bottom, either the axle is oversize, or the rubber is too thick and a correction should be made. Do not use grease, oil, rubber cement, or other lubricant on the rubber or axle. If the axle is to be painted, the paint should be approved by our Engineering Department.

If these instructions are carefully followed, the concentricity of the mounting will usually come within .010 total indicator reading (.005 off center), which has proven satisfactory for all general types of service. However, it is desirable to check the concentricity at this point and hold it at least within above limits.



AXLE GEAR UNIT – MODEL 8
FIG. 1

To do this, mount the axle on centers or on the wheel bearings. Hold the gear unit stationary and place indicators against the quill bearing retainer. Rotate the axle, checking the total runout on the indicators. If the concentricity is not within the required limits, this may be controlled when tightening the screws by pulling up more on some than others. Continue to tighten the compression screws until a wrench torque of 90 to 120 ft. lbs. has been reached.

If no torque wrench is available, the torque load on the screws may be controlled by using a 12 or 14 inch wrench. This would correspond to the required torque of 90 to 120 ft. lbs., which is the amount an average man can pull with this size wrench.

The clearance between the compression ring and the clamp should never be less than 1/64 inch at any point. See that all screws, nuts, etc., are properly locked.

The axle may now be applied to the truck in the conventional manner.

Caution: Before operating the drive, be sure the correct lubricant has been added to the gear unit, the universal joints, and the propeller shaft spline in accordance with the instructions concerning correct lubrication.

MAINTENANCE

All units of the Axle Drive have been designed to reduce wear and maintenance to a minimum. This has been made possible by using a small number of moving parts, carburized alloy steel gears and anti-friction bearings. The gears and bearings are running in a constant bath of oil completely sealed and protected from dirt, water, snow and ice. However, there are minor items such as lubrication, oil seals, gaskets, rubber mountings, screws, nuts and washers, that must be maintained in good condition if the major parts are to be protected and the full life of the Drive is to be realized.

The best type of maintenance is preventive maintenance. "An ounce of prevention is worth a pound of cure." Arranging a definite program of inspection and replacing the small parts necessary will prevent excessive wear or possible failure of major parts and assure satisfactory performance and long life of the Drive. Inspection should be made regularly but need not be frequent. Inspection points are few and conveniently located. Minor repairs necessary may be quickly done either under the car, or in the shop.

The general maintenance schedule outlined below was developed to show WHAT should be done and WHEN it should be done to obtain the maximum reliable service from each Drive at the minimum cost. Although this schedule is based on mileage intervals, it may be arranged on a daily, weekly, monthly or trip basis, provided these correspond to the mileage given.

Caution: Propeller Shaft must be disconnected when dropping wheels or jacking up car.

General Maintenance Schedule

*Inspection Period Each 10,000 Miles

Check oil level in the gear unit and add oil if level is below the bottom threads of the filler plug.

Inspection Period Each 60,000 Miles

Drain all lubricant from the gear unit and refill to the correct level with new oil.

Inspection Period Each 120,000 Miles

Drain all lubricant from the gear unit, flush with light flushing oil and refill with new oil. Check oil leakage at pinion oil seal and replace seal, if required.

Remove and clean air vent or replace with new vent. Check wrench torque on axle mounting rubber compression screws and readjust if necessary.

Replace any broken screws, nuts and washers with new.

General Inspection — After the drives have been in use for some time, it is advisable to make a general inspection to locate any parts that may have become worn, loose, or broken; such as rubber mountings, screws, nuts, washers, oil seals, gaskets, bearings, etc. It is not possible to advise any definite period when this should be done as it has been found that when the drives have been correctly installed and maintained in accordance with instructions, they will operate satisfactorily without additional attention over very long periods. If parts are loose or worn, they should be readjusted or replaced with new. In cases of excessive bearing wear, the complete unit should be removed and returned for major repairs.

LUBRICATION

Correct lubrication is undoubtedly the most important item of maintenance in connection with the Drives. If improper lubricants are used, or if the correct oil level or regular periods of inspection and relubrication are not maintained, premature failure of the drive will result. There are only four (4) lubrication points on the complete drive (including propeller shaft), and all are conveniently located for easy inspection and lubrication. The following instructions should be rigidly followed to assure satisfactory performance of the drives:

Gear Unit Lubrication

The spiral bevel gears used with the Drives require a special E.P. (extreme pressure) type of lubricant. This is absolutely necessary as ordinary lubricants are not satisfactory for the gears. See The Budd Company Rail Diesel Car Lubrication and Fuel Chart. No new or repaired drives are shipped from the factory filled with lubricant. Therefore, ***BE SURE*** that the lubricant is added before the drive is put in operation. To do this, remove the filler plug and pour in the lubricant until the level comes up to the bottom threads of the filler plug hole. This will require twenty (20) quarts of lubricant. Do not attempt to overfill as this will result in leakage at the oil seals. If the lubricant is put in before the drive is installed under the car, it is necessary to measure even quarts or support the gear unit in a horizontal position to obtain the correct oil level.

The gears and all bearings are lubricated by the splash or bath method of lubrication, and therefore, it is very important that the correct oil level be maintained at all times. Regular inspection of the oil level should be made each 10,000 miles. If the oil level has dropped below the bottom threads of the filler plug hole, additional oil should be added to bring the level up to the bottom threads.

Extreme care should be taken to prevent dirt entering the open filler plug hole. Filler plug and filler hose or can nozzle should be kept clean. If successive inspections indicate that a rapid loss of oil is occuring, an examination of the oil seals should be made and the seals replaced with new — if necessary.

At each 60,000 miles, the gear unit should be drained of all old oil and completely refilled with new. This not only removes the worn out lubricant, but, also any contamination such as; water, dirt, chips, etc. Do not be alarmed if the old oil drained out appears to be "muddy" or gray as this is caused by the extreme pressure additive used in the oil.

At each 120,000 miles, or at each wheel turning, the old oil should be completely drained and the unit flushed out with a light flushing oil before refilling with new. It is a good plan to rotate the gears and bearings at moderate speed to thoroughly flush them. It is therefore suggested that this flushing be performed when the axle is in the lathe for turning the wheels. It is advisable to first flush with kerosene or benzol and then with the flushing oil. In no case should kerosene or benzol be used without following with the flushing oil. This flushing oil should be of the straight petroleum type. No caustic or alkaline cleaning solutions should ever be used. Old oil from the gear unit cannot satisfactorily be reclaimed. ***USE NEW OIL ONLY.***

OIL LEAKS

If leakage occurs, it is due to some definite reason and the cause should be located and corrected. There is usually a slight seepage of oil indicated by a wetting of the surface around the sealed points. This is only a natural condition and should not be misinterpreted as serious. Leakage that requires attention is indicated by an excessive amount of oil on the surface or thrown on to the car body or truck, or by a rapid consumption of oil in the unit, requiring frequent refilling.

The usual causes of leakage at either the quill or pinion are the overfilling of the gear box with lubricant, or vent plug may be dirty which permits pressure to build up inside the housing. Very often changing to a different lubricant will cause leakage as some lubricants are much more adhesive than others. If leakage continues after checking and correcting these conditions, new oil seals should be installed. (See Repairs).

RUBBER MOUNTINGS

Rubber cannot be compressed but under pressure slowly flows or creeps, gradually reducing the pressure until it is lost entirely and the rubber becomes loose. All the axle mountings used on the Drives have been designed to closely confine the rubber, thereby reducing the creep and loss of pressure to a minimum. However, over long periods of operation some creep and loss of pressure does occur, therefore, the bolts or screws, controlling the pressure on the rubber should occasionally be tightened. A convenient time to do this is when the axle is off the car for re-turning the wheels.

If no additional pressure on the rubber is possible (restricted by metal to metal contact), the rubber should be replaced with new. All mountings must have sufficient pressure between the rubber and the metal so that all movements and deflections are taken internally within the rubber and not by slipping between the metal and the rubber. Rubber also expands and contracts, due to temperature changes, more rapidly than metal. Therefore, unless sufficient pressure is maintained, looseness is more likely to result during cold weather than warm. ANY LOOSENESS WILL CAUSE VERY RAPID WEAR OF THE RUBBER AND PREMATURE FAILURE OF THE COMPRESSION SCREWS.

SCREWS — NUTS — LOCKWASHERS

Screws and nuts are securely locked either by lockwashers or special locking means. However, the excessive vibration under the car may have a tendency to loosen these and therefore, they should be tightened at each wheel turning to torque chart specifications. (See Page 16).

REPAIRS

To be of greatest service to the railroads a method of handling repairs has been adopted which has proven very satisfactory over the many years that the Spicer Drive has been in use. Repairs have been divided into two classes; railway repairs and factory repairs. Railway repairs are those that can readily be made under the car or in the railroad shops and involve only such items as replacing oil seals and rubber mountings. Factory repairs are major repairs that cannot be conveniently made in the railroad shops, but should be returned to the factory. These involve the complete rebuilding of the major units requiring close adjustment of gears and bearings. This arrangement of handling repairs has shown the following advantages and the reduction of maintenance for the railroads.

a. Assures continued long life and excellent performance of drive.

b. Eliminates the necessity of a large investment for assembling and testing equipment by the railroads. The gears and bearings cannot be satisfactorily adjusted for long life and quietness without the use of extensive fixtures, gauges, and testing equipment costing several thousand dollars.

c. It makes it unnecessary for the railroads to carry a large inventory of repair parts.

d. Repairs can be made promptly at the factory where the necessary parts, assembling and testing equipment, and experienced mechanics are available.

e. Latest improvements both in design and materials can usually be incorporated when the repairs are being made.

f. For convenience of maintenance during the development and improvement of the Drive, all completely assembled units have been kept interchangeable. However, it has not been possible to keep all the internal parts within these units interchangeable, which would make it difficult for the railroads to make this type of repairs. Gears are in matched sets and bearings selected for press fit.

g. With the long life of the drive, factory repairs are normally required only after long periods of operation.

Railway Repairs

Only the replacing of oil seals and rubber mountings should be attempted in the field. For all other repairs, return unit to Spicer Manufacturing Div., Dana Corp., Toledo, Ohio.

Pinion Oil Seal Replacement

To replace the pinion oil seal, remove the lock wire from the universal joint flange screws and remove. Keep lockwashers on scrcews. Remove companion flange washer. Use puller to pull off companion flange assembly. Remove retainer cap assembly screws and lockwashers. Remove retainer cap assembly. Drive out worn oil seal assembly and gasket from retainer cap. (NOTE: Drive-out holes in retainer cap). Put new gasket back of seal and press in the new seal. Be sure there is a press fit between the seal and the cap, and that the seal edge is facing inward toward the bearing. If the flange is worn, it should be replaced. Reassemble the retainer cap to the pinion bearing cap. Make sure to torque retainer cap screws to chart specifications. With a pusher, push the flange on the pinion spline. These splines should have a press fit. Position the companion flange washer and screw in the companion flange bolts. Be sure to torque screws to chart specifications. Lock screws with lock wire.

Axle Mounting Repairs

Rubber Mounting — When the clearance between the compression ring and the clamp has been reduced below 1/64 inch the rubber should be removed and replaced with new. To do this, first block up the gear unit to support the weight. Next disassemble the mounting by removing screws, lock straps, compression rings and compression rubbers. Keep all parts mated and be sure both halves of the new rubbers are marked with the same mating number. Reassemble the same as described for new installations.

Factory Repairs

Units that should be returned to the factory for repairs include:

a. Gear units in which the gears, bearings or quills are worn or damaged. The maximum allowable end play (wear) of the bearings should not exceed .040 for quill bearings and .015 for pinion bearings.

b. Gear units that require a change in ratio of the gears.

All units returned for repairs are completely disassembled. All of the parts are inspected and replaced where required, then reassembled and tested in the same manner as new units. If any returned unit is so badly damaged that repairs would cost more than 80 per cent of the price of a new unit, the customer will be so advised and it will be recommended that this unit be scrapped and a new one ordered to replace it. No unit will be scrapped without authority from the customer. There is no refund for any material scrapped as the cost of disassembling and inspection is much greater than the scrap value of the parts.

SERIAL NUMBERS

Each gear unit is given an individual serial number. A complete record is kept of each and the full history of each unit is available at all times.

Units returned to the factory for repairs are given a new serial number and a cross reference made to the old so that a complete record of the repairs will also be available. A record of the new serial number is sent to the railroad when the repaired unit is returned.

SPARE UNITS

The quantity of spare units to keep on hand for ready maintenance depends upon the various conditions of each raailroad. Those with few maintenance points require the least amount of spares. It has been our experience that the quantity of spare units required will vary from five to ten per cent of the total number of drives in operation.

TORQUE RANGE CHART

Part	Type	Torque Lb. Ft.
Pinion Bearing Cage Screw	5/8-11NC3 x 1-13/16	115-125
Pinion Bearing Cap Screw	1/2-13NC3 x 1 3/4	90-100
Bevel Drive Gear Screw	5/8-18NF3 x 1 5/8	115-125
Quill Driving Clamp Screw	3/4-16NF3 x 1 7/8	140-150
Quill Driving Clamp Bolt	1 -14NF3 x 6 1/8	175-200
Quill Bearing Retainer and Torque Arm Flange Screw	5/8-11NC3 x 2-5/16	115-125
Quill Bearing Retainer Screw	5/8-11NC3 x 2	115-125
Puller Screw	5/8-11NC3 x 5/8	115-125
Universal Joint Flange Screw	5/8-18NF3 x 1 5/8	115-125

NOTE: The above values are based on dry, unlubricated threads.

SECTION 8

AIR COMPRESSOR

The air compressor is a Westinghouse Air Brake Company Type 3-YC two stage operated in the direction indicated by the arrow on the flywheel, with V-belt drive and provided with flexible connections.

The compressor is equipped with an unloading feature which interlocks with the pressure type lubricating system. When the compressor is operating, oil pressure keeps the unloading valve in a closed position. When the compressor stops and the oil pressure drops, the unloading valve is opened, which removes the load from the compressor. The unloading valve remains in this position until the oil pressure builds up at the next start, thus allowing the motor to pick up full speed before the load is again applied.

If the lubricating oil supply becomes low and the oil pressure drops, the unloading valve remains open and the compressor will not deliver full load. This provides a low oil level protection to the compressor.

For Compressor Lubrication see The Budd Rail Diesel Car Lubrication and Fuel Chart.

The approximate oil capacity of the 3YC compressor is 2⅜ quarts.

The oil filling plug should be removed and the oil level observed weekly. If the oil level is not up to the tapped opening, add sufficient oil to raise level to this opening and replace plug. Never remove the oil plug while the compressor is operating.

Drain, flush and refill crankcase at approximately each 60,000 miles.

The following charts, Figs. 1 and 2, may be used in testing the Westinghouse Type 3YC compressor.

The test may be performed on the car. An orifice (#37 drill) holder or a pipe union containing the orifice should be applied to the drain cock on the second main reservoir. The compressor is then started and when the reservoir gauge shows approximately the required pressure corresponding to compressor speed, the drain cock to the orifice holder is opened.

Comparing the data obtained from the above procedure with that given on the charts, the condition of the compressor can be determined.

Prior to the tests, it should be established that there is no leakage from the main reservoir system and the compressor should be operated long enough to assure that it is at normal working temperature.

A more detailed description of parts, their function and diagnosis of compressor unit ailments, may be found in Service Manual 1D19352-3.5 which may be obtained from Westinghouse Air Brake Company, Wilmerding, Pa.

DRIVE BELTS

The air compressor is driven by four V drive belts which should always be obtained in matched sets. The replacement of these belts should also be made in matched sets. Any good belts removed from old sets may be held for spares.

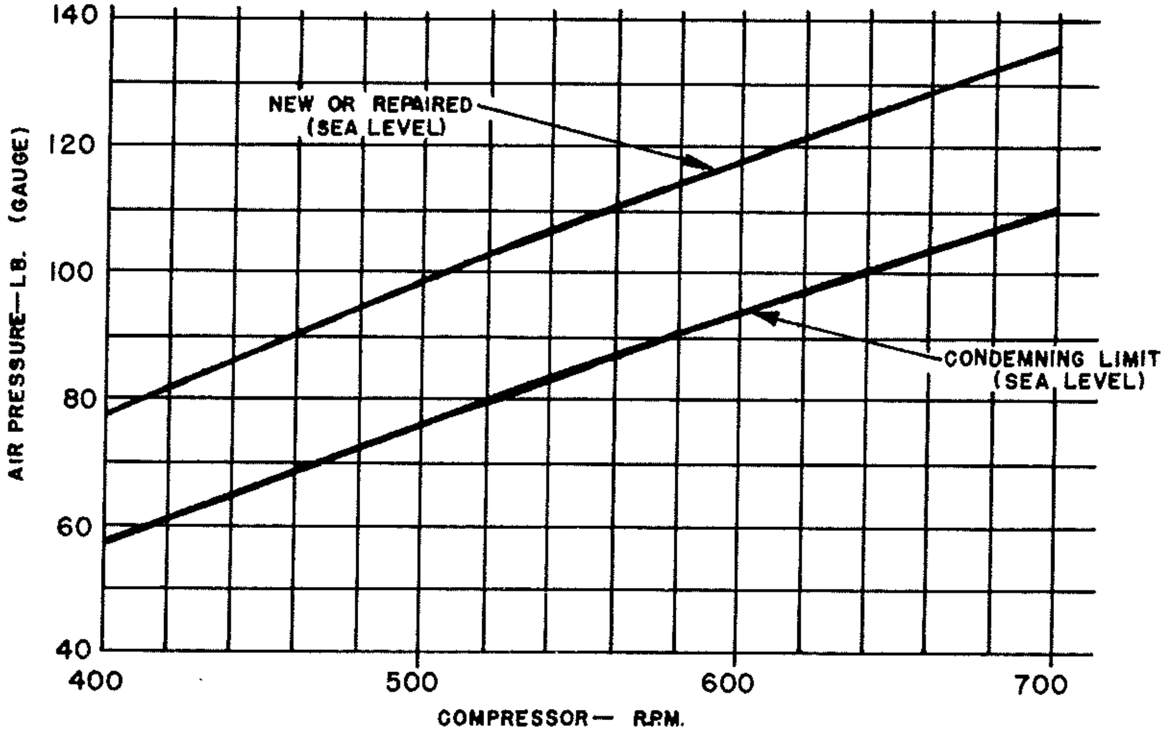
When installing new belts, do not pry the belts over the pulley grooves. Loosen motor adjusting bolt to allow motor to swing toward compressor. Drop the belts into place on pulleys and retighten the motor adjusting screws.

Increase tension on belts until they have a live springy vibration when struck by hand. Do not over-tighten.

Badly worn or chipped pulleys should be replaced as they increase wear on belts.

Check pulleys for parallel alignment as misalignment wears belts and pulley grooves.

The belts required on the RDC'S should have the standard "A" cross-section, ½" wide x 11/32" thick, with nominal outside length of 95" and nominal inside length of 93".



THESE TEST CURVES ARE BASED ON THE FOLLOWING CONDITIONS:

Nº. 37 DRILL (.1040 IN. DIAMETER) ORIFICE WITH SQUARE EDGES BORED THROUGH PLATE 1/16 IN. THICK.

VOLUMETRIC EFFICIENCY OF 75% FOR NEW OR REPAIRED AT 100 LB. AIR PRESSURE AND 60% CONDEMNING LIMIT AT 100 LB. AIR PRESSURE.

RESERVOIR TEMPERATURE 80° F. ROOM TEMPERATURE 70° F.

ATMOSPHERIC PRESSURE 14.7 (SEA LEVEL).

FOR HIGHER ALTITUDES DEDUCT 1% FROM PRESSURES ON CURVES FOR EACH 260 FT. ABOVE SEA LEVEL. SEE ALSO FIGURE 2.

VARIATION FROM THE STATED TEST CONDITIONS WILL CAUSE VARIATION FROM THE GIVEN PRESSURE.

SEE FIGURE 2 FOR INSTRUCTIONS

TYPE 3-YC AIR COMPRESSOR
TEST CHART FOR NEW OR REPAIRED AND CONDEMNING LIMIT
BY ORIFICE TEST METHOD
TWO CYLINDERS, 1 L.P. 5.0 IN. BORE, 3.5 IN. STROKE
1 H.P. 2.5 IN. BORE 3.5 IN. STROKE
TWO STAGE, SINGLE ACTING, AIR COOLED
DISPLACEMENT 25 CU. FT. PER MINUTE
AT RATED SPEED OF 630 COMPRESSOR R.P.M.

REF. W.A.B. CO. T-4640.9-1

FIG. 1

TEST PRESSURES
N°.37 DRILL, .1040 INCH DIAMETER ORIFICE

PRESSURES (P.S.I.) TO BE MAINTAINED AT VARIOUS ELEVATIONS ABOVE SEA LEVEL.

	RPM \ ELEVATION (FT.)	0	1000	2000	3000	4000	5000	6000	7000	8000
NEW OR REPAIRED COMPRESSORS	400	77	74	71	68	65	62	59	56	53
	450	87	84	80	77	74	70	67	64	60
	500	97	93	90	86	82	78	75	71	67
	550	107	103	99	95	91	86	82	78	74
	600	116	112	107	103	98	94	89	85	80
	650	125	120	115	111	106	101	96	91	87
	700	[illegible]	128	123	118	113	107	102	97	92
CONDEMNING LIMIT	400	58	56	54	51	49	47	45	42	40
	450	67	64	62	59	57	54	52	49	46
	500	76	73	70	67	64	61	58	56	53
	550	85	82	78	75	72	69	65	62	59
	600	93	89	86	82	79	75	72	68	64
	650	102	98	94	90	86	82	78	75	71
	700	109	105	101	96	92	88	84	80	75

SEE FIGURE I. FOR ADDITIONAL INFORMATION

REF. W.A.B.CO. 4640.9-IA

ORIFICE TESTS FOR AIR COMPRESSORS
TYPE # 3-YC COMPRESSOR
LIMITING PRESSURES AND SPEED AT SEA LEVEL

FIG.2

SECTION 9

AIR BRAKE

For Instruction Pamphlet on "HSC" Brake Equipment for Budd Self-Propelled Passenger Cars

Write

New York Air Brake Company

420 Lexington Avenue

New York, N. Y.

SECTION 10

HEATING SYSTEM

The Rail Diesel Cars are heated by the engine cooling water as shown in Figs. 1, 2, 3 and 4.

Motor driven pumps are provided that draw water from the engine sump tanks and force it through the heating systems and back to the sump tanks.

The pumps are started and stopped by thermostats to maintain the proper temperature in the car body.

As shown in Fig. 1, in the RDC-1 model, the floor heat pump draws water from the sump tank of the #2 engine circulating system. It is controlled by a 76° floor heat thermostat located under the tenth seat from the "B" end of the car.

The overhead heat pump draws water from the sump tank of the #1 engine circulating system. It forces this water through the overhead heating coil located above the ceiling in the "B" end of the car. The pump is controlled by a 76° thermostat located just above the fifth anemostat from the "B" end of the car. A blower is provided which forces a mixture of recirculated and fresh air through the heating coil and into the overhead duct. This air is then distributed into the car body by means of the anemostats located in the center ceiling panel.

The heating control panel (located in the switch locker) has a switch with five positions: HIGH HEAT, LOW HEAT, OFF, COOL and ANTI-FREEZE. When the switch is in the LOW HEAT position, the car temperature is maintained at approximately 74°. When the switch is in the HIGH HEAT position, the car temperature is maintained at approximately 76°. It is recommended that the HIGH HEAT position be used only when the outside temperature is below 40°.

When the heat switch is in the OFF position, neither pump operates, and as a result, no heat is injected into the car. However, if the overhead blower is kept running, the car will be ventilated. The blower is under control of the master light switch.

The ANTI-FREEZE position is used to provide layover heat when the car is parked in the yards (See Standby Provision, Section 10).

As shown in Fig. 2, in the RDC-2 model, the heating system in the passenger section is similar to that in the RDC-1 model.

Heat is provided in the baggage compartment from the overhead duct and by side wall radiation. A grille located in the partition between the baggage and passenger sections, just over the doorway, is connected to the main discharge duct. This furnishes hot air into the baggage section from the overhead heat coil. In addition, there are two banks of side wall radiation directly connected to the floor heat radiation of the passenger compartment and therefore, are under the control of the floor heat thermostat in that section.

As shown in Fig. 3, in the RDC-3 model, the heating system differs in that the overhead heat coil in the coach section and the fan operated unit heater in the RPO section are connected to the #1 heat pump which is under the control of the coach section overhead heat duct thermostat.

The floor heat radiation in the coach section, the fan operated unit heater in the baggage section and the side wall radiation in the RPO section are connected to the #2 heat pump. This pump is under the control of the coach section floor heat thermostat.

The fan motor of the unit heater in the baggage section is connected to the #2 heat pump motor and is also provided with a THERMO, OFF, MANUAL switch to control the operation.

The fan motor of the unit heater in the RPO section operates according to the temperature selected by the RPO thermostat and a THERMO, OFF, MANUAL switch.

The baggage section also receives heat from the overhead heat duct through a grille in the partition between the passenger section and the baggage section.

As shown in Fig. 4, the RDC-4 baggage compartment heating system consists of a bank of four passes of 1 inch finned radiation 30 inches long mounted on the end wall of the car in the toilet section. In addition, there are two overhead heaters with fans mounted from the ceiling.

The overhead heater toward the "B" end of the car and the finned radiation are connected in series; and then to the #1 heating pump. The remaining overhead heater is connected to the #2 heating pump.

The RDC-4 RPO compartment heating system consists of a bank of four passes of 1 inch finned radiation 17½ inches long mounted on the forward bulkhead under the mail distributing table. At right angles to the above, along the sidewall of the RPO compartment, and in series, is a bank of two passes of 1 inch finned radiation 46½ inches long.

Identical heating systems are applied to both sides of the RPO compartment at the distributing table area. The right side system is connected to the #1 heating pump and the left side system is connected to the #2 heating pump.

On the right side wall of the RPO compartment, extending from the mail distributing table to the side mail door is located a bank of two passes of 1 inch finned radiation 12 feet long. Also, there is a bank of 8 passes of 1 inch finned radiation 23 inches long at right angles and adjacent to the mail door. Both of these units are connected in series and then to the #1 heating pump.

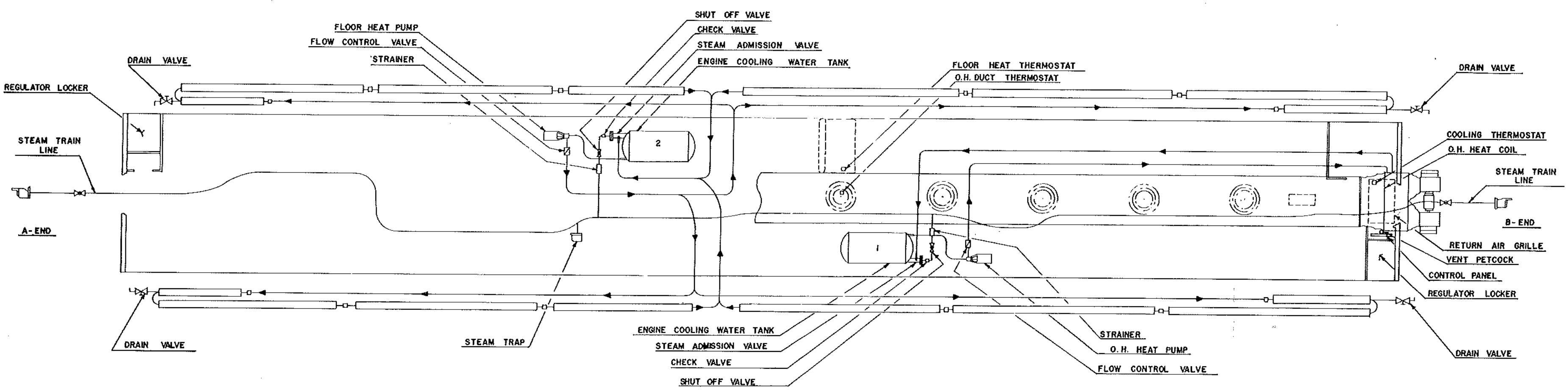
On the left side wall of the RPO compartment, extending from the mail distributing table to the left side mail door is located a bank of two passes of 1 inch finned radiation 12 feet long. Also, there is a bank of 8 passes of 1 inch finned radiation 23 inches long at right angles and adjacent to the side mail door. In addition there is a single pass of 48⅛ inches of finned radiation along the sidewall of the RPO annex and a single pass of 1 inch finned radiation 16 inches long in the annex on the partition adjacent to the regulator locker. The above mentioned left side units are connected in series and then to the #2 heating pump.

In order to prevent false heating, due to Thermo-Syphon action in the car body radiation during the summer season when the cooling system is in operation, a spring check type flow control valve is provided in each of the heating pump outlet lines. This valve is arranged to open due to the pressure developed by the heating pump, but remains closed as long as the heating pump is not running.

STANDBY PROVISION

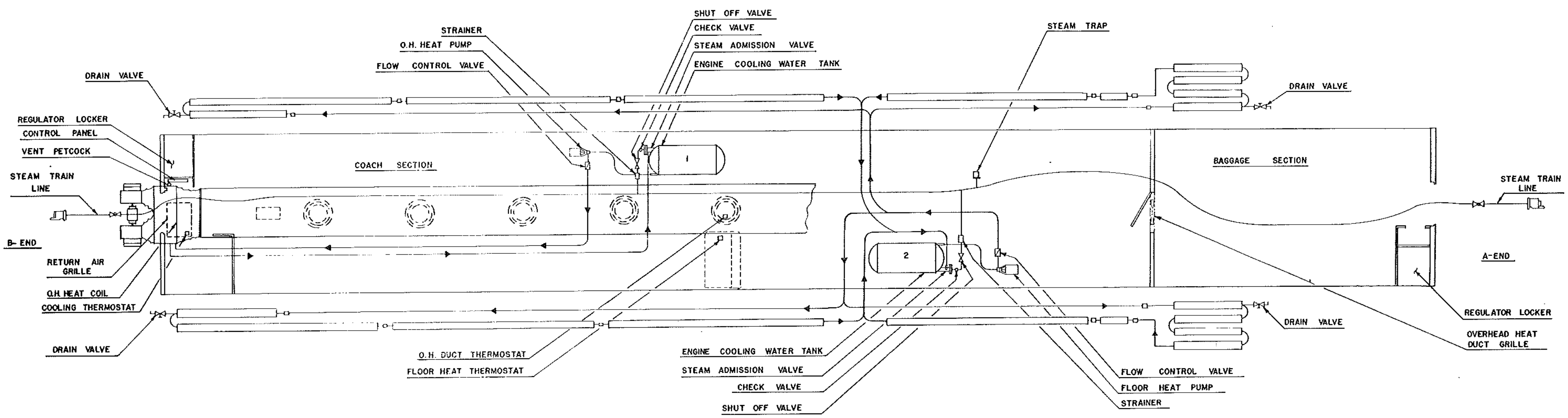
In order to provide car heating and prevent freezing of the engines and their cooling water system when the cars are parked with the engines shut down, a 1½ inch steam trainline is used to provide standby heat. This steam trainline is provided with shut-off valves, either rubber hose or flexible metallic connectors and standard Vapor #312 steam couplers on each end of the car. If the cars are operated in multiple, the steam connections can be made up between cars and it is only necessary to connect steam to the end car.

Steam from this trainline is injected directly into each of the sump tanks through a Vapor #9331 Steam Admission Thermostatic Valve mounted on the immersion heater cover plate at the engine end of the sump tank. (See Fig. 5). The valve is set for 190°.

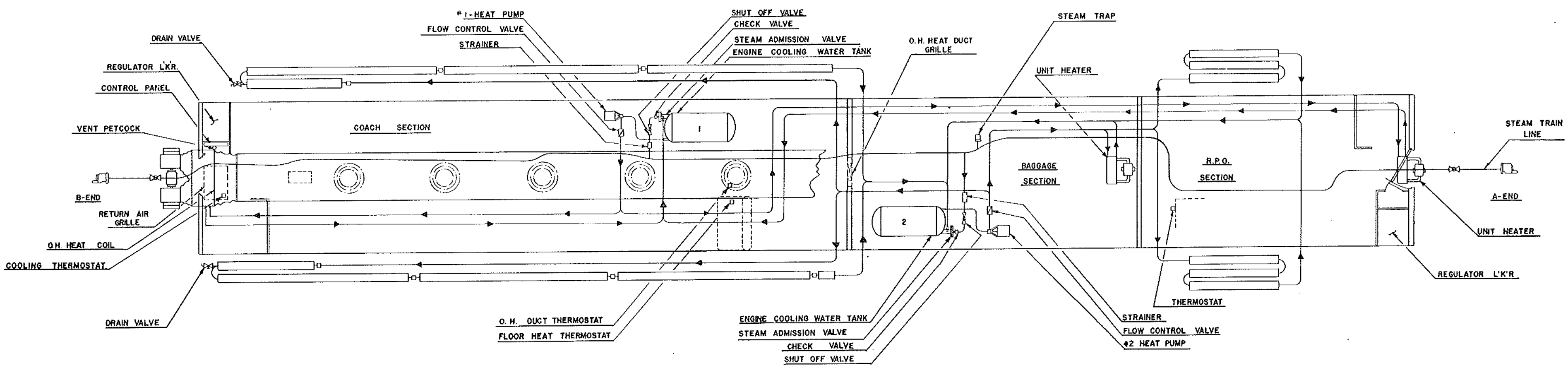


HEATING LAYOUT R.D.C.-I

FIG-I

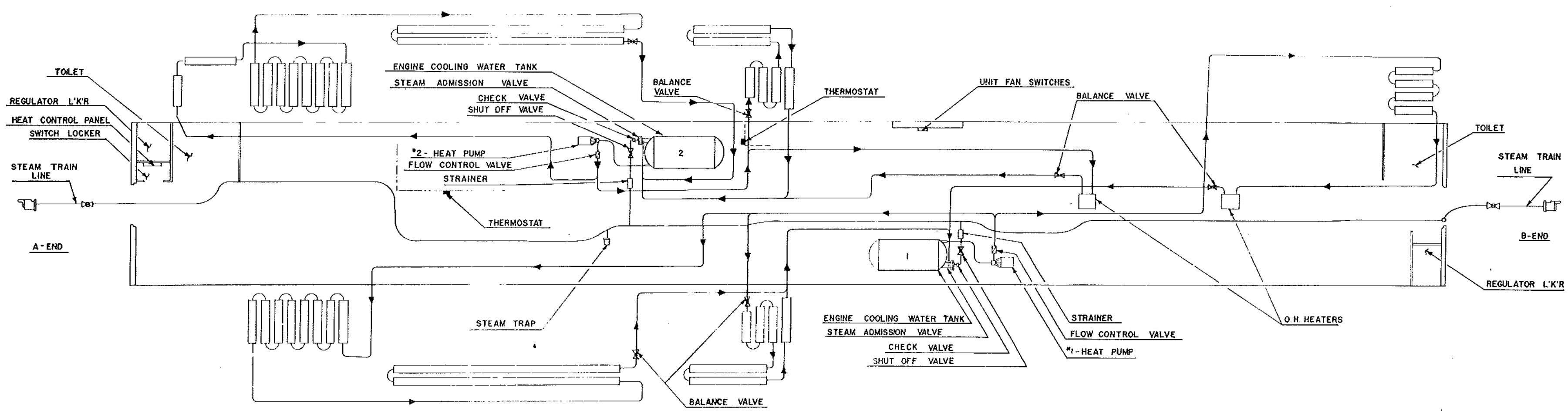


HEATING LAYOUT R.D.C.-2
FIG-2



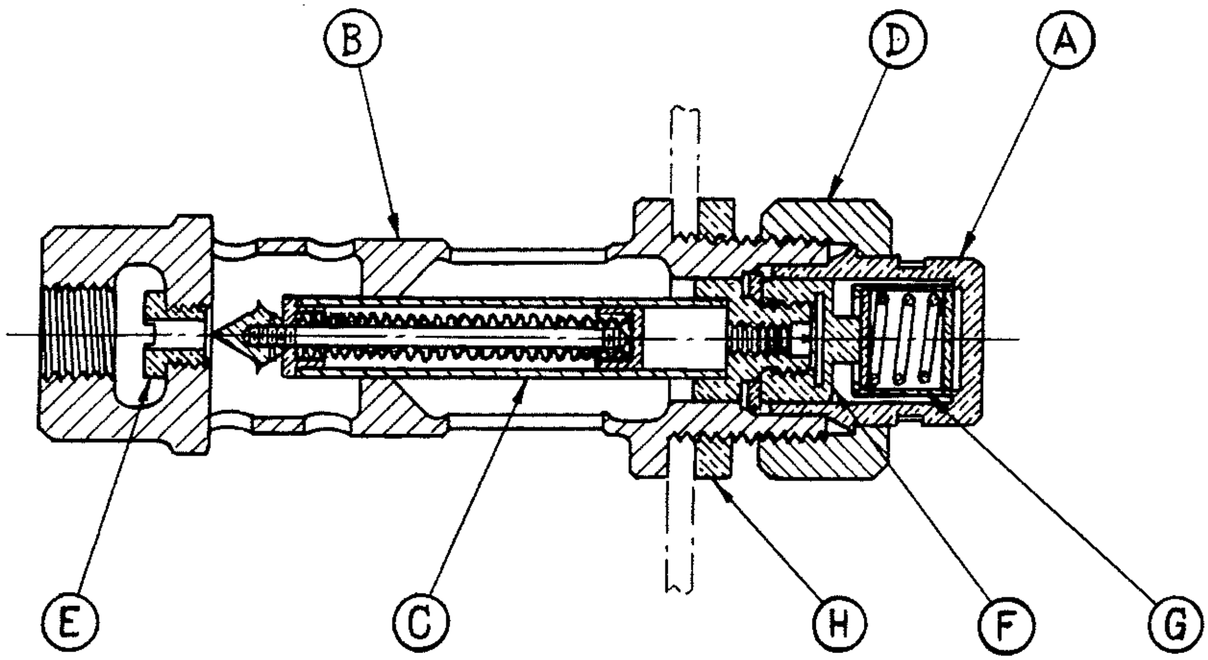
HEATING LAYOUT R. D. C.-3

FIG-3



HEATING LAYOUT R. D. C.-4

FIG-4



LIST OF PARTS	
Sym.	Description
A	ADJUSTMENT HEAD
B	BODY
C	CARTRIDGE ASSEMBLY
D	ADJUSTING NUT
E	SEAT
F	ADJUSTMENT SPACER
G	OVERRIDE SPRING ASSEMBLY
H	LOCKNUT

Adjustment Instructions

Loosen Adjusting nut "D" about one-tenth of a turn and turn adjustment head "A" slowly and a little at a time until the correct position is found. To raise temperature, turn "A" clockwise; to lower turn anti clockwise. When making any adjustment, "A" should be moved only one-sixth of a turn at a time and sufficient time should be allowed after each adjustment to make certain of the resultant temperature change. At least ten minutes should be allowed to establish the true result of the adjustment. After each adjustment, tighten Adjust Nut "D".

If proper results are not obtained by following the above mentioned procedure, the Cartridge Assembly "C" and Seat "E" should be replaced.

The above mentioned procedure should be followed for setting after new parts are installed.

STEAM ADMISSION THERMOSTATIC VALVE
Vapor No. 9331 Temperature Regulator
FIG. 5

Both heating pumps are under control of the layover thermostat and operate at its demand to maintain a temperature of 60° in the car. The circulation of water together with Thermo-Syphon action in the engines prevents freezing of any part of the engine cooling system or car heating system. It also keeps the engines at a temperature which permits quick and easy starting.

The blower on the overhead heat coil should be shut down during the layover period. A separate blower switch is provided on the heating and cooling control panel and is under control of the master light switch.

PROCEDURE FOR APPLYING STEAM TO RDC-1 AND 2

Steam Layover Protection

1. Check the heating and cooling control panel (located in the switch locker at the "B" end of the car) to see that the Selector switch is in the ANTI-FREEZE position and the blow switch is in the OFF position.

2. Turn off all lights in the car by tripping the master switch at the top of the switch panel.

3. Check that the hand valves ahead of the #9331 Steam Admission Thermostatic Valves (located in the supply lines to each sump tank) are in the open position.

4. Check that the water level in both Engine sump tanks is between the upper two try-cocks.

5. Plug in a source of 64 volts battery charge. ***CAUTION:*** Be sure both engines have been shut down before the plug has been inserted. ***DO NOT*** start either engine without first pulling the battery charge plug.

6. Couple one end of the steam trainline to yard steam and open the end train pipe valve.

7. Open the end train pipe valve on the opposite end of the car to blow out any condensate; then partly close the valve, leaving a feather of steam blowing out of the coupling.

8. Check for rumble of steam at both sump tanks indicating that steam is entering the water.

9. Check that floor heat and overhead heat circulating pumps operate when car body temperature falls below 60°.

Removing Car from Yard Steam (RDC-1 and 2)

1. When removing car from layover steam protection, close train pipe valve, disconnect yard steam line and then open train pipe valve on opposite end of car to blow out any condensate.

2. Disconnect 64 volt battery charge cable.

3. Check engine water temperature gauge to verify that engine water temperatures are normal before starting engines.

Steam Heating When Being Towed in a Conventional Passenger Train (With Passengers) (RDC-1 and 2)

1. Check that the hand valves ahead of the #9331 Steam Admission Thermostatic Valve (located in the supply lines to each sump tank) are in the open position.

2. Check that the water level in both Engine Sump Tanks is between the upper two try-cocks.

3. Couple the steam trainlines and open the end train pipe valve. If the RDC is being towed between cars, open both end train pipe valves. If being towed as a rear end car, open the forward train pipe valve and partly open rear end train pipe valve to permit a feather of steam to blow out of the coupling.

4. One engine must be operating to provide battery charging. The engine stop and isolation switch (located in the respective regulator locker) must be in the "ISOLATE" position to isolate the engine controls. It is not necessary to "ISOLATE" the shutdown engine from its respective regulator locker.

5. Insert the master plug switch in the receptacle (located in the collision post at the controller) at either end of the car for air compressor operation. Do not insert the reverse lever in the controller.

6. Snap the main lighting breaker and the blower switch to the "ON" position. Set the selector switch on the heating and cooling control panel for "HIGH" or "LOW", depending on the requirement.

Steam Anti-Freeze Protection When Being Towed in a Conventional Passenger Train with Both Engines Shut Down (No Passengers) (RDC-1 and 2)

1. Check that the hand valves ahead of the #9331 Steam Admission Thermostatic Valves (located in the supply lines to each sump tank) are in the open position.

2. Check that the water level in both engine sump tanks is between the two upper try-cocks.

3. Check the heating and cooling control panel (located in the switch locker at the "B" end of the car) to see that the selector switch is in the "ANTI-FREEZE" position and the blower switch is in the "OFF" position. (This places the floor heat and overhead heat circulating pumps under control of the 60° layover thermostat).

4. Check that the floor heat and overhead heat circulating pumps operate when the car body temperature falls below 60°.

5. Turn off all lights in the car by tripping the master switch at the top of the switch panel.

WARNING: If steam is not available, see Draining Instructions.

DRAINING INSTRUCTIONS

1. Open the "T" handle valve located at the bottom of the engine block and to the left of the engine water pump.

2. Remove the drain plug from the engine inlet water pipe (located in engine sump tank bottom fitting).

3. Open the petcock of the engine water pump (located inside the engine casing).

4. Open the petcock drain in the car heat feed line from the pump.

5. Open the vent petcock on the top of the pump.

6. Open the four petcocks (located at the ends of the floor radiators inside of the car).

7. Open the petcocks (above the floor in men's and women's annexes) and behind water cooler (if cooler is installed) to drain the overhead service water tank.

8. Open annex basin faucet, flush hoppers and operate water cooler faucet (if cooler is installed) to complete overhead water tank drainage.

9. When #1 engine has been drained, check that blower switch is in the "OFF" position and that overhead heat pump fuse is removed.

10. When #2 engine has been drained, check that floor heat pump fuse is removed.

HEATING PUMPS (RDC-1, 2, 3 and 4)

Both pumps (floor heat and overhead heat) are of the centrifugal impeller type directly connected to a 1/3 horsepower, 64 D.C., 3450 RPM motor. Each pump will circulate 22 GPM through the radiation system. (See Fig. 6).

Each pump is mounted on a bracket attached to the side sill of the car and located between the sump tank and engine casing.

The motors have grease packed ball bearings and should be lubricated every 10,000 miles, winter only. (See Budd Rail Diesel Car Lubrication and Fuel Chart.) Use caution not to over-grease.

These pumps are Vapor #6-8602 as shown on Fig. 6.

Both heating pumps should be removed during the summer season and overhauled. The heating lines on the car should be capped to prevent entrance of dirt. The pump portion should be removed and the impeller inspected for corrosion or pitting. The water seal should be replaced by a new one. Carbon brushes, pig-tails and commutators should be examined carefully. The motor windings should be blown out with dry air and examined for abrasion, etc.

TO REPLACE WATER SEAL (See Fig. 6)

NOTE: Be sure seal specification is John Crane BF-271.

1. Remove suction head of pump by removing 8 bolts.

2. Check end play of motor shaft. If end play is over 1/64 inch, check motor bearings.

3. Remove impeller nut and washer.

4. Pull impeller off motor shaft.

5. Remove floating seat and sealing washer.

6. Remove seal assembly from shaft of impeller.

7. Make sure that the synthetic rubber seat ring of the new seal is tight against the shoulder of the floating seat with rounded outer edge exposed to facilitate insertion. (The ring is assembled this way when shipped).

8. Oil the outer surface of seat ring and push assembly into cavity, seating it firmly and squarely.

9. Clean and oil the sealing face.

10. Check end of impeller hub and see that there are no burrs to cut rubber bellows when it is slid into place.

11. Oil impeller hub and push bellows and spring assembly into position. Be sure the spring slips over the centering washer and that the driving notches of the sealing washer index with the tabs on the retainer shell.

12. Check key-way on motor shaft and impeller for burrs.

13. Slide impeller on motor shaft with key in place. (Note: This should be done with the motor shaft in a vertical position to insure spring of seal remaining in proper position on the centering washer until the sealing faces meet).

14. Install impeller washer and nut. Tighten latter securely. Be sure that the impeller hub fits tightly against the shoulder on the motor shaft.

15. Replace gasket on suction head. (Note: This gasket must be same thickness as original as it determines the clearance between impeller and suction head). Install suction head.

16. Rotate motor shaft by hand to check that all parts turn freely.

CAUTION: Do not run pump dry as this will ruin the sealing surfaces of the water seal.

FLOW CONTROL VALVE (Spring Check Valve with Large Bore)

These valves are located in the discharge line of both the floor heat and overhead heat pumps. They are used to prevent false heating in the car by thermo-syphon action when heating is not required.

The valve has a spring check which prevents the flow of water as long as the pump is shut down. However, the pressure developed by the pump is sufficient to open this check and allow the hot water to circulate.

This valve should be removed annually and the seat examined for wear.

FLOOR HEAT RADIATION

The floor heat radiation in the RDC-1, 2 and 3 consists of one run of fin radiation, 48 fins per foot, full length of each passenger section, on each side with an additional six feet at each end of the car. A drain petcock is provided at the low point on each end for draining any water that may lie in the radiation, if the car is to be parked without standby heat.

OVERHEAD HEAT COIL

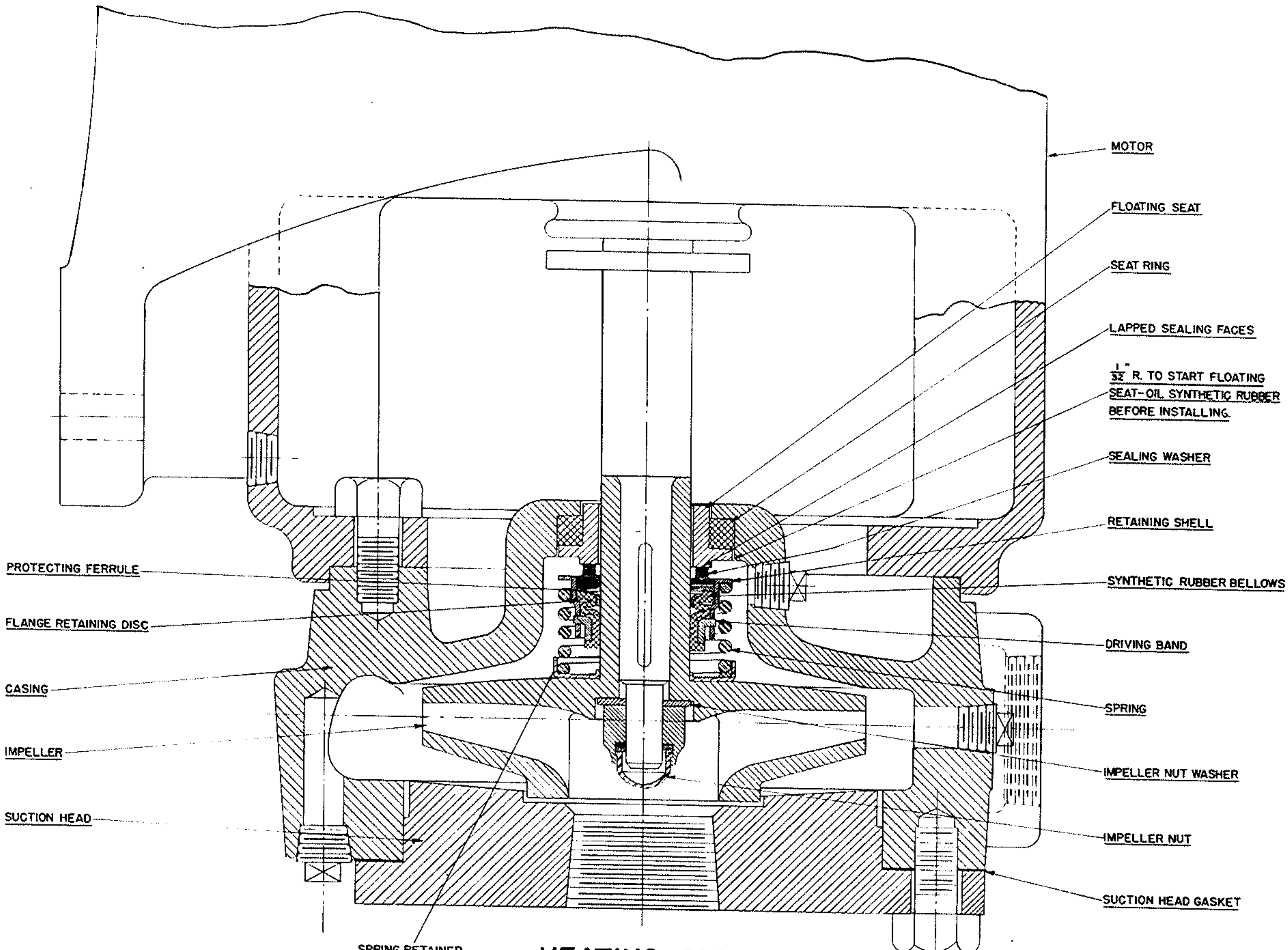
RDC-1, 2 and 3 only. The overhead heat unit is a two pass coil made a part of, and bolted to, the evaporator unit. It is a standard Frigidaire coil as furnished with their evaporator. The water enters the lower connection of the coil, and leaves by the upper connection. A petcock is installed in the top of the main header to bleed off any air that may be trapped. Normally, it is not necessary to use this bleeder petcock since pump operation will purge the coils, unless the car is standing with a heavy lean. Since this coil is a part of the evaporator unit, removal is explained under "Cooling System".

FLOOR HEAT THERMOSTAT

RDC-1, 2 and 3 only. This thermostat is located under the tenth seat from the "B" end of the car and controls the starting and stopping of the #2 heat pump. It is provided with a set back resistor which lowers its setting to 74°. Another set back of 60° controls the operation of both the #1 and #2 heat pumps during layover.

OVERHEAD HEAT THERMOSTAT

RDC-1, 2 and 3 only. This thermostat is set for 76°. It is located in the air discharge duct, above the fifth anemostat from the "B" end. This thermostat is provided with a set back resistor which corrects its setting to 73° for "LOW HEAT" and 75° for "HIGH HEAT".



HEATING PUMP

FIG. 6

CONTROL PANEL

The control of the heating system is integral with the control of the cooling system and is incorporated in the air conditioning control panel located in the bottom of the switch locker in the "B" end of the car.

On the RDC-1, 2 and 3 models, the panel is a #1906 ATF.

On the RDC-4 model, the panel is a #1906 HH Floor Heat Control Panel.

UNIT HEATER

The unit heater used in the mail and baggage compartments of the RDC-3 consist of a fin coil with a motor driven fan to circulate air over the coil and through the compartment. The heaters are mounted near the ceiling in the end of each compartment.

On the RDC-4 there are two unit heaters mounted from the ceiling in the baggage compartment. These heaters consist of a fin coil with a motor driven fan to circulate air over the coil and through the compartment.

STEAM ADMISSION THERMOSTATIC VALVE

The valve consists of a steam dispersing tube with a built-in thermostatic element to control the steam and is located on the immersion heater cover plate at the engine end of each sump tank.

The valves are set to maintain a water temperature of 190° in the tank. An adjusting screw is provided at the valve for varying the temperature setting. (See Fig. 5).

A shut-off valve is installed in the steam line to each valve plus a strainer to remove dirt, scale, etc.

The steam admission thermostatic valves handle the trainline steam pressure without the use of regulating valves.

ELECTRICAL OPERATION ON MODELS RDC-1, 2 AND 3

(See Wiring Schematics Nos. 1, 2, 3 and 4)

The heating panel for RDC-1, 2 and 3 is provided with the following:

a. Control switch with positions "HIGH" and "LOW HEAT", "OFF", "COOL", and "ANTI-FREEZE".

b. Blower fan circuit breaker switch.

c. Floor heat pump relay (FHPR) #8060.

d. Overhead heat pump relay (OHPR) #8060.

e. Cooling pilot relay (CPR) #8060.

f. Cooling modulating relay (CMR) #8063.

The thermostats shown are:

a. Overhead heat DN2501 — 76°.

b. Floor heat FSN2501 — 76°.

c. Air conditioning DN2522-1-1 Modulation 75° — Off 72°.

Low Heat

When the control switch on the heating control panel is moved to Low Heat position, contacts 2, 3, 4, 7 and 9 are closed.

a. Closing contact #2 places the TROH relay coil and the two 1000 ohms resistors in the circuit.

b. Closing contact #3 adds the mercury tube thermostat across the TROH coil.

c. Closing contact #4 places the TRFH coil and the two 1000 ohm resistors in the circuit.

d. Closing contact #7 inserts the 3° setback resistor in the circuit with the heater element of the mercury thermostat 2501 OH.

e. Closing contact #9 inserts the 2° setback resistor in the circuit with the heater element of the mercury thermostat 2501 F.H.

With the electrical circuit set up as mentioned above, the setback resistor allows a small current to flow in the heating element of the floor heat mercury thermostat. This small current creates sufficient false temperature on the mercury tube to reduce its operating temperature 2°, thereby causing it to operate at 74° instead of 76°.

The same conditions are set up for the overhead heat thermostat except the setback resistor is such that a 3° false temperature is produced. This reduces the operating temperature to 73° instead of 76°.

When the mercury connections are open, due to lowered temperature, the shunt is broken across the relay coils. Current flowing through the TRFH and TROH coils will energize them and close the respective relay contacts, starting the water pumps. When the car temperature rises to 73°, the overhead mercury thermostat closes and shunts the TROH coil causing the relay contacts to open, thus shutting off the overhead pump. The floor heat pump will continue to run until the car temperature rises to 74°. At this temperature, the mercury thermostat closes and shunts the TRFH coil causing the relay contacts to open, thus shutting off the floor heat pump.

High Heat

When the control switch on the panel is moved to High Heat position, contacts 2, 3, 4 and 6 are closed. The closing of contacts 2, 3 and 4 set up circuits as mentioned in items a, b and c under "Low Heat". The closing of contact 6 inserts the 1° setback resistor in the circuit with the mercury thermostat 2501 OH heater coil. The overhead heat thermostat now operates at 75° instead of 76°. The action of the setback circuit is described under "Low Heat".

The floor heat thermostat will have no circuit connected to the heating element of the mercury thermostat. The switch contact #4 will place the TRFH 8160 in the circuit, allowing it to operate at the 76° thermostat setting.

Anti-Freeze

When the control switch on the heating control panel is moved to the "Anti-Freeze" position, contacts 4, 5 and 8 are closed.

a. Closing contact #4 places the TRFH coil and the two 1000 ohm resistors in the circuit.

b. Closing contact #5 connects the FP+ of the TRFH relay to one side of the #2 switch. This feeds battery positive (+) to the TROH relay coil when the TRFH contacts are closed.

In the Anti-Freeze position, the #2501 floor heat thermostat controls the heat in the car. With the circuit set-up as in (b) above, the floor heat thermostat energizes the TRFH relay; the contacts of the TRFH close, starting the floor heat pump. Battery positive (+) through the #5 switch, energizes the TROH relay, closing TROH contacts and starting overhead heat pump.

c. Closing contact #8 places the 16° setback resistor in series with the heater element of the floor heat mercury thermostat. The false heat created by the current through the resistor reduces the operating temperature from 76° to 60°.

Although the overhead heat pump operates to protect piping, the fan is not operated to heat the car in the Anti-Freeze position.

RDC-3 Baggage and RPO Heating Controls

The heating control panel is located in the utility locker in the RPO compartment. The selector switch has three positions: Anti-freeze, Low Heat and High Heat. The Anti-freeze position selects 60° temperature; Low Heat, 71° temperature and High Heat, 74° temperature.

One thermostat containing the three temperature ranges is located on the end of a letter case in the RPO compartment.

The fan control switches for the RPO and Baggage unit heaters are mounted, one on each heater housing. These switches have three positions: THERMO, OFF and MANUAL for selecting the fan operation of the unit heaters.

As shown on Wiring Schematic #4, with the RPO fan control switch set in THERMO position, the heating control selector switch set for Anti-freeze and the compartment temperature below 60°; the following circuit will be set up: Battery current will flow from battery positive through the 2.8 Amp. fusetron, the 1000 ohm resistor, through the relay coil (the 60° mercury thermostat being open), the second 1000 ohm resistor, the 2.8 Amp. fusetron to B—. The relay coil being energized, closes the contacts and sets up a circuit from battery positive through one pole of the control switch, the fan motor, the second pole of the control switch to battery negative starting the fan motor.

As the temperature in the compartment rises, the 60° thermostat closes. With the mercury thermostat and selector switch in series across the relay coil, the coil is shunted, deenergizing the relay and opening the contacts. This breaks the battery positive circuit shutting off the fan motor.

The sequence of operation is the same on the two higher temperature ranges.

With the fan control switch (in the baggage compartment) in the THERMO position, a circuit is set up from battery negative through the 2.8 Amp. fusetron, one pole of the control switch, the fan motor, the second pole of the control switch, the second 2.8 Amp. fusetron, through wire FP+ to terminal FP+.

Due to the action of the 76° floor heat thermostat, the TRFH relay contacts will close completing the battery positive circuit to the fan motor and causing the motor to run under thermostatic control with the pump motor.

With the fan control switch (Baggage or RPO) in the OFF position, the fan motor is isolated from both positive and negative circuits.

With the fan control switch (Baggage or RPO) in the MANUAL position, a circuit is set up from battery negative, through the 2.8 Amp. fusetron, the fan motor, the second 2.8 Amp. fusetron to battery positive. This places the fan motor in continuous operation.

Steam Layover Protection for the RDC-3

1. Check the heating control panel (located in the utility locker) to see that the selector switch is in the desired position.
2. See that the fan control switches (Baggage and RPO) are in the THERMO position.
3. Follow procedures as outlined for RDC's 1 and 2.

RDC-4 Heating Controls

The heating control panel containing the 15 Amp. circuit breaker, pump fusetrons, 6B-8160 pump relays and the temperature selector switches is located in the utility locker at the "A" end of the car. The selector switches have three positions, Anti-Freeze, Low Heat and High Heat. The Anti-Freeze position selects the 60° temperature; Low Heat the 71° temperature; and High Heat the 74° temperature.

Two thermostats, each containing the three temperature ranges are located in the RPO compartment. One thermostat is located on the end of the letter case and the other on the left side paper boxes.

Two fan control switches are located near the desk in the baggage compartment. These switches have three positions marked THERMO, OFF, and MANUAL for selecting the fan operation of the unit heaters.

The heating of the entire car is controlled by the two thermostats located in the RPO compartment. The two electrical control circuits are identical in operation.

As shown on Wiring Schematic No. 5, with the 15 Amp. circuit breakers closed, a selector switch in the 60° position and the car temperature below 60°, the following circuit will be set up: Battery current will flow from battery positive through the 1000 ohm ballast resistor, the 6B-8160 relay coil, the 1000 ohm ballast resistor the battery negative. The 6B-8160 pump relay coil being energized, closes the 6B-8160 contacts.

A circuit is now set up to the pump motor as follows: Battery positive flows through the 15 Amp. circuit breaker, the 6B-8160 pump relay contacts to OP+, the pump motor windings to OP—, the 8 Amp. fusetron to battery negative starting the pump motor.

As the temperature in the car rises, the 60° mercury thermostat closes. With the mercury thermostats and the selector switch in series across the relay coil, the coil is shunted, deenergizing the relay and opening the contacts. This breaks the battery positive circuit, shutting off the pump motor.

The sequence of operation is the same on the two higher temperature ranges.

With a fan control switch (in the baggage compartment) in the THERMO position, a circuit is set up from battery negative through the 8 Amp. fusetron to OP—, the 2.8 Amp. fusetron, one pole of the control switch, the fan motor, the second pole of the control switch, the second 2.8 Amp. fusetron to OP+ and to one side of the 6B-8160 relay contacts.

When the 6B-8160 relay coil is energized by its controlling thermostat, the contacts close, completing the circuit to battery positive. This provides battery positive to both fan and pump motors so that both cycle under thermostatic control.

With the fan control switch in the OFF position, the fan motor is isolated from both positive and negative circuits.

With the fan control switch in the MANUAL position, a circuit is set up from the battery negative through the 8 Amp. fusetron, OP—, then through the 2.8 Amp. fusetron, one pole of the control switch, the fan motor, the second pole of the control switch, through Z+, through the 20 Amp. circuit breaker (in switch locker) and to B+. This places the fan motor in continuous operation.

STEAM LAYOVER PROTECTION FOR THE RDC-4

1. Check the heating control panel (located in the switch locker at the "A" end of the car) to see that the main control breaker is "ON" and that both selector switches are on "ANTI-FREEZE".

2. Check that the two fan control switches near the desk in the baggage compartment are on "THERMO".

3. Turn off all lights in the car by tripping the master light switch.

4. Check that the hand valves ahead of the #9331 steam admission thermostatic valves (located in the supply lines to each sump tank) are in the open position.

5. Check that the water level in both engine tanks is between the upper two try-cocks.

6. Plug in a source of 64 volts battery charge. ***CAUTION:*** Be sure both engines have been shut down before the plug has been inserted. ***DO NOT*** start either engine without first pulling the battery charge plug.

7. Couple one end of the steam trainline to yard steam and open the end train pipe valve.

8. Open the end train pipe valve on the opposite end of the car to blow out any condensate; then partly close the valve, leaving a feather of steam blowing out of the coupling.

9. Check for rumble of steam at both sump tanks (if temperature is below 190°) indicating that steam is entering the water.

10. Check that both heat circulating pumps operate when car body temperature falls below 60°.

Removing Car from Yard Steam (RDC-4)

1. When removing car from layover steam protection, close train pipe valve, disconnect yard steam line and then open train pipe valve on opposite end to blow out any condensate.

2. Disconnect 64 volt battery charge cable.

3. Check engine water temperature gauge to verify engine water temperatures are normal before starting engines.

Steam Heating when Being Towed in a Conventional Passenger Train (With Crew) (RDC-4)

1. Check that the hand valves ahead of the #9331 steam admission thermostatic valve (located in the supply line to each sump tank) are in the open position.

2. Check that the water level in both engine sump tanks is between the upper two try-cocks.

3. Couple the steam trainlines and open the end train pipe valve. If the RDC is being towed between cars, open both end train pipe valves. If being towed as a rear end car, open the forward train pipe valve and partly open rear end train pipe valve to permit a feather of steam to blow out of the coupling.

4. One engine must be operating to provide battery charging. The engine stop and isolation switch (located in the respective regulator locker) must be in the "ISOLATE"

position to isolate the engine controls. It is not necessary to "ISOLATE" the shut down engine from its respective regulator locker.

5. Insert the master plug switch in the receptacle (located in the collision post at the controller) at either end of the car. Do not insert the reverser lever in the controller.

6. Snap the main lighting breaker and the main heat control breaker (located in switch locker) to "ON". Set both heat selector switches (located on heat control panel) to "HIGH" or "LOW". Set both fan control switches (baggage compartment) to "THERMO".

Steam Anti-Freeze Protection when Being Towed in a Conventional Passenger Train with Both Engines Shut Down (No Crew) (RDC-4)

1. Check that the hand valves ahead of the #9331 steam admission thermostatic valves (located in the supply lines to each sump tank) are in the open position.

2. Check that the water level in both engine sump tanks is between the two upper try-cocks.

3. Check the heating control panel (located in the switch locker at the "A" end of the car) to see that the main control breaker is "ON" and that both selector switches are on "ANTI-FREEZE".

4. Check that the two fan control switches near the desk in the baggage compartment are on "THERMO".

5. Turn off all lights in the car by tripping the master light switch.

6. Check that both heat circulating pumps operate when car body temperature falls below 60°.

WARNING: If steam is not available, see Draining Instructions.

SECTION 11

ENGINE COOLING SYSTEM

The general arrangement of the Engine Cooling System is shown in Figure 1.

The various units in this system are as follows:

1. SUMP TANK

The sump tank is a 75 gallon stainless steel tank, 22" in diameter and 50" long, provided with baffles to prevent excessive surging. The tank is located under the car adjacent to the engine and is wrapped with a vinyl plastic material over fibre-glass insulation. Pipe connections are provided as follows:

a. Engine End

One 5" flange connection suitable to support the bypass valve (water from engine).

One 1¼" coupling at top.

Two 1¼" connections near the bottom (car heating system).

Flange for Thermostatic Valve (steam admission).

Three try-cocks for checking the water level.

b. Opposite End

One 2½" flange connection (return from radiators).

One 1¼" connection near the bottom.

One 1¼" connection near the top (filler pipe).

c. Bottom

One 3" elbow connection (water to engine).

A pipe connection is made between the vent pipe (overflow) and the down pipe between the radiator and sump tank. This connection serves to break the vacuum in the radiators, allowing the water to drain out when they are not used for cooling purposes.

2. ENGINE WATER CIRCULATING PUMP

The circulating pump is an impeller type attached to and driven by the engine. This pump delivers 30 gallons per minute at an engine speed of 800 RPM and 130 gallons per minute at 1800 RPM.

3. COOLING RADIATORS (See Fig. 2)

There are two radiators for each engine mounted on the roof, (one on each side) sloping upward toward the center line of the car. Each radiator is 36" x 70", 6" thick. They are of horizontal copper tube construction with vertical fins. The two radiators are connected in parallel with the water entering one lower corner and leaving by the opposite upper corner. The radiators are set into a box-like enclosure or dome built on top of the roof sheets near the center line of the car. This enclosure also houses the cooling fans and motors. The radiators are mounted on rubber pads and have rubber sealing strips around the edges to eliminate air leakage. The "in" and "out" connections are made by means of bolted flanges with a rubber ring of square cross section forming the seal.

4. RADIATOR FAN

Each pair of radiators is provided with a 36" multiblade fan directly connected to a 5 H.P. series motor. The fan and motor are mounted vertically between the two radiators; the fan draws air through the radiators discharging it upward on the center line of the car. The motor delivers 2½ H.P. when operating at low speed of 1440 RPM and 5 H.P. at high speed when operating with weakened field at 1835 RPM.

Maintenance

Once a month or oftener if found necessary, the carbon dust and dirt should be blown from the motor coils and air passages of the armature. Brushes and commutator should be inspected at this time for any unusual wear conditions. Brushes should be free in the holders and pigtail shunt connections tight. Worn brushes should be replaced when the limit of wear is reached (1 inch). Any oil or grease on the commutator should be wiped off with a cloth.

Lubrication

The motor is equipped with sealed ball bearings that have been lubricated at the factory and do not require any additional lubrication for the life of the bearing. Lack of lubrication or wear indicate the need for replacement of the bearings.

5. ENGINE WATER OUTLET THERMOSTATIC VALVE

An Thermo-Pneumatic Control Valve (See Fig. 3) is installed in the water outlet line of each engine. The valves are screwed into a 1¼" ferrule which is welded into the pipe between the engine and the sump tank. They are set to open at 176° and admit air to the by-pass valve causing the by-pass valve to close.

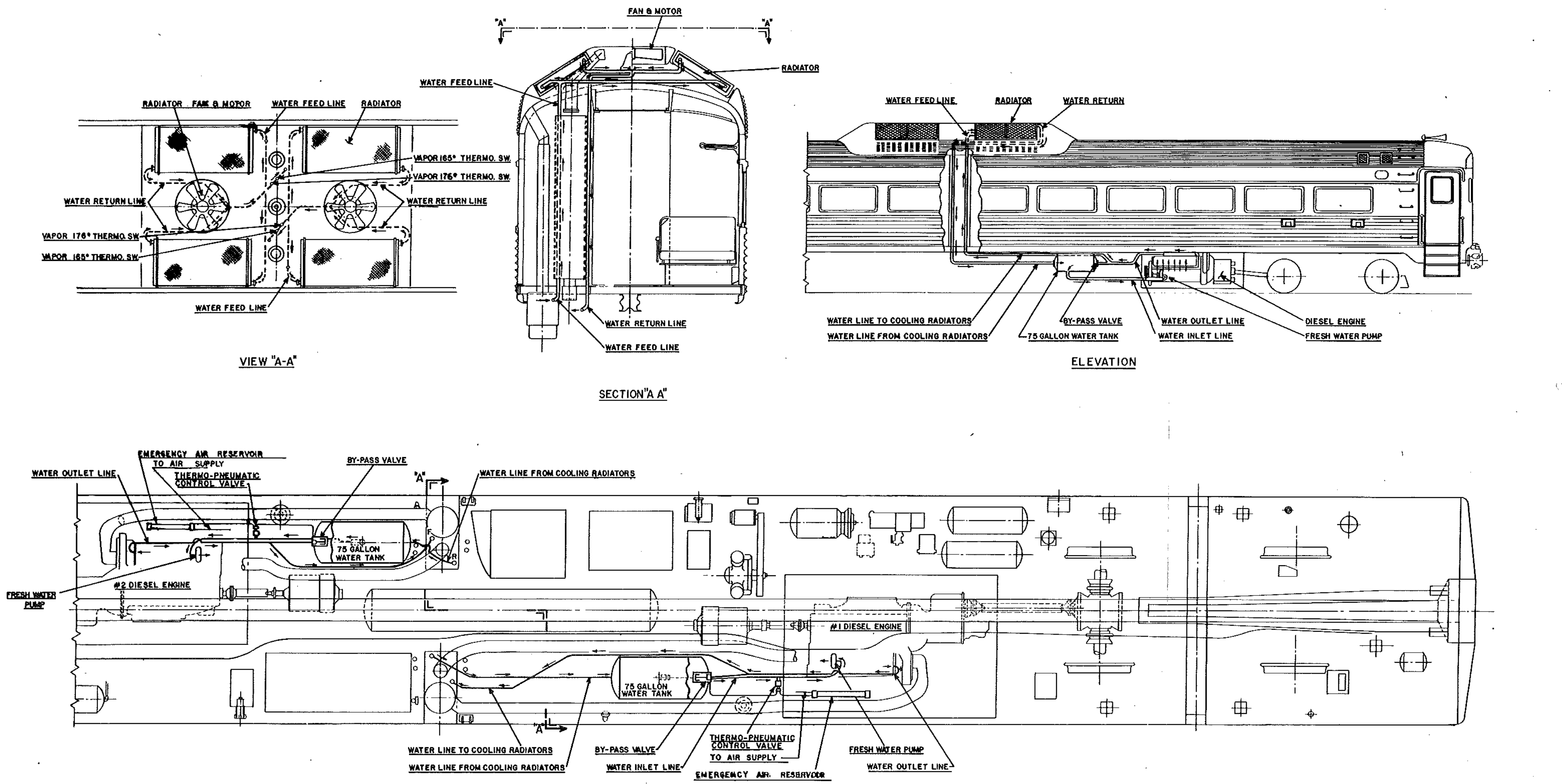
The valves are set for proper operation at the factory and should not be tampered with unless it is *positively* determined that they are out of calibration. See Service Instructions for Thermo-Pneumatic Control Valve (Page 13, Section 11).

6. EMERGENCY AIR RESERVOIR

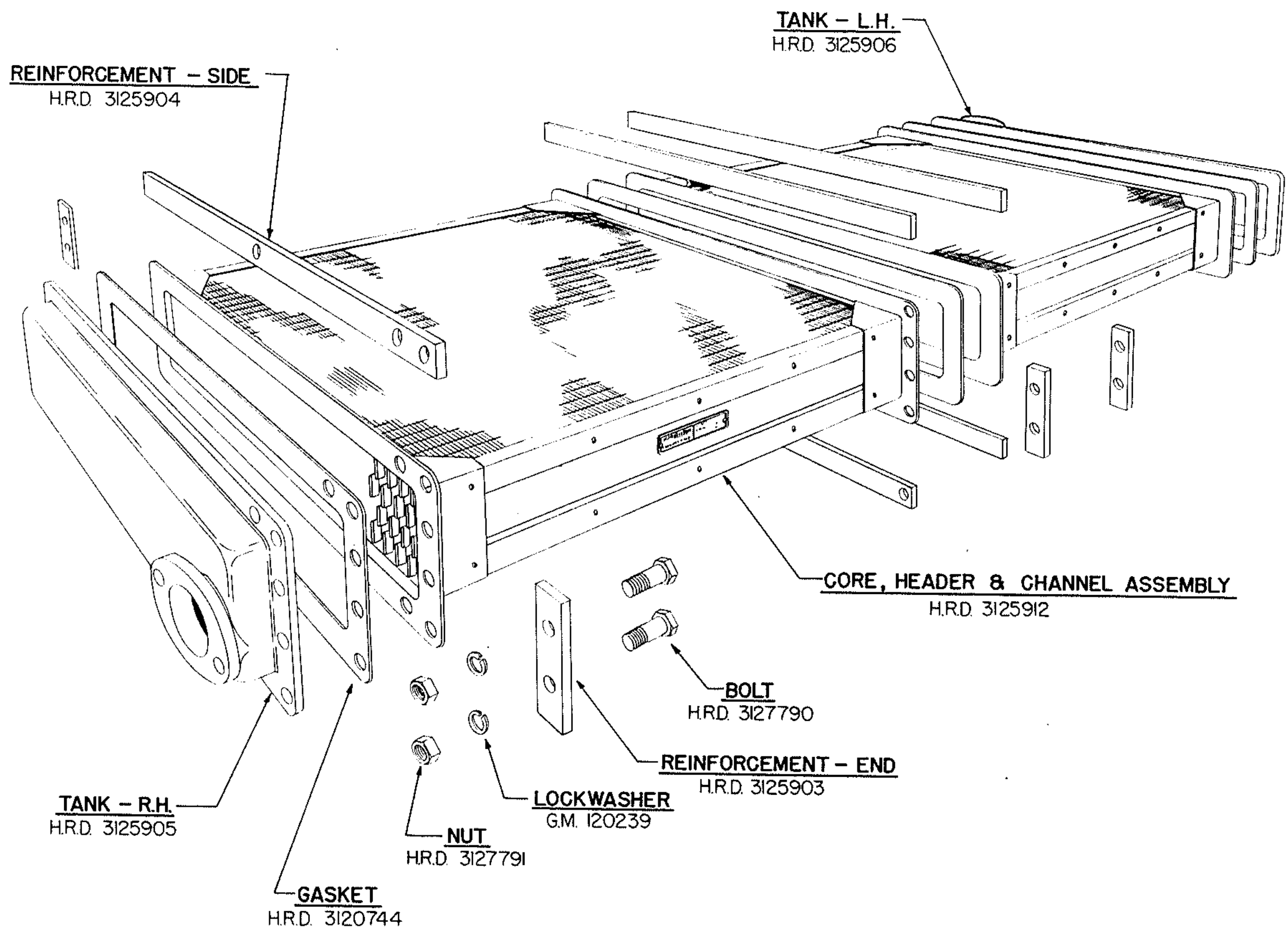
An emergency air reservoir 24 inches long and 2½ inches in diameter is provided in the air supply line to the Thermo-Pneumatic Control Valve.

As shown in Figures 5 and 6, there is a shut-off valve and a check valve in the air supply line to the reservoir. The line out of the reservoir to the Thermo-Pneumatic Control Valve is equipped with a test tee and a strainer.

The purpose of this reservoir is to supply air to the by-pass valve for three or more cycles of by-pass valve operation in case of a failure of the main air supply.

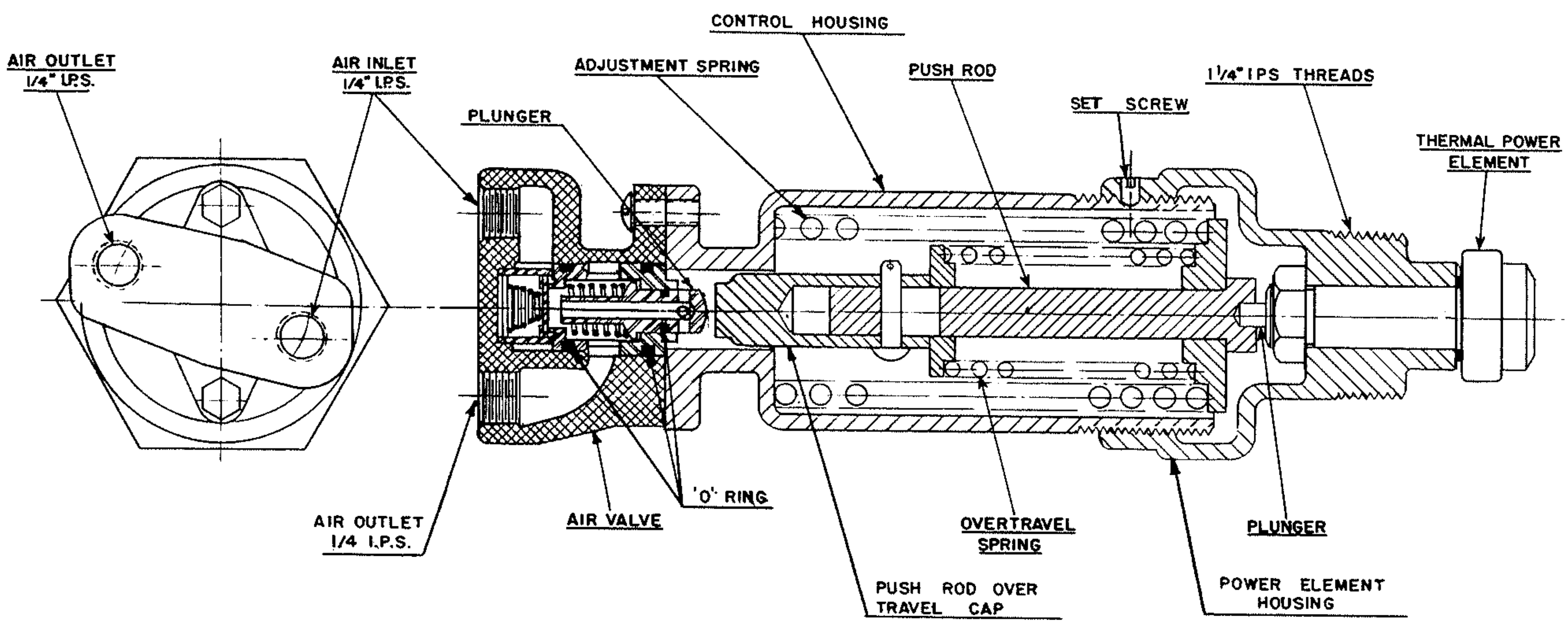


ENGINE COOLING SYSTEM
FIG. 1



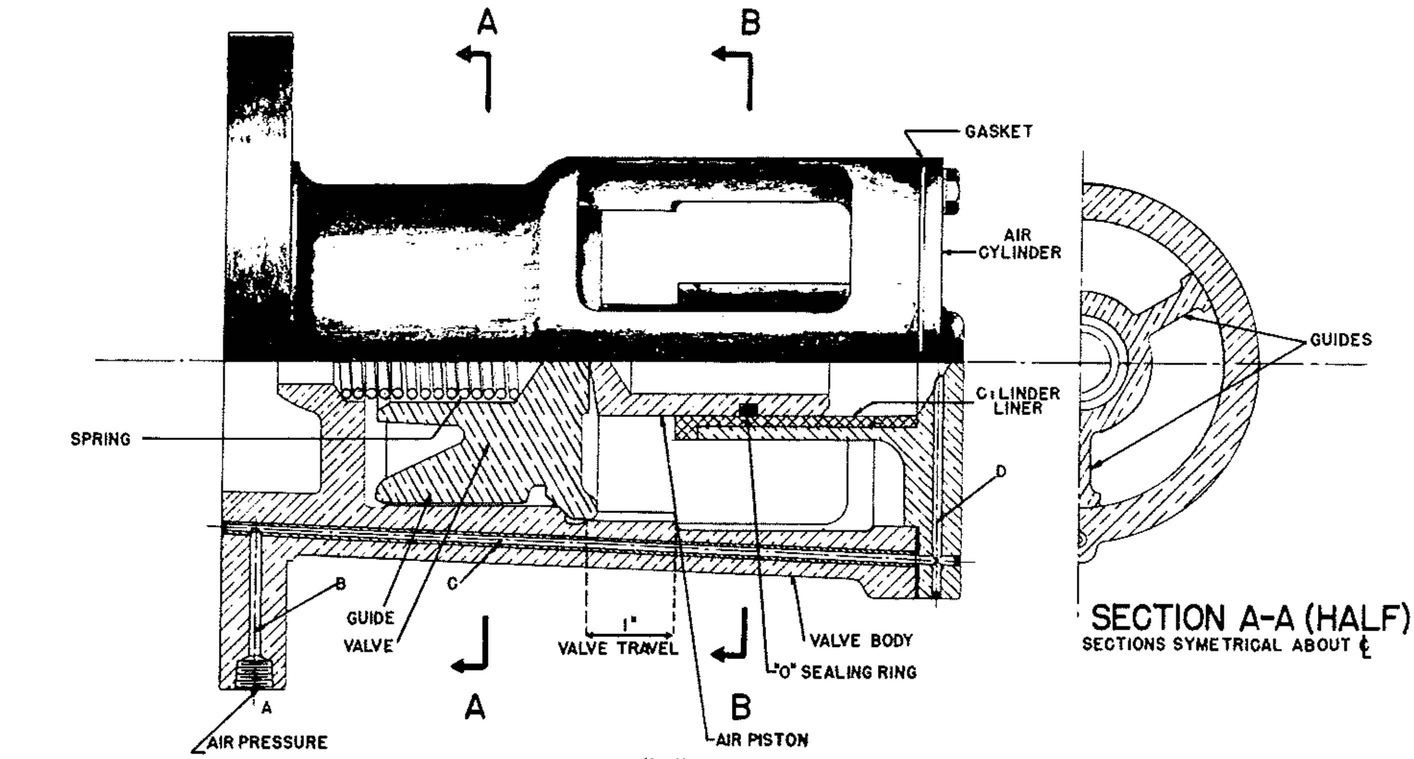
ENGINE COOLING RADIATORS

FIG. 2

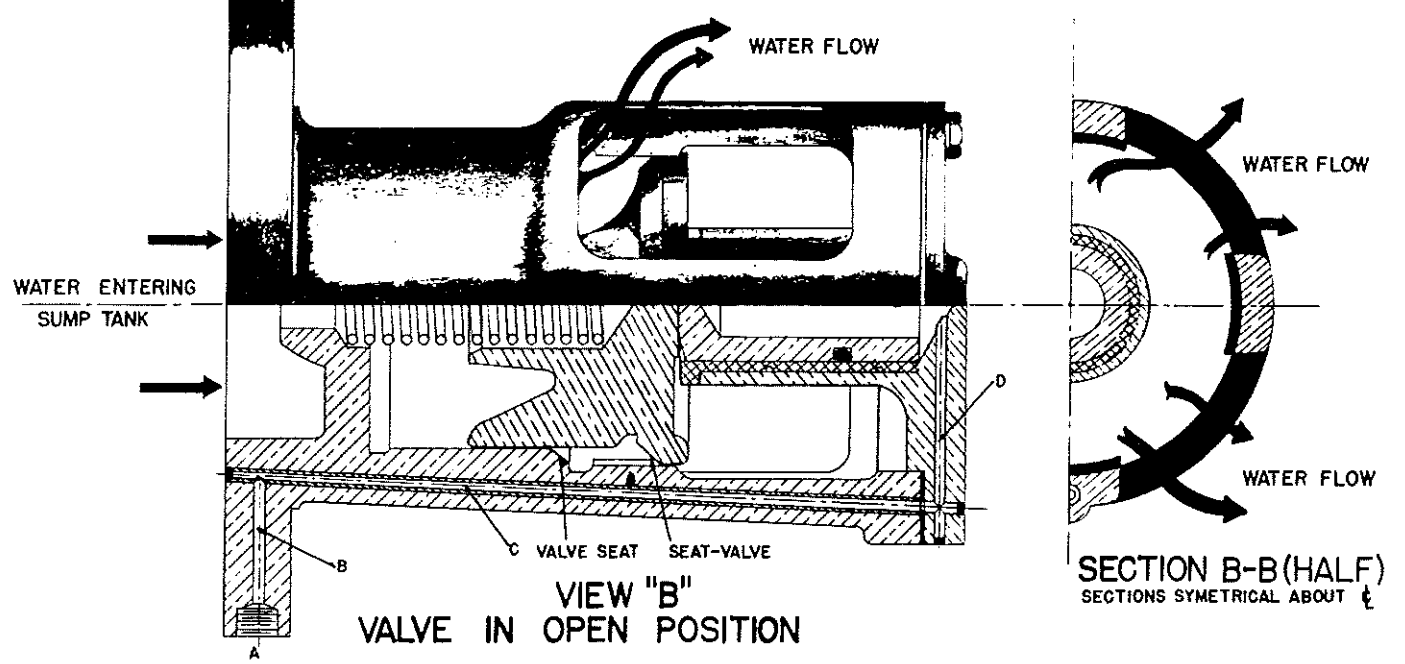


THERMO-PNEUMATIC CONTROL
FIG.-3

SEC. 11



VIEW "A"
VALVE IN CLOSED POSITION



VIEW "B"
VALVE IN OPEN POSITION

BY-PASS VALVE

FIG. 4

7. BY-PASS VALVE (See Fig. 4)

This is an air operated valve located in one end of the sump tank, being mounted in and bolted to the flange to which the 3″ pipe from the engine is connected.

As shown in Fig. 4, this unit consists of a 3″ valve actuated by an air operated piston, moving in a cylinder liner in the air cylinder. This piston has one rubber "O" ring inserted in a groove which seals against loss of air between the piston and the cylinder wall. Air from the thermo-pneumatic control valve enters Port "A" and passes through passage "B", "C" and "D" to the air piston; thus when air pressure is applied to the valve in the open position, as shown in View "B", the piston moves to the closed position, as shown in View "A".

The end of the piston bears against the 3″ valve, which is free to move laterally on three radially located guides. This valve is provided with a seat, which matches with a seat in the valve body. The valve is held against the end of the piston by a coil spring, which serves to return the valve to the open position when the air pressure is released.

As shown in View "B", when there is no air pressure in Port "A", the valve is in the open position and water will flow through the valve into the sump tank as shown by the arrows. However, when air pressure is applied to Port "A", the piston moves to the left, as shown in View "A", moving the valve over to its seat, shutting off the water and forcing it to flow to the roof through the radiator (as shown in Fig. 6) and back to the sump tank.

The by-pass valve is mounted in the engine end of the sump tank by means of a pipe flange. In order to remove it for servicing, it is first necessary to remove a section of the 3″ pipe between the sump tank and the engine. This removable section of pipe is provided with bolted flanges to permit its easy removal. Since the by-pass valve is held in place on the sump tank by the bolts in the flange it can be withdrawn through the tank flange after the pipe section has been removed. Care should be taken to use the proper length of bolts when replacing this valve since the threaded holes in the tank flange are bottomed to prevent water leakage.

It is recommended that the by-pass valve be removed semi-annually, dismantled, inspected and air tested. The valve and seat should be checked for wear and it is recommended that the "O" ring in the air piston be renewed at this time. The air piston and cylinder liner should be lubricated (See Budd Rail Diesel Car Lubrication and Fuel Chart).

After assembly, 90 p.s.i. air pressure should be applied to the ¼ inch port and the valve operated a few times to insure proper functioning. While under 90 p.s.i. air pressure, the valve should be immersed in water to check for any air leaks.

8. RADIATOR THERMOSTATS

There are two immersion thermostats located on the roof in the water outlet line from the radiators. One thermostat is adjusted to close when the water leaving the radiator reaches 165° and start the fan rotating at low speed. The other thermostat is adjusted to close when the water leaving the radiator reaches 176°, and increases the fan speed to high.

Care should be taken when removing the two wires on these thermostats to mark the positive wire. The positive wire must always be attached to the terminal on the thermostat marked +.

9. FAN CONTROL PANEL

Each fan has a set of contactors, relays and resistances mounted on a panel in the regulator locker in the "A" end of the car. This panel also carries the 15 amp. control fuse as well as the 80 amp. Fusetron for the fan motor.

OPERATION OF THE COOLING SYSTEM

From the flow diagram shown on Fig. 5, it will be seen that when the engine is first started and the circulating water is below 176°, the water is drawn from the sump tank by the engine pump, forced through the engine block to the water outlet manifold and returned to the sump tank through the water-outlet hose, without flowing through the roof radiators.

This circulation continues until such time as the water leaving the engine reaches a temperature of 176°.

When this occurs, as shown on Fig. 6, the Thermo-Pneumatic Control Valve in the engine water outlet line opens and admits air pressure to the piston of the by-pass valve, closing the valve. Since the by-pass valve is located in the inlet to the sump tank, the closing of this valve stops the flow of water from the engine to the sump tank and forces it to run up the branch pipe to the radiators on the roof and back to the sump tank by means of the down pipe.

This water will leave the engine at 176° and enter the radiators at approximately the same temperature. Due to the cooling effect of the radiators, the water will first leave at a lower temperature. However, as the radiators warm up the outlet water temperature will gradually rise. When it reaches a temperature of 165° thermostat, the contact of the low speed fan thermostat closes. This energizes the proper contactors on the fan control panel and starts the fan revolving at low speed. As soon as the fan starts moving air through the radiators, it cools the water thus reducing the radiator water outlet temperature. When this temperature drops to 157-159° the contact of the low-speed fan thermostat opens and the fan stops. The radiator water outlet temperature will then start to rise again until it reaches 165°, when the fan again starts rotating. This cycle is repeated as long as the by-pass valve is closed and water is flowing through the radiator.

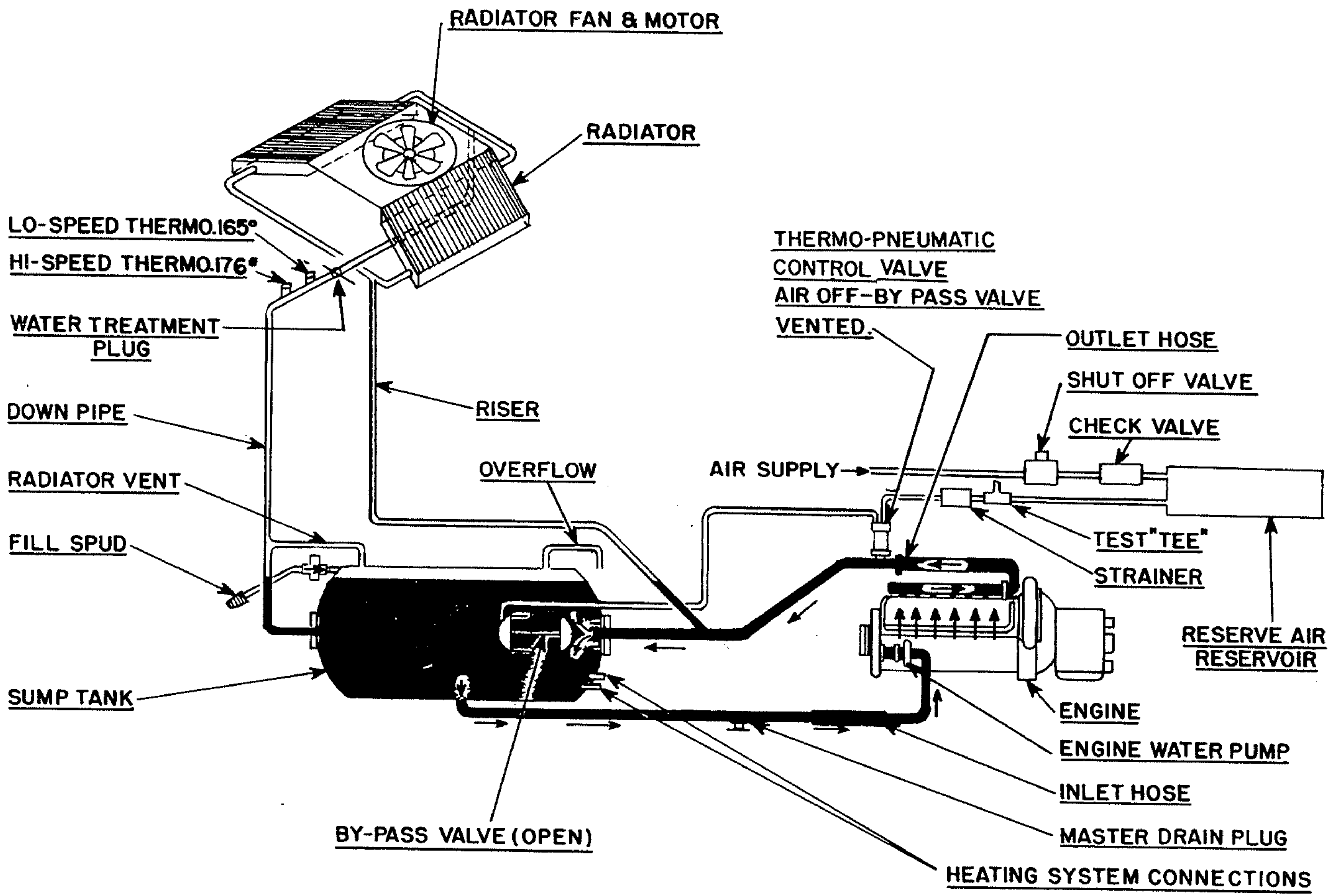
If the outside air temperature is such that low speed of the fan does not provide sufficient cooling, then the radiator water outlet temperature will rise above 165°. When it reaches 176°, the contact of the Hi-speed fan thermostat will close and switch the fan to high speed. With the fan at high speed the radiator water outlet temperature will drop until it reaches 168-170°, then to contact of the 176° Hi-speed fan thermostat will open and the fan will return to low speed. This cycle will continue as long as the outside temperature remains high and the engine is delivering full output.

If for any reason, the 165° fan thermostat fails to start the fan, when radiator water outlet temperature reaches 176°, the 176° Hi-speed thermostat will close. This will then start the fan and also bring it up to high speed.

From the above it will be seen that once the water outlet temperature of the engine reaches 176°, water will flow through the radiators and the fans will start and stop, depending on the temperature of the water leaving the radiator. This on and off operation will continue as long as the engine is delivering power. However, if the outside temperature is low enough and the engine is idling, the heat dissipation of the engine may be less than that of the radiator. In this case, the engine outlet water temperature will drop below 176°. When it reaches 168-170°, the valve will close. This cuts off the air to the piston of the by-pass valve and vents it to atmosphere. A spring in the by-pass valve forces the valve open and permits the engine outlet water to flow into the sump tank instead of to the radiator. When this happens, all of the water in the radiators on the roof will drain back into the sump tank and the water flow will be as shown in Fig. 5.

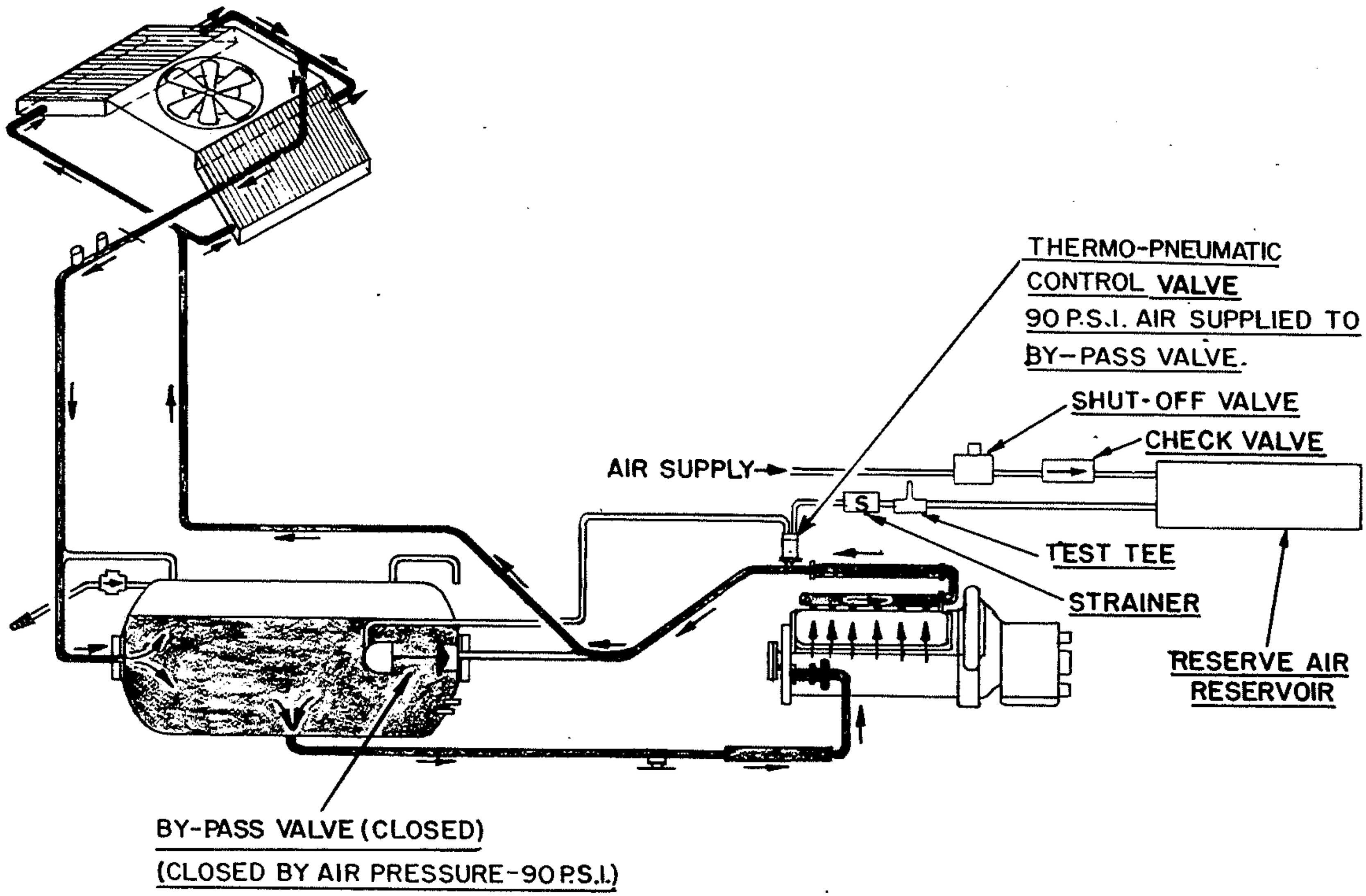
Filling the Engine Cooling System

The sump tank is provided with three try-cocks to indicate the level of the water. Care should be taken when replenishing the water not to overfill the tank. When the by-pass valve closes approximately 15 gallons of water is drawn from the sump tank and



ENGINE COOLING SYSTEM
(WATER TEMPERATURE BELOW 176°)

FIG.5



ENGINE COOLING SYSTEM
(WATER TEMPERATURE ABOVE 176°)
FIG.6

forced into the radiators on the roof. This will lower the level of the water in the sump tank.

When checking the level of the water in the sump tank, it is best (but not absolutely necessary), to first shut down the engine. With the engine shut down:—

Top Cock—water should not be above this level (FULL)

Middle Cock—water should flow (NORMAL)

Bottom Cock—water flowing from this cock only is a signal to add water (LOW)

If it is necessary to add water, open the top cock and fill until water flows. Any further filling is only a waste of the chemical treatment in the water.

It is possible to check the water level with the engine running. The by-pass valve position should first be determined by opening the petcock in the airline to the valve. If air blows out this petcock, ***the by-pass valve is closed.*** If no air blows out the petcock ***the by-pass valve is open.***

With the by-pass valve open, the same levels apply in the sump tank as if the engine was shut down.

With the by-pass valve closed, the following apply:—

Middle Cock—water should not be above this level (FULL)

Bottom Cock—water should flow from this cock (NORMAL)

If water does not flow from the bottom cock, open the middle cock and fill the tank until water flows. ***Do not*** fill above the middle cock.

If, for any reason, the engine cooling system has been drained and it is necessary to refill, there are four steps that must be followed:

a. Fill the sump tank to overflowing.

b. Start the engine and run long enough to purge all air in the engine block and piping.

c. Start the car heat pump associated with the engine involved and let it operate for approximately 20 minutes to purge all the air from the heating coils.
To start the floor heat pump (#1 engine), remove the cover plate from the Vapor Panel in the lower part of the switch locker and place a temporary jumper between terminals B+ and FP+ on this panel. The heat control switch should be in the "OFF" position. Remove the jumper before replacing the panel cover.
To start the overhead heat pump (#2 engine), place the temporary jumper between terminals B+ and OP+ on this panel. The heat control switch should be in the off position. Remove the jumper before replacing the panel cover.

d. Refill the sump tank to the top try-cock level.

Anti-Freeze Protection

The design of this system is such that it is not necessary to use an anti-freeze solution in the cooling water. As long as the engines are running, all associated piping are at a safe temperature.

However, if an engine should stop en route and cannot be restarted and the ambient temperature is such that there is danger of freezing before the next scheduled stop is reached, the cooling system should be drained (See Engine Draining Instructions this section).

Anti-freeze protection by means of steam is provided for yard parking with the engines shut down. A steam trainline is provided with standard end connections. Steam from this trainline is injected into the sump tank of each engine to maintain the water at normal engine temperature. The operation of this stand-by system is explained in Section 10 under "Heating".

Inhibitor

It is recommended that some type of inhibitor be used in the cooling water. The type used will depend on the water used and the standard practice of the railroad on which the cars are operating. It is suggested that each railroad use the same treatment as used in their Diesel locomotives. In the absence of any specified Diesel locomotive water treatment, the following is recommended by the engine manufacturer:

1. Maintain 1 ounce of sodium chromate per 35 gallons of water.
2. Adjust the PH value to between 8.5 and 9.5.
3. Analyze the water at least once a week.

Since the system contains 85 gallons of water (with a full sump tank), 2½ ounces of sodium chromate should be added every time the system is drained and refilled.

A removable plug has been provided for the easy insertion of water treatment powder, pellets or liquid. This plug is located in the outlet line from the radiators.

Since the steam used on standby anti-freeze protection is injected into the engine cooling water, there will be considerable dilution of the inhibitor solution during the winter time. Therefore, more frequent check of the concentration of the inhibitor is required in winter.

Engine Draining Instructions

A master drain plug is provided in the sump tank bottom fitting. This plug is provided with a cross-bar for easy removal. Tapping on the cross-bar with a hammer will loosen the plug so that it can be removed by hand. A small fitting is provided in the bottom of the engine water pump for draining. Since the oil coolers on the engine have a low sump, a valve is provided for draining. The extension handle of this drain valve is located on the lower part of the engine to the left of the water pump.

As shown in Fig. 7, the electrical equipment of the engine cooling system consists of the following:

a. Fan Control Thermostats

The low-fan speed thermostat is set to close at 165° and open at 157-159°. The high fan speed thermostat is set to close at 176° and open at 168-170°.

b. Line Contactor

This contactor has one normally open main contact and one normally open and one normally closed interlock.

c. Hi-Speed Contactor

This contactor is a duplicate of the line contactor.

d. Time Delay Relay

This contactor has one normally closed main contact and one normally open interlock. This contactor is adjusted to hesitate for 1½ seconds after the coil has been de-energized before the armature drops out and closes the main contact and opens the interlock.

e. Damper Switch

The damper switch is located on the engine and is connected to the combustion air damper in such a way that if the damper is closed, the switch contacts are open. When the engine is running, this damper must be open and the switch contacts closed. (See Fig. 7).

In the following, it is assumed that the engine under consideration is running and that the damper switch is closed.

As the water flows through the radiators it is cooled somewhat by natural aspiration. However, if the cooling rate is insufficient, the temperature of the water leaving the radiator will rise. When it reaches a temperature of 165°, the contacts of the low speed fan thermostat will close. When this contact is made, battery current will flow from B+ through the 15 Amp. control fuse, wire BP1, wire HC1, the low speed fan thermostat, wire LC3, the coil of the time delay relay, M1 interlock, wire 8F1, the engine damper switch to B—. At the same time, battery current flows through jumper from terminal #5 (B+) to one side of M1 contactor coil.

When the time delay relay coil becomes energized, the TD interlock in the M1 contactor coil circuit closes and completes the circuit to 8F1 (B—). This energizes the M1 contactor coil, closing the M1 interlock and sealing the M1 contactor closed. At the same time, the M1 interlock in the TD relay coil circuit opens and the coil de-energizes after 1½ seconds.

When the M1 contactor closes, a circuit is completed from B—, through wire CR1 to A2 of the fan motor. When the TD interlock closes in the M1 contactor coil circuit, the TD contact opens in the B+ circuit to the fan motor. This places the start resistance in series with the motor so that the motor starts on reduced voltage and reduced speed. After 1½ seconds, the de-energizing of the time delay coil closes the contact across the start resistance and places the full battery voltage across the motor. The 1½ seconds is sufficient time for the fan motor to have reached a speed where the application of full battery voltage will not produce a noticeable voltage drop and thus reduce light flicker.

When the fan starts, it cools the water flowing through the radiator. When the water temperature reaches 157-159°, the contact of the low speed fan thermostat will open. This de-energizes the coil of M1 contactor permitting M2 contacts to open and stop the fan motor. At the same time, interlock M1 closes and re-establishes the circuit to the time delay relay coil for subsequent starting.

However, if the low fan speed is insufficient to cool the water in the radiator and the temperature continues to rise; when it reaches 176°, the contact of the high speed fan thermostat closes.

This causes battery current to flow from B+ through the 15 Amp. control fuse, wire BP1, wire HC1, the 176° high speed thermostat, wire HC3, the coil of M2 contactor, wire 8F1, the engine damper switch to B—. This energizes the M2 contactor coil, closes the M2 interlock shunting the 165° thermostat, closes the M2 contactor which connects the shunt resistance in parallel with the series field coils of the fan motor, weakening the field and increasing the speed of the motor and fan.

The increased speed forces additional air through the radiator, providing increased cooling of the water and lowering the outlet water temperature. When this temperature drops to 168-170°, the contact of the high speed fan thermostat opens. This de-energizes the coil of the M2 contactor allowing M2 contacts to open cutting out the shunt resistor and restoring full field to the motor. The motor then slows down to low speed.

Under normal high speed fan operation, the closing of the M2 interlock across the 165° thermostat has no effect since the 165° low speed thermostat contacts would be closed. However, if the 165° thermostat should fail to close and prevent the starting of the fan at low speed, then when the water out of the radiator reaches a temperature of 176° and the contact of the high speed thermostat closes, the starting circuit would be set up the same as if the 165° low speed fan thermostat had closed. This is an emergency condition, provided to prevent unnecessary engine shut-downs in the event of a failure of the low speed fan thermostat.

It is recommended that a periodic check of the 165° thermostat be made in order to insure its operation at all times. A continued use of the high speed thermostat without the low speed thermostat first closing imposes an extra duty on the fan motor for which it is not designed.

MAINTENANCE

All contacts of the contactors should be inspected periodically, the burrs removed and contacting surfaces maintained smooth. The interlocks should be checked for proper contact.

The engine should be run for a sufficient length of time in #1 throttle position to cause the thermo-pneumatic control valve to open, admit air pressure to the by-pass valve and cause the low speed fan thermostat to close. After the low speed fan thermostat has once closed and opened, a piece of paper should be inserted under the TD contacts in the M1 contactor coil circuit. This will prevent the fan motor from starting and the radiator water outlet temperature should rise until the high speed fan thermostat contacts close; thus energizing the high speed contactor coil M2 and closing the contacts M2. The paper should then be removed and a check made that the fan motor starts at high speed. Temperatures of the engine should be observed by watching the temperature gauge on the engine panel. The temperature should not exceed 200° at any time. If the temperature exceeds 200°, it is an indication that the high speed fan thermostat contacts have not closed.

Three of the terminals on each fan control panel (in the "A" regulator locker) have been numbered 4, 5 and 12.

In the event of a hot engine shut-down, the fan controls can be checked by placing a jumper across the following pairs of terminals.

a. Terminals 12 and 5 shunt out the low speed fan thermostat and cause the fan to run at low speed.

b. Terminals 12 and 4 shunt out the high speed fan thermostat and cause the fan to run at high speed.

Before the above checks can be made, the engine damper switch contacts must be closed and the engine running.

Servicing Engine Water Outlet Thermostatic Valve

Figure 3 shows the working parts of the Thermo-Pneumatic Control Valve.

As the temperature of the water surrounding the thermal power element rises, the plunger in the thermal power element pushes the rod toward the air valve. At 176° the push rod will have moved the push rod overtravel cap into contact with the plunger causing the air valve to open. The inner spring is an overtravel spring which allows the push rod to telescope in the push rod overtravel cap when the cap has reached its maximum travel allowed by the air valve assembly.

The air valve assembly should be removed for cleaning and lubrication periodically. To perform this work, remove the two ¼ inch screws which retain the air valve assembly to the bronze control housing. Remove the air valve mechanism from the housing and wash off any foreign matter. Remove and renew the three "O" rings. Apply a small amount of lubricant to the working parts and to the 3/4 inch hole through which the push rod overtravel cap operates. Reassemble and securely tighten the two 1/4 inch screws. DO NOT USE DISTILLATE OILS ON "O" RINGS.

If it should be *positively* determined that the valve requires adjustment proceed as follows:

1. Remove the valve from the car.
2. Connect a 90 p.s.i. air pressure source to the air valve "IN" connection.
3. Remove the two setscrews in the power element housing.
4. Place the thermal power element in 176° water. Place an accurate thermometer in the water, locating the thermometer bulb close but not in contact with the power element. Keep the water agitated while making adjustments.
5. Turn the top portion of the control housing into the power element portion of the housing until the air valve operates.

   NOTE: It is important that the adjustments be made as described in Item 5, i.e. by bringing the power element up to the temperature and not on the downward cycle.

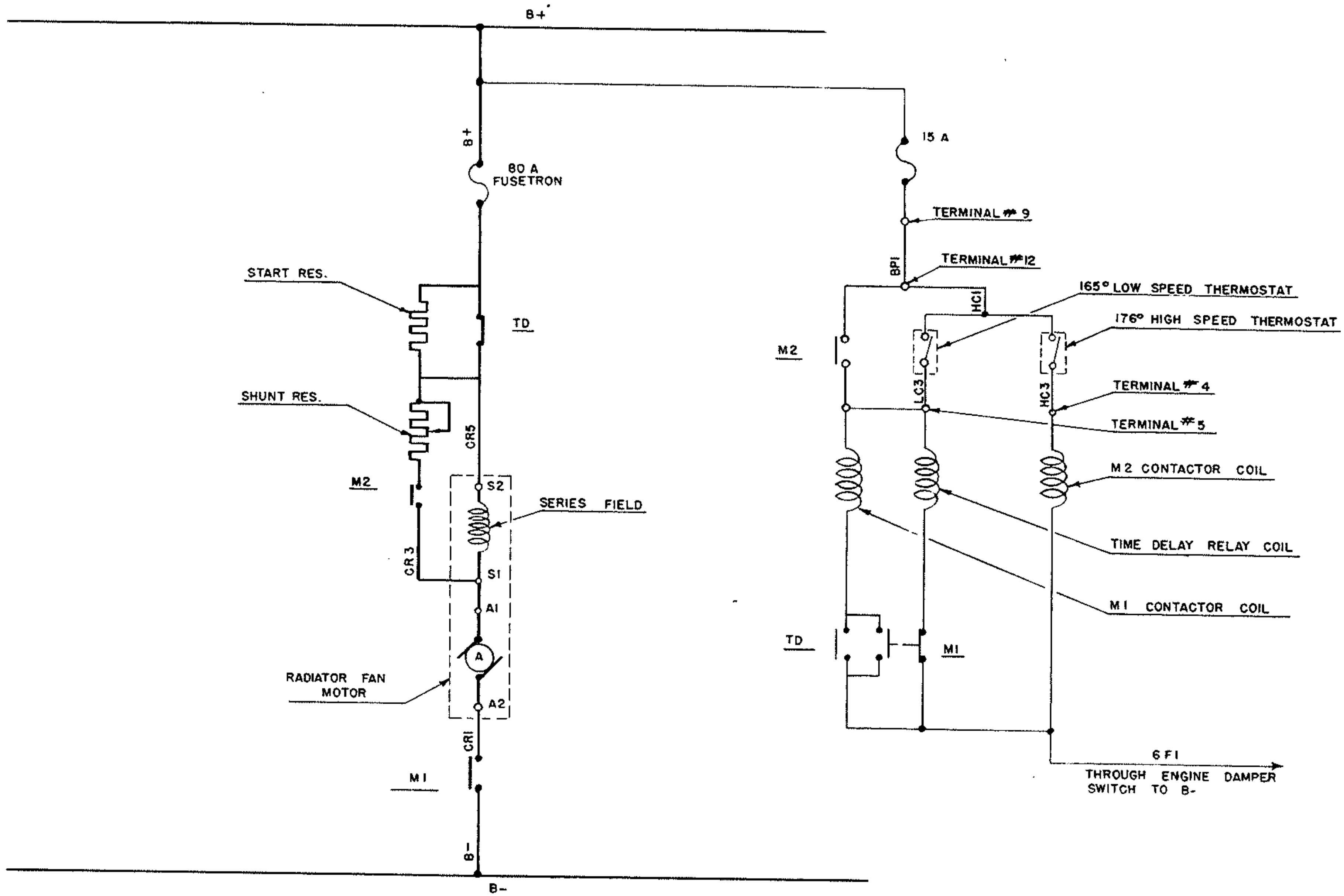
6. Recheck the operation of the valve several times by removing the thermal power element from the water and reinserting.
7. Drill point an indentation into the top portion of the housing through the setscrew holes. This is to insure the setting and to protect the threads.
8. Replace an tighten the two setscrews.

After installing a new thermal power element, cycle it a few times in hot and cold water before making any adjustment. DO NOT PLACE THE THERMAL POWER ELEMENT IN HOT WATER UNLESS IT IS IN THE HOUSING UNDER SPRING PRESSURE. THE SPRING PRESSURE IS NECESSARY TO LIMIT THE PLUNGER TRAVEL. DISREGARDING THIS INSTRUCTION MAY CAUSE DIAPHRAGM RUPTURE IN THE THERMAL POWER ELEMENT.

It is recommended that the thermal power element on assembled valves be protected by a 1 1/4 inch pipe coupling until such time as the valve is installed on the car. Serious damage or change of calibration may result if the power element is exposed to mechanical abuse.

Also, when installing the valve it is important that the wrench be applied to the hex nut provided on the lower portion of the valve for this purpose. The application of any force to other portions of the valve will result in damage or change in calibration due to forcing the lock provided at the setscrews.

When installing a valve in the pipe fitting on the car, care should be exercised to make the last turn so that the small hole between the air valve portion and the control valve portion is facing down. This provides a drainage source in case of water leakage into the valve.



ELECTRICAL CIRCUITS
ENGINE COOLING SYSTEM.

FIG-7

SECTION 12

AIR CONDITIONING SYSTEM (COOLING)

For RDC-1, 2 and 3 Only

The cooling system as shown in Fig. 1 consists of a standard Frigidaire Electro-Mechanical Unit arranged for 7 tons rating with a dry type condenser.

The compressor motor unit and condenser unit are mounted underfloor and are connected to the cooling coil and blower unit mounted over the low ceiling at the "B" end of the car.

The Frigidaire compressor-motor control panel is located in the "B" end regulator locker.

The cooling control panel is located in the switch locker at the "B" end of the car.

COMPRESSOR-MOTOR UNIT

The compressor-motor unit consists of a four cylinder compressor driven by a 12 horsepower, 72 volt DC, 1750-1000 RPM motor equipped with a 5⅝ inch pulley. This motor drives the compressor by means of six V belts.

The compressor and motor are mounted in a suitable frame designed to withstand severe impact shocks. Rubber mounts isolate the unit from the supporting car mounting members.

The motor is suspended from the frame by means of a swivel mounting. Belt tension is maintained by means of a belt adjustment rod.

CONDENSER UNIT

The condenser unit consists of: two identical condenser coils, motor and fans and a liquid receiver. The entire condensing unit is mounted in a sturdy frame. Resilient mountings are used to insulate the frame from the car supporting members.

The condenser coils are identical; therefore, eliminating the need for carrying right and left hand coils.

The condenser motor is mounted to a motor support base welded to the liquid receiver. This motor is a 1 horsepower, 72 volt DC, 1750 RPM double shaft motor and is equipped with stainless steel fans.

A field control resistor is mounted on the bottom of the traction relay panel in the "B" end regulator locker. The resistor is used to adjust the field of the condenser motor so as to obtain the proper RPM; hence, the proper air delivery through the condenser coils.

The receiver is a welded cylindrical tank, designed with ample storage capacity to store the entire charge of refrigerant when the system is pumped down. It is equipped with a sight glass to visually determine the liquid level.

The full charge of refrigerant is approximately 50 pounds and the pump down capacity is based upon the full charge not exceeding this amount.

Water sprays may be added to the condensers to provide greater cooling capacity if required.

AIR CONDITIONING UNIT

The air conditioning unit consists of a heating coil, cooling coil, flexible duct and blower assembly. A drip pan is located under the heating and cooling coils.

The heating coil is located at the discharge end of the unit. It is attached to the cooling coil by means of two cap screws at the top and a nut and bolt at the bottom of each side. Thus, by removing these six fasteners, the heating coil may be removed through the opening at the hinged return air grille.

COOLING COIL

The cooling coil is a standard unit suspended from the roof of the car over the low ceiling area. This unit is a split coil construction, with a solenoid controlling the top half of the coil. When the system is operating on the modulating cycle, half of the coil is cut off by the solenoid, and the compressor speed reduced to provide approximately four tons of refrigeration.

This unit is supported by a set of slide rails supported by the roof structure (See Fig. 1). The front end of the unit is driven under a wedge and held in place by two bolts attaching the unit to the slide rail, one at each side of the rear of the unit.

To remove the cooling coil, first remove the blower unit. It is only necessary to remove the two bolts attaching the cooling coil to the slide rails; then the coil can be slid on the rails toward the end of the car. At a point above the trap door, in the ceiling of the vestibule, the coil will slide off of the rails and can be lowered through the trap door.

BLOWER UNIT

The blower is a standard unit consisting of a 1 horsepower, 60 volt DC, 1250 RPM motor with a double extended shaft provided with two squirrel cage blowers. The unit is capable of delivering 2400 CFM through the coils into the main discharge duct.

A two ohm, 420 watt resistor is connected in series with the armature of the motor to permit adjustment of its speed. This resistor is mounted in the plenum chamber above the motor.

On the RDC-1 and 2 cars this resistor is adjusted to provide the delivery of 2400 CFM.

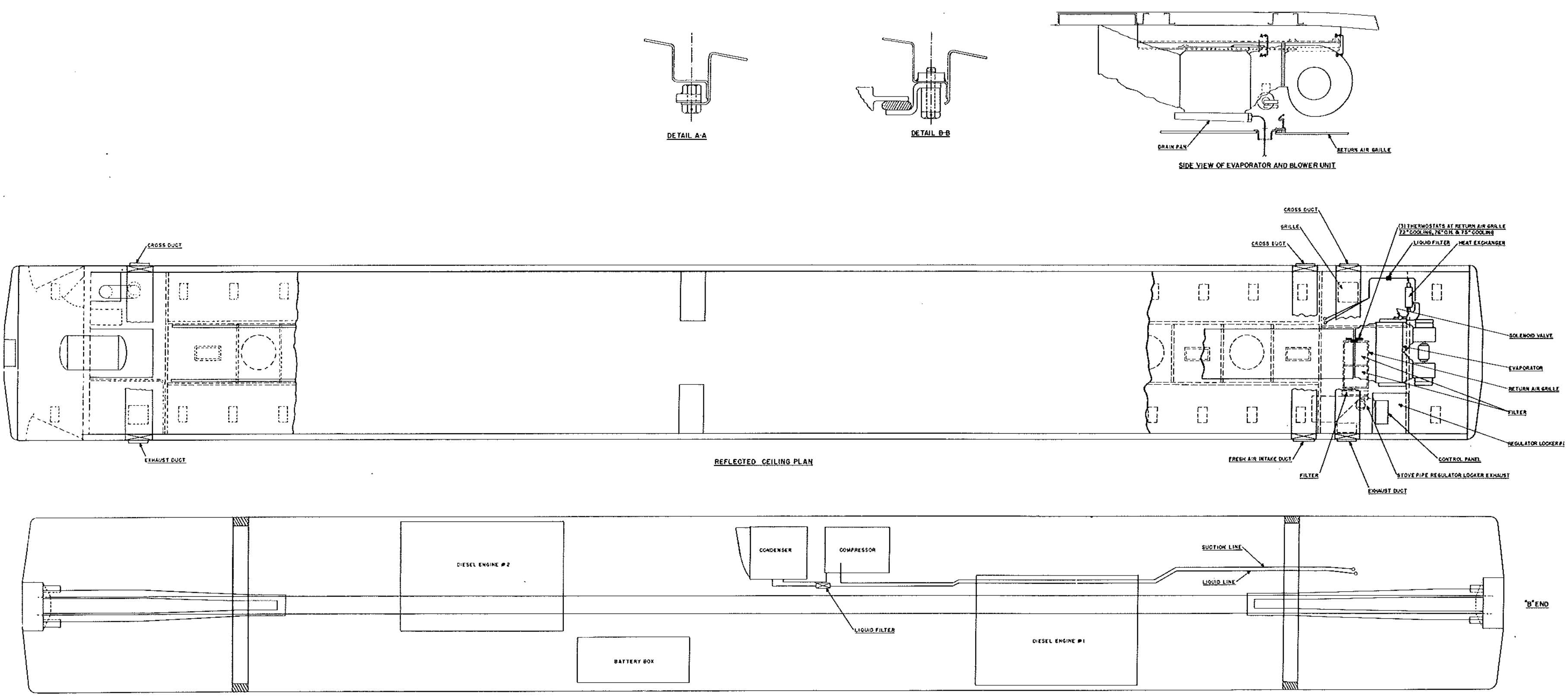
On the RDC-3 car the resistor is adjusted to reduce the motor speed, to provide the delivery of 2100 CFM.

The blower unit is attached to the same set of rails that support the cooling coil. The blower unit is attached to the rails by means of four bolts. To remove this unit, remove the four attaching bolts and the unit can be lowered through the trap door.

An additional access panel is provided in the ceiling of the toilet on the "B" end of the car.

SUCTION AND LIQUID LINES

The suction and liquid lines are both type "K" copper tubing. The suction is 2⅛" OD and the liquid line, ¾" OD. These two lines are run close together whenever possible and wrapped and covered with an insulating jacket.



AIR CONDITIONING SYSTEM (COOLING) LAYOUT

FIG. I

LIQUID STRAINER

The liquid strainer is installed in the liquid line between the condenser and the cooling coil. This strainer is mounted on the centersill of the car just in back of the compressor.

LIQUID FILTER

The liquid filter is installed in the liquid line just ahead of the expansion valves. It is accessible through the trap door in the ceiling of the toilet.

HEAT EXCHANGER

The heat exchanger, as shown in Fig. 1, is located over the ceiling near the cooling coil. It is connected in the suction line with the liquid line connections on one end.

THERMOSTATS

There is a thermostat containing two mercury tubes located in the recirculated air stream. It is mounted just above and to the left of the recirculated air grille.

One mercury tube has a setting of 75° and is used as the modulating control. The other tube has a setting of 72° and is used as the pilot control.

RETURN AIR GRILLE

The return air grille is a 20¾″ x 32¾″ grille, mounted in the low ceiling under the evaporator unit. It is provided with a frame to receive the return air filters. A perforated plate is located under the return air filter and has been calibrated to produce the proper ratio of fresh air and return air. The calibrated plate should not be removed or changed except after exhaustive tests have shown that the fresh air-return air ratio is wrong. The various ratios applied to the RDC cars are as follows:

	Fresh Air	*Recirculated Air*	*Total*
RDC-1	600	1800	2400
RDC-2	600	1800	2400
RDC-3	600	1500	2100

RETURN AIR FILTERS

These are standard 16″ x 20″ x 2″ oil coated wire mesh filters. They are located in the return air grille. Normally, the cars are furnished with Air Maze type "B", however, the holder will accommodate any standard 16″ x 20″ x 2″ unit. These filters can be removed for cleaning and replacement by lowering the return air grille.

FRESH AIR INLET

The fresh air inlets are in the side of the roof just above the letterboard, one on each side of the car. These inlets are connected together by means of a 3″ x 19″ cross duct installed immediately under the roof sheets between the carline. This cross duct is in turn connected to a fresh air filter box located forward of, and to the left of, the cooling coil.

FRESH AIR FILTER

This is a standard 16" x 20" x 4" oil coated wire mesh filter. This filter is located in the plenum chamber just above and to one side of the recirculated air grille. Normally, an Air Maze Type P-18 filter is furnished on the car, but the holder will accommodate any standard 16" x 20" x 4" unit.

EXHAUST OUTLETS

There are two exhaust outlets in the roof at each end of the car, one on each side. These outlets are connected by a cross duct which in turn is connected to an exhaust air grille in the ceiling of each toilet. There is also a 6" stove pipe connection running to the top of the regulator locker.

Since there is only one toilet provided in the RDC-2 and RDC-3 models, provision is made to exhaust a portion of the passenger compartment air into the baggage compartment by means of a grille in the partition between these two sections.

AIR DISTRIBUTION

Air from the cooling coil is conducted down the center of the car by means of a 9" x 35" stainless steel main discharge duct. There is a flexible connection between the duct and the outlet of the air conditioning unit and is provided with a zipper for access to the face of the coil. Air is distributed into the car by means of "Anemostats" located in removable panels forming the lower side of the main discharge duct. These anemostats have adjustable dampers which have been set to give the proper distribution of air in the car body before the cars are delivered. These dampers should not be changed as it may seriously affect the air distribution in the car resulting in improper temperature levels.

The three RDC models have the following quantities of air distributors:

RDC-1 — 9 RDC-2 — 7 RDC-3 — 5

The lower panels of the duct in which the air distributors are mounted are removable for access to the interior of the duct for cleaning. The moulding along one edge of these removable panels is held in place by slotted head screws. If these are removed and the moulding taken down, this edge of the panel can be dropped and the opposite edge slid out from under a fixed piece of moulding. The alternate panels without anemostats are fixed and should not be removed for cleaning.

COMPRESSOR CONTROL PANEL

This is a standard type "QG" Frigidaire panel. It is equipped with main contactors, a time delay relay, a low voltage relay, a timer and resistors to control the starting and stopping of the compressor and condenser fan motors. It also contains the relays and resistance to slow down the compressor motor when the system goes into "modulated" control.

PRESSURE CUTOUTS

The Hi and Lo pressure cutout switches are mounted together with the Hand-off-Auto switch in a cast iron box in the motor compressor unit. Above these switches is mounted a Modulating Pressure switch. The Hi pressure cutout switch is set to cut out at 245 lbs.

pressure and cut in at 175-200 lbs. pressure. The Lo pressure switch is set to cut out at 2-3 lbs. pressure and cut in at 35 lbs. pressure. The Modulating Pressure switch is set to open at 240 lbs. pressure and close at 200 lbs. pressure.

CONTROL SWITCH

The switch controlling the cooling system is mounted on the heating and cooling control panel in the lower part of the switch locker in the "B" end of the car. This switch has five positions: Hi-Heat, Lo-Heat, Off, Cool and Anti-Freeze. When the switch is in the cool position, it energizes control circuits to start the cooling system providing the car temperature is above 72°. The blower switch located in the bottom of this panel must be in the "ON" position and the main lighting breaker "ON" before cooling can be obtained.

COOLING PILOT LIGHT

This pilot light is a white bull's-eye lens provided with a lamp and is located just above the switch locker door on the "B" end of the car. This light is on only when the cooling system is operating. It goes out whenever the temperature of the car has been lowered to satisfy the cooling thermostats and the compressor has shut down. This lamp is 110V., 6W, candelabra base bulb, GES-6.

FUSES

The following fuses or circuit breakers are used in the cooling system:

Compressor Fuse — 175 amp. Fusetron mounted on the compressor control panel — "B" End Regulator Locker.

Condenser Fuse — 30 amp. Fusetron mounted on the traction relay panel immediately above the Frigidaire control panel — "B" End Regulator Locker.

Blower Circuit Breaker — 30 amp. circuit breaker on the heating and cooling control panel in the Switch Locker.

Positive Control Fuse — 15 amp. plug fuse on the heating and cooling control panel in the Switch Locker.

Negative Control Fuse — 15 amp. plug fuse on the heating and cooling control panel in the Switch Locker.

OPERATION OF THE SYSTEM

To obtain cooling in the car, it is necessary to first: turn the main lighting breaker to "ON", move the blower switch at the bottom of the panel to the "ON" position, and then turn the heating and cooling control switch to the "COOL" position. If one or both engines on the car are running, the air conditioning system will operate if the car body temperature is above 72°. When the cooling pilot light is lighted, it is an indication that the compressor and condenser motor are running.

If the interior of the car is above 75° when the system is started, the compressor will run at full load until the modulating thermostat is satisfied. When this occurs, the unit will then be cut to slow speed and will operate at approximately half tonnage until the low temperature thermostat is satisfied, at which time it will shut down completely. However, the overhead blower continues to run to deliver air into the car body.

If the engines on the car are not running, it will be necessary to push the reset button to start the unit. However, the unit may or may not start depending entirely on the charged condition of the battery. If it does start, it will run for only a short time before the battery voltage has been pulled down to a point where the low voltage relay will trip off the unit in order to properly protect the battery against discharge.

If one or both of the engines are running, and the auxiliary generators are charging, the battery reset function is automatically taken care of by the auxiliary contact on the reverse current relay.

OPERATION OF CONTROLS

Wiring Schematics No. 1 and 2 indicate the car schematic diagram for the cooling system of the RDC cars. The operation of this system is as follows:

1. The selector switch on the heating and cooling control panel in the switch locker should be turned to "COOL". The blower switch on the panel, turned to "ON", and the Main Lighting Breaker to "ON".

2. If one or both engines are running, the cooling system will start without pushing the reset button. If both engines are shut down, pushing the reset button will energize the LV relay via terminals C3 and C1 (the LV relay circuit is closed by the auxiliary contact of the generator reverse current relay when an engine is running).

Note that the LV relay is sensitive to a definite voltage and state of battery charge through a current compensating coil in the compressor motor circuit and a voltage coil across the battery. Thus, a heavy starting current which would create a low battery terminal voltage preventing the "LV" relay from tripping out at the time the compressor motor starts. However, a low battery terminal voltage due to abnormal discharge condition will trip out the "LV" relay and shut down the compressor, thus preventing further drain on the battery.

3. After the "LV" relay closes, "LV1" coil is energized and its contacts closed: One set to lock in the "LV" coil so that the "Reset" button may be released and one set to energize the motor accelerating circuits between terminals "A" and "LR".

4. If the "CPR" relay is energized, (due to a car temperature of above 72° and the Hi-Lo pressure cut-outs closed), then closing of "LV1" contacts will energize the accelerating contactor "1A" and the compressor motor starts in series with the armature starting resistance. An auxiliary contact on the "1A" contactor also shorts out the field resistance of the compressor motor and improves the motor starting torque. At the same time, the condenser fan motor also starts running.

Lifting of the "1A" solenoid releases the pneumatic timer and 2.5 to 3 seconds later the timer "1A" contacts close. This energizes the coil of the line contactor "2A", closing its main contacts and connecting the compressor motor directly across the line. One auxiliary contact of the "2A" contactor also closes to cut the economizer resistance #3, in series with the coil of "2A" contactor, thus reduceing its coil energy. The other auxiliary contact of the "2A" contactor opens the circuit of the coil of the "1A" contactor causing it to drop out, returning the pneumatic timer to its original starting position. At the same time auxiliary contact "1A", which had shunted out the motor field resistor, opens and the compressor motor comes up to full speed, providing "P" contact is open as explained in item #6.

5. If the car temperature was above 75° when the control switch was turned to "COOL" as noted in item 2 above, then the coil "CMR" would be energized through the closed contacts of the 75° modulating thermostat.

6. With "CMR" coil energized, its two contacts are closed. One energizes the "RV" valve causing the valve to open and admit freon to the upper portion of the cooling coil so that it operates at full capacity. The other contact energizes the "P" relay coil opening

its contact "P". This removes the shunt across the field resistance and establishes it in series with the motor shunt field; thus reducing the field strength and increasing the speed of the compressor motor so that the motor runs at full speed.

7. When the car temperature drops below 75°, the contacts of the 75° modulating thermostat will open and de-energize the "CMR" relay. One contact of the "CMR" relay in opening, de-energizes the "P" relay and the other one in opening de-energizes the "R V" valve. When the "P" relay is de-energized its contact closes, shunting out the compressor motor field resistance. This increases the field strength of the compressor motor causing it to slow down, thus reducing the output of the compressor. At the same time, the "RV" valve closes, shutting off the freon to ½ of the cooling coil and reducing its capacity.

8. When the outside temperature is high and the head pressure rises to 240 lbs.; the modulating pressure switch contacts which are in series with the 75° modulating thermostat will open. This will create the same condition as described in item 7 above, reducing the compressor capacity to one half. When the head pressure reduces to 200 lbs., the modulating pressure switch contacts will close and allow the compressor to operate at full capacity.

9. When the car temperature falls to a point below 72°, the CPR relay is de-energized by the opening of the contacts of the 72° thermostat. Opening of the contact of the CPR relay de-energizes the coil of the relay 2A causing it to drop out. The normally closed interlock of the 2A contactor sets up the circuit to the 1A coil and the normally open interlock of the 2A contactor opens the holding circuit to the coil of the 2A contactor through resistance #3. The main contact of the 2A contactor opens and breaks the circuit to both the compressor motor and condenser fan motor.

10. The Hi-Lo pressure switch is also in the circuit to the 1A and 2A coils. In the event that the contacts of either the Hi pressure or Lo pressure switch open, the unit will stop and will not start again until these contacts return to a closed position.

11. However, if the Hand-Off-Auto switch is thrown to the Hand Position, the contacts of the CPR relay and pressure switch will be shunted and the unit will re-start providing the LV relay is in.

Moving the Hand-Off-Auto switch to the "OFF" position isolates the starting circuits and the compressor motor can not be started.

CHECKING AND ADJUSTING THE LOW VOLTAGE RELAY

The "pick-up" and "drop-out" settings of the low voltage relay on the RDC cars is entirely different from the standard settings recommended by Frigidaire for passenger car equipment with axle driven generators. However, the testing and adjusting procedures are similar.

1. Testing equipment required:

a. Adjustable resistor 200 ohms, 100 watts.

b. Reliable accurate voltmeter 0 to 150 volts.

c. DC ammeter and shunt 0 to 200 amps.

2. Pick-Up Voltage Check

a. One engine on the car should be running and a generator charging the battery.

b. Insert a piece of paper between the auxiliary contacts "RC" of the reverse current relay for the generator of the running engine. Check the "RC" contacts of the reverse current relay for the other engine and see that they are open.

c. Pull compressor motor fusetron.

d. Disconnect external wire from terminal "C1" on the compressor control panel and insert the variable resistor with the resistance all cut in.

e. Connect voltmeter leads to "CL" (+) and "B—" terminals of the compressor control panel.

f. Connect a temporary jumper between "B+" and "C3" terminals of the compressor control panel (equivalent to pressing reset button).

g. Turn heating and cooling control panel switch to "COOL" and Voltmeter should register.

h. Raise the voltage slowly by means of the adjustable resistor and the LV relay should pick up at 67-68 volts. Check several times. If the pick-up voltage is other than 67-68, relay should be adjusted.

3. Adjustment of Pick-Up

a. Turn heating and cooling control panel switch to "OFF".

b. Remove "LV" relay seal and enclosure, "LV".

c. Loosen hex locking nut on the right hand stationary contact screw. One turn of this screw, counterclockwise increases the pick up setting four volts.

d. After proper adjustment has been obtained, tighten hex locking nut and again check pick up setting as instructed in item #2 — (g) and (h).

4. Drop-Out Check

a. One engine on the car should be running and the generator charging the battery.

b. Insert a piece of paper between the auxiliary contacts "RC" of the reverse current relay for the generator of the running engine. Check the "RC" contacts of the reverse current relay on the other engine and see that they are open.

c. Turn heating and cooling control panel switch to "OFF".

d. Remove jumper ("B" to "C3") applied during pick-up check and tighten terminals.

e. Set adjustable resistor for *minimum* resistance.

f. Insert ammeter and shunt in place of compressor fuse. Close ammeter short-circuiting switch.

g. Turn heating and cooling control panel switch to 'ON" and voltmeter, which should still be connected B— and "C1", should indicate.

h. Push reset button on heating and cooling control panel and compressor motor should start. Open short-circuiting switch on ammeter.

i. Lower voltage slowly by means of adjustable resistor and read ammeter and voltmeter at the same time. Check when the "LV" relay drops out. Drop-out at a given motor current should be as follows:

	Amp.	Voltage
Compressor "OFF"	0	66-67
Compressor Low Speed	80	63-64
Compressor High Speed	130	61-62

j. Make sure ammeter short-circuiting switch is closed. Press reset button and check several times. If drop-out voltage is other than above table adjust.

5. Drop-Out Adjustment

a. Turn heating and cooling control panel switch to "OFF".

b. Loosen the hex locking nut on the left hand stationary screw of the "LV" relay. One turn of this screw, counterclockwise, lowers the drop-out voltage approximately four volts.

c. After the adjustment has been made, tighten the hex locking nut and check drop-out voltage using procedure given in item #4.

d. Repeat "Adjusting and Checking" procedure as often as necessary to obtain desired drop-out setting.

e. When pick-up or drop-out settings have been made: (1) replace "LV" cover and seal, (2) replace compressor motor fusetron, (3) remove voltmeter and leads, (4) remove adjustable resistance and reconnect external wire to "C1" terminal on the compressor control panel, (5) remove paper from the auxiliary contacts "RC" of the reverse current relay.

6. Checking and Adjusting Timer Element

The timer element is set for a timing period of 2.5 seconds. Under normal operating conditions, it should rarely be necessary to make any adjustment of this control. Field servicing of the timer is simple and rather limited. If any servicing or repairs, other than the adjustment procedure as given below, are required, it will be necessary to return the entire timer to the factory.

a. Adjusting

It will first be necessary to remove the molded cup at the base of the timer element. To do this, remove the wax deposit that has been placed in the setscrew hole. This will reveal the Allen setscrew that must be backed out, so that the cover can be unscrewed.

The adjusting valve stem is held in place by a locking plate, secured by four screws. Do not disturb these screws, but check to see that they are tight. The timing can be changed by turning the adjusting valve stem clockwise for increased timing and counterclockwise for decreasing timing. However, it is strongly suggested, that so long as the timer is actuating within the range of 2.5 to 3 seconds, no attempt be made to change the setting.

The contacts, which are mounted at the front of the timer element can be examined and serviced by removing the mounting screws holding the auxiliary switch in place. In servicing or replacing the contact mechanism, it is important that the adjusting screw, which engages the contact plunger, be arranged to obtain a positive closing of the contact after the timer element has actuated.

Upon completion of adjusting and servicing the timer element, replace the molded cup at the base, tighten Allen setscrew and fill remainder of screw hole with wax or some other substance that will not set hard. This is to prevent any unauthorized person from attempting to adjust or service the timer element.

7. Servicing and Maintenance

a. Filters

It is important that both the fresh air and recirculated air filters be removed and cleaned weekly in order to secure the proper air flows and distribution in the car. To remove these filters, drop the recirculated air grille at the low ceiling area at the "B" end of the car. The recirculated air filters are mounted in this grille. The fresh air filter is located in a frame above and to one side of the trap door. The filter should be removed, steamed, and washed clean, dipped in oil and drained according to standard practice. (On some Railroads it is common practice to spray the filters with oil instead of dipping and draining).

b. Cooling Coil and Blowers

The cooling coil and blowers should be blown out with compressed air every 6 months. The flexible connection between the coil and main discharge duct is provided with a zipper in its lower portion to permit access to the front coil face. The flexible connection between blower and coil is attached to the cooling unit by means of a ring held in place with wing nuts just above the drip pan and a slot along its upper edge. After loosening the wing nuts the ring can be pulled down and out of the slot, and pushed back against the blower for access to the coil rear face. When replacing this flexible connection be sure the upper edge of the ring is hooked under the groove along the upper part of the coil and the sides of the frame are under the hooks on the coil sides. An air leak at this point will seriously affect the capacity of the unit.

c. Expansion Valves and "RC" Valve

These units are accessible through the trap door in the ceiling of the toilet at the "B" end of the car. In case of malfunctioning of these valves, they should be replaced with a new valve and the old one serviced in the shop. For servicing details, see Chapter V "Mechanical" of Frigidaire Service Manual SER-548. Care should be taken when installing a new expansion valve to see that the control bulb makes proper contact with the suction manifold.

d. Condenser

The condenser coils should be blown out with compressed air at least every month. If a cleaning solvent under pressure or steam is available, it should be used instead of compressed air. A clean condenser coil is absolutely necessary in order to obtain maximum cooling.

The Freon level in the receiver should be checked weekly. For normal operation the liquid level should be approximately half way up the sight glass, while the system is operating under full loaded conditions. At half load with the compressor running at low speed, the liquid level should be approximately ¾ up the sight glass. The total capacity of the system is 50 lbs. of Freon.

e. Main Contacts

If the main contacts on the compressor control panel are badly burned or arced together, it is an indication that the cooling thermostats are chattering. These thermostats should be checked with a thermo-meter located at the thermostat to see that there is not less than 2° difference between opening and closing of the thermostat contacts.

f. Detail Maintenance

For more detailed maintenance such as recharging the system, replacing compressor seals, etc. see Frigidaire Service Manual SER-548, Chapter VII "Mechanical".

PROCEDURE FOR COOLING RDC CAR WHEN BEING TOWED IN A CONVENTIONAL PASSENGER TRAIN

1. One engine must be operating to provide battery charging. The engine stop and isolation switch (located in the respective regulator locker) must be in the "ISOLATE" position to isolate the engine controls. It is not necessary to "ISOLATE" the shutdown engine from its respective regulator locker.

2. Insert the Master Plug Switch in the receptacle (located in the collision post at the controller) at either end of the car. Do not insert the Reverse Lever in the Controller.

3. Snap the Main Lighting Breaker and the Blower Switch to the "ON" position. Set the Selector Switch on the Heating and Cooling Control Panel to "COOL" position.

CAUTION: If abnormal loads are encountered due to operating conditions, the second engine may be required. If second engine is required, item #1 should be repeated for this engine.

SECTION 13

BATTERY

One battery consisting of 8 trays with 4 cells per tray, is provided underfloor. On the RDC-1, 2 and 3, the battery is located in a stainless steel box on the right hand side of the car. On the RDC-4, the battery is divided into two groups of four trays each and each group is located in a stainless steel box. One box at each side of the car. The battery is 64 volt, lead acid type having 17 plates, 32 cells and a 284 Ampere Hour nominal capacity at an 8 hour rate of discharge. The full charge gravity is 1.240 to 1.250 and is based on the electrolyte level being at the high limit of 1/8" below the bottom of the filling tube. The low electrolyte level is at the splash cover.

Distilled water or approved water only should be added to the cells at frequent intervals. The electrolyte should always be kept above the splash covers. Overfilling of the battery will cause overflow of electrolyte through vent ports, lowering of gravity, reduction of battery capacity and damage to electrical circuits and the battery box.

When adding water in cold weather, it is important that it be added before the car is placed in service so that the water and electrolyte will mix. If the water is added and the car is left in freezing temperatures without being operated, the added water will not mix with the electrolyte and a freeze up and damage to the battery will result.

Batteries should be kept clean and free of any spilled electrolyte. If top of battery is found to be damp with electrolyte, a solution of one pound of bicarbonate of soda mixed in one gallon of water should be applied with a paint brush. Care should be taken that none of the solution be allowed to enter the cells as this will neutralize the acid and reduce the cell capacity. After foaming has stopped flush off battery with clear water to remove bicarbonate óf soda solution.

All vent plugs are provided with small openings for the escape of gas.

Clogged openings may cause sufficient gas pressure within the cell, to break the seal between the jar and cover.

If these openings are found clogged with dirt, when examined during any inspection, they should be immersed in water and thoroughly cleaned.

It may be necessary to use a piece of wire to clear the openings.

Accumulated gum or grease deposits on the plugs, can be removed by cleaning with carbon tetrachloride or Stoddards Cleaning Fluid. Remove cleaning fluid with low pressure air.

A cracked vent plug, or one upon which the soft rubber gasket does not seal tightly, or from which the hard rubber disc below the gas chamber has been lost, must not be used.

Vent plugs, when removed, should be placed bottom-side up, on battery covers. When laid right side up, accumulated dirt may be introduced into the cell contaminating the electrolyte, which may in turn shorten battery life.

Cell covers damp with electrolyte may be an indication of clogged vent openings. Damp covers may also be caused by poorly applied plugs, adding too much water or a break in the seal.

The bolted battery connections should be kept clean. The solid lead terminal surfaces may be cleaned with a wire brush. The lead coated copper lugs must not be scraped or cleaned with a wire brush, as the thin lead coating may be completely removed.

Corrosion on connector bolts, lugs and cables should be removed by washing in a hot soda solution, consisting of one pound of commercial bicarbonate of soda to one gallon of water. The cleaned parts should always be washed thoroughly in clean water and dried.

Apply a thin coating of vaseline or mineral grease to all contact surfaces and connector bolts. Securely tighten, using two wrenches to lessen strain on battery terminal posts and wipe off excess grease with a clean cloth.

Where heavy currents are required to start a Diesel engine it is important that connections are kept clean and tight.

The battery should be well blocked to prevent excessive movement in the compartment. The side blocking must engage both upper and lower reinforcing strips and the end blocking should not be higher than 9 inches. Clearance between sides, back and front of the battery and the compartment surfaces should be about $\frac{1}{8}$ of an inch.

All cables and intercell connectors should be arranged to prevent crushing or any rubbing action that may damage insulation and cause grounds.

It is recommended that a Routine Battery Inspection be made at least once a week. The following procedure should be used:—

1. Take specific gravity reading — one cell in each half of battery. — Record.

   If reading is 100 points or more below full charge value— boost charge battery.

2. Measure and record level of electrolyte above splash cover, one cell in each half of battery.

   Water additions should be required only at time of monthly inspection. If electrolyte level is close to splash cover, add water to all cells and check reason for need — Record.

3. Check temperature of battery cover by hand. Take thermometer reading of electrolyte if cover feels very warm.

   If electrolyte temperature is found above normal, find cause and correct.

4. If marked vent plug is used, rotate marked vent plug to the next cell in the series. When the last cell in each half of the battery is reached return rotating vent plug to the original cells started with.

5. Check:

   (a) Tray blocking.

   (b) Inter-tray and terminal wiring, and bolted connections.

   (c) Tightness and condition of vent plugs.

   (d) Evidence of electrolyte leakage, as from broken container, cover, or loose or missing vent plug.

   (e) Cleanliness of battery.

The following is a procedure recommended for a monthly inspection:—

1. Take specific gravity readings — one cell in each half of battery — record.

2. Measure and record level of electrolyte above splash cover — one cell in each half of battery.

   If level has lowered more than $\frac{1}{2}$ inch since last inspection find reason and correct.

3. Check temperature of battery cover by hand. Take thermometer reading of electrolyte if cover feels very warm.

   If electrolyte temperature is found above normal find cause and correct — make sure that voltage regulator is operating properly.

4. Add water to all cells and record.
5. Advance the rotating vent plugs to the next cells in the series circuit.
6. Record the voltage regulator setting "as found" and "as left".
7. Check:
   (a) Tray blocking.
   (b) Inter-tray and terminal wiring and bolted connections.
   (c) Tightness and condition of vent plugs.
   (d) Evidence of electrolyte leakage from any source.
   (e) Cleanliness.

   Dampness found around vents or elsewhere on covers usually contains some acid. Neutralize and remove.

The following is a procedure recommended for an annual or emergency inspection:—

1. Take specific gravity readings of all cells and record.
2. Add water to all cells and record.
3. Record the voltages of all cells on charge either at the finishing rate or with engines idling. Record the amperes charging current.
4. Record cell number of specific gravity and voltage readings of the highest and the lowest cell in the battery.

   Record electrolyte height to above splash covers, — electrolyte temperatures and sediment depths in these two cells. Record the temperature of the ambient air. If the low reading cell is lower than it should be (voltage 0.20 volt below average and specific gravity 40 points below highest reading cell) locate the cause and correct.

   Do not rotate vent plugs during this inspection.
5. The voltage regulator should be thoroughly checked during the annual or emergency inspection. Adjust and recheck if necessary.
6. Clean the battery and battery compartment.

PRECAUTIONS

Do not work on battery or in compartment unless main battery leads are disconnected.

Keep all flames away from battery.

Do not lay any tools on top of battery.

Do not tap or connect any load across part of battery. If lower than total battery voltage is needed for any accessory equipment, use an adequate series resistor for reducing the total battery voltage to the value desired.

Low electrolytic temperatures temporarily reduce battery capacity. Restoration of normal temperature restores the usual capacity.

Continued and frequent temperatures above 115° F shorten battery life. Provide full ventilation in warm weather.

With proper operation, battery temperature should not exceed 15° F more than the temperature of the outside air.

Oil should not be permitted to drip on the battery. It injures the sealing compound.

Oil on the battery covers, trays and compound should be removed by wiping with a cloth dampened with carbon tetrachloride. Do not pour this liquid on cover or compound, but use it only for dampening the cloth used in wiping off the oil.

Do not crank engine until battery is exhausted if engine fails to start. If combustion does not take place promptly when cranking engine, do not needlessly hold in the starting button and continue to crank or roll the engine. Conditions may not be just right for starting and a check should be made to assure that all necessary steps preparatory to starting have been taken. If something has been overlooked or if all conditions are not favorable to starting, then it is futile to continue rolling the engine.

If the battery cranks the engine and the engine fails to start, the battery is not at fault. The failure to start may be due to a number of causes, either mechanical or electrical. For probable causes refer to Budd Rail Diesel Car Mantainers Manual for Diesel Power Unit.

CONDENSED RULES

a. Make sure that the battery compartment is well ventilated.

b. See that all circuits or bolted connections are made clean and tight and are maintained so.

c. Block the battery well into place; do not wedge.

d. Maintain battery in a healthy state of charge by keeping voltage regulator properly adjusted to conform with the working schedule of the car.

e. Add water at regular intervals.

f. Keep the battery, its connections and surrounding parts clean and dry. Vent plugs must be securely locked in place, except when taking readings.

g. Keep a continuous record of the condition of the battery and its charging equipment, as found at each inspection.

SECTION 14

GENERATORS

Two identical generators are provided per car and are resiliently mounted to support plates attached to the centersill of the car. They are readily accessible for maintenance and may be readily dismounted by removing four mounting bolts, four drive coupling bolts and four bolts in the wire terminals.

The generators are driven, one by each engine, from the front crankshaft extension of the engine; coupled by a Propeller Shaft. (See Section 15.)

The generators supply 220 amperes, 75 volts D.C. at 750 RPM continuous duty.

MOTORING THE GENERATOR

As a routine check in the yards for defective bearings and to be assured of satisfactory operation, the generator can be operated as a motor. This operation is a "must" after any electrical connections have been disturbed. This operation is commonly referred to by the maintenance groups as "motoring".

Motoring a generator is a simple operation and is easily accomplished. The propeller shaft must be removed and the armature and pulley should turn freely by hand without drag.

The generator is now ready to be motored. Go to the locker where the regulator and reverse current relay are located. Grasp the lever arm under the voltage coil firmly with one hand and hold down to compress the carbons tightly. The reverse current relay is then closed manually with the other hand. The first rush of current upon closing the relay will cause a heavy rush of current to the generator. It will exert a strong pull upward on the lever arms. When the reverse current relay has been closed it remains closed and hand may be removed. Care must be taken or the fingers of the hand holding the regulator arm will be pinched.

As the generator picks up speed, the pull of the current will die down and the lever may be moved up gradually. This will reduce the pressure on the field carbons and thus introduce resistance into the field circuit which will speed up the generator, now operating as a motor.

Do not raise the lever arms sufficiently to break open the generator regulator pile, thus opening the field circuit. This will cause the motor to operate at a dangerously high speed. Do not operate the generator as a motor at speeds higher than in normal operation, as this will tend to damage the armature. With the generator turning over at a reasonable speed, pull the lever arms down and then release. The reverse current relay should open, automatically close and then open again. This is a sure test that the generator will operate on the road.

There are no pole changers on the RDC generators as the generators are always turned in one direction.

INSPECTION AND MAINTENANCE

The generator bearings should be checked monthly to determine the condition of the lubricant. The bearing at the shaft end may be checked by removing a 1/4 inch pipe plug from the bearing cap. Under any conditions, do not force grease into this cap by inserting a grease fitting and using a pressure grease gun, as the grease would be forced by the inner seal and into the generator interior. The opposite end bearing grease may be checked by removing 4 cap screws which allows the bearing cap to be removed and the lubricant checked. A grease cap 1/2 full indicates sufficient lubricant. Care must be taken to prevent dirt from entering the bearings or bearing caps.

Also, each month, it is recommended that the carbon dust and dirt be blown out of the generator and air passages of the armature. Brushes and commutator may be inspected at this time for any unusual wear condition. Brushes should work freely in holders.

Once a year or at 120,000 miles, the generator should be removed from the car and dismantled. The interior of the machine should be thoroughly cleaned, coils inspected and pole bolts tightened. The brushes should be replaced if necessary, brush holders cleaned and reinstalled.

The bearings should be removed and washed off in kerosene (not gasoline), repacked with grease and reapplied to the generator.

Care should be taken to prevent dirt from entering bearings during the operation.

For proper lubricant see the Budd Company Rail Diesel Car Lubrication and Fuel Chart. A grease cap packed 1/2 full indicates sufficient lubricant.

The commutator should have a dark burnished appearance after a short time of operation, but if rough it can be buffed with fine sandpaper. ***DO NOT USE EMERY CLOTH.*** The commutator should be kept free from oil or grease.

There are 8 brushes to each generator. The brushes may be worn to 1 inch in length at which time they should be replaced. When new brushes are installed, a piece of sandpaper placed around commutator with sand side next to brushes and commutator rotated will seat brushes to commutator.

The correct brush pressure for the RDC generator is 3 lbs.

SECTION 15

GENERATOR PROPELLER SHAFT

Power is transmitted from the engine to the generator by means of a propeller shaft. This shaft, as shown in Fig. 1, is of tubular construction with a Universal joint on each end. A four bolt flange is provided on each end for attachment to the engine and generator flanges. The bolts are special and should ***NEVER*** be replaced with a substitute.

The tubular portion of this propeller shaft is of special construction having a rubber insert to absorb the shocks inherent to a drive of this type. This rubber insert can be inserted and removed only with special tools and equipment, so in the event of its failure, the complete shaft should be returned to the Spicer Manufacturing Co. for repairs.

A spline (slip joint) is provided on one end together with seals and grease retainers.

The shaft should be installed with the slip joint toward the engine flange.

LUBRICATION

The slip joint and each journal cross is equipped with a zerk fitting. The slip joint and Crosses should be lubricated as specified in The Budd Company Rail Diesel Car Lubrication and Fuel Chart. Failure to maintain proper lubrication in these units will cause an early failure.

A Relief Valve assembled to the central chamber of the Journal Cross prevents damage to the oil seals or gaskets when extremely high pressure is used to force in the lubricant. The Relief Valve also serves as an indicator to show when the joint is completely filled.

DO NOT USE GREASE in Needle Bearing Joints as grease is liable to clog the oil passages.

SERVICE INFORMATION

Generator propeller shaft needle bearing joints are simple in construction, easily removed from the car, readily disassembled and reassembled without the use of any special tools or any special mechanical knowledge.

1. REMOVAL FROM THE CAR

Generator propeller shafts are removed as complete assemblies by removal of the Companion Flange Bolts, Nuts and Lockwashers, which allow the assemblies to slip out from between the Companion Flanges.

2. REMOVAL OF THE SLIP JOINT

(a) Loosen the snap ring at the Sleeve Yoke and slide the Joint off from the Propeller Shaft.

(b) Arrow Marks — Make sure arrow marks are stamped on the Shaft and Sleeve Yoke before removing the Slip Joint. If arrow marks are not readily seen, mark both members so that when reassembled they will be in exactly the same relative position, as the Sleeve Yoke Lugs must be on the same plane as the Stub Ball Yokes to prevent excessive vibration in operation.

3. DISASSEMBLING UNIVERSAL JOINT

Bearing Cap Construction

(a) Lock Strap — Bend down the locking lugs with a screw driver and remove the Cap Screws and the Bearing Caps.

(b) Needle Bearings — Remove by first tapping with a soft round drift on the exposed face of the Needle Bearing until the opposite Needle Bearing comes out. Turn the Joint over and tap the exposed end of the Journal Cross until the opposite Needle Bearing is free. Use a soft round drift with a flat face about 1/32" smaller in diameter than the hole in the Yoke, otherwise there is danger of damaging the Bearing.

(c) Journal Cross — Remove by sliding it to one side of the Yoke and tilting it over the top of the Yoke Lug.

4. CLEANING AND INSPECTION

(a) Clean all parts — Use a suitable cleaning fluid. Allow the parts to remain in the cleaner for some time to loosen up any particles of grease or foreign matter. Remove any burrs or rough spots from all machined surfaces.

(b) Needle Bearing — Do not disassemble. Clean with a short stiff bush and blow out with compressed air. Work a small quantity of lubricant, (see The Budd Company Rail Diesel Car Lubrication and Fuel Chart), into each Needle Bearing and turn the Needle Bearing on the trunion to check wear. Replace if worn.

(c) Journal Cross — Because worn Needle Bearings used with a new Journal Cross or new Needle Bearings used with a worn Journal Cross will wear more rapidly making another replacement necessary in a short time, always replace the Journal Cross and four Needle Bearings as a unit.

(d) Journal and Bearing Kit — To facilitate the replacement of Journals and Bearings, a Journal and Bearing Kit is available. The use of the Kit insures having the correct individual parts when required and saves valuable time.

5. ASSEMBLING UNIVERSAL JOINT

(a) Gasket — If unnecessary to install a New Kit, make sure that four New Gaskets are installed in the Journal Retainers.

(b) Journal Cross — With the Relief Valve facing the Flange Yoke, insert one trunion of the Journal Cross into the bearing hole in the Yoke Lug from the inside between the lugs and tilt until the trunion of the Journal Cross will enter the hole in the opposite Yoke Lug.

(c) Needle Bearing — Insert from the outside of the Yoke. Press into place with an arbor press or tap with a soft round drift so as not to mar any surfaces.

(d) Bearing Cap — Make sure that the key on the Bearing Cap fits into its keyway on the back of the Needle Bearing. This is ***VERY IMPORTANT.***

(e) Lock Strap and Cap Screws — Assemble and bend the lugs of the Lock Strap up against the flat of the Cap Screws. If the Joint appears to bind, tap the lugs lightly to relieve any pressure of the Bearing on the end of the Journal.

6. ASSEMBLING THE SLIP JOINT ON THE SHAFT

(a) Slip Joint — Lubricate the splines thoroughly, (See The Budd Company Rail Diesel Car Lubrication and Fuel Chart), and assemble on the Shaft. **BE SURE** that the arrows or marks on the Shaft and Slip Joint are in line, since the Sleeve Yoke Lugs must be on the same plane as the Stub Ball Yoke Lugs to prevent excessive vibration.

(b) Cork Washer — Renew if necessary before assembling with the Steel Washer on the Sleeve Yoke.

(c) Snap Ring — Install Snap Ring to the Sleeve Yoke.

7. INSTALLING PROPELLER SHAFT

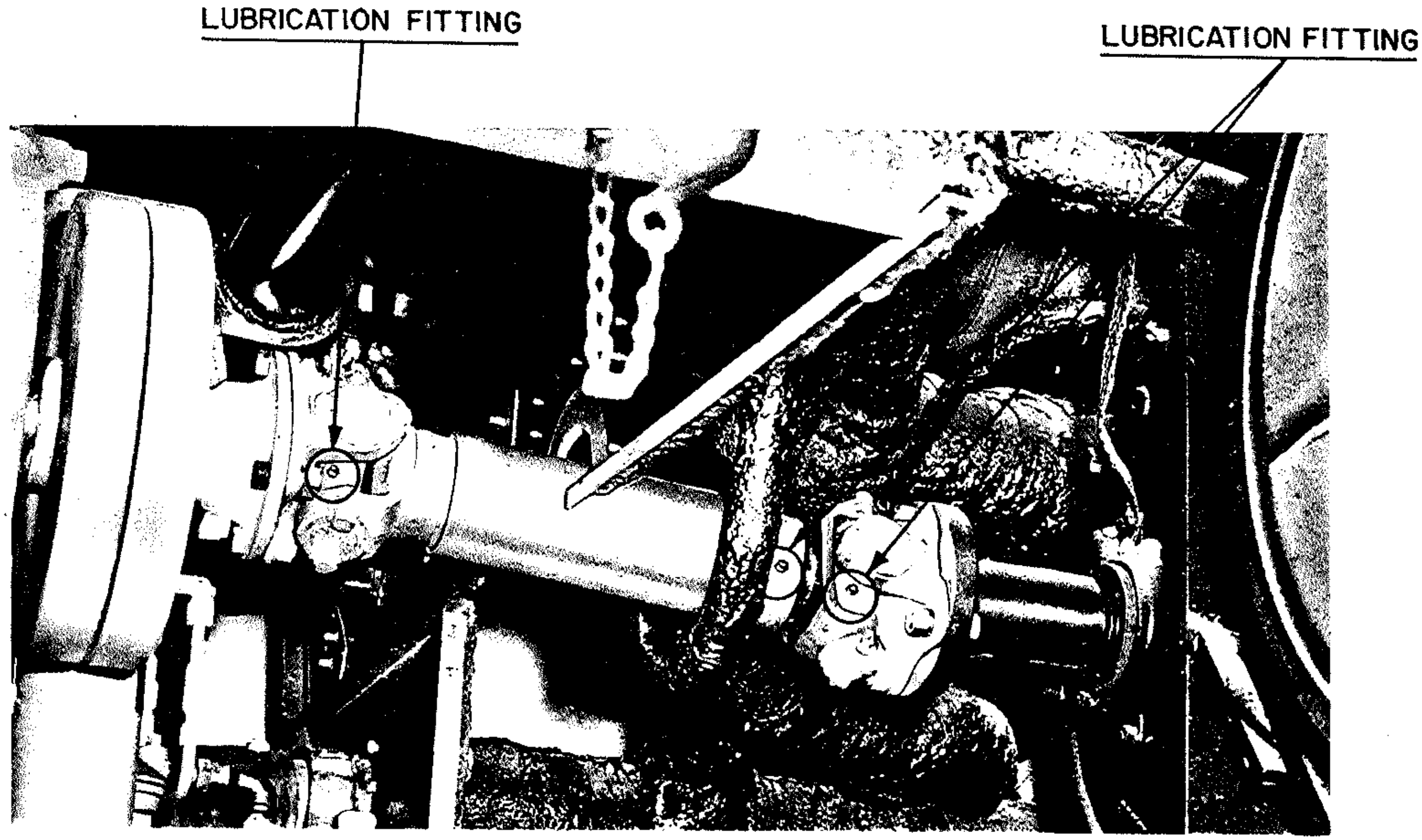
(a) Propeller Shaft Assembly — Place in a pair of centers and check the Shaft for runout. The runout on the Tube should not be more than .020" indicator reading, and on the neck of the Slip Stub Shaft the runout should not be more than .005" indicator reading. Mark the high and low points on the shaft with chalk and straighten if necessary. Install with the Slip Joint nearest the source of power.

(b) Double Flange Yoke Type — Tighten the Flange Bolts evenly after the Nuts and New Lockwashers are in place.

For protection against out of service failures, it is recommended that one or more spare sets of Journals and Bearing Kits Spicer #5-15x be kept on hand.

The Journal and Bearing Kit consists of:

- 1 — Journal Cross Assembly
- 4 — Bearing Assemblies
- 4 — Bearing Caps
- 4 — Lock Straps
- 8 — Bearing Cap Screws
- 1 — Zerk Nipple
- 4 — Journal Gasket Retainers
- 4 — Journal Gaskets
- 1 — Journal Relief Valve



GENERATOR PROPELLER SHAFT

FIG. 1

SECTION 16

GENERATOR VOLTAGE REGULATOR

There are two generator voltage regulators per car, one in each regulator locker. Each one controls the respective generator for that end of the car in which it is located.

The regulators used in the RDC car are Safety SM-150-EA.

The generator is controlled to give the proper battery and load current through changes in speed and load by the current supplied to the shunt field. The field current is controlled by the resistance of the carbon pile in series with the field. The resistance of the carbon pile is governed by the pressure exerted on it by levers which are operated by the plungers of current and voltage magnets. The windings of the series coil carry the total current output of the generator. If the current output tends to rise above that which the regulator is set to maintain, the plunger of the series coil through its lever changes the pressure of the carbon pile; thereby, reducing or increasing the field strength and holding the generator current to its proper value. If the voltage tends to rise above that which the regulator is set to maintain, the plunger of the voltage coil through its lever reduces the pressure on the carbon pile and holds the voltage to its proper value; thereby, insuring reliable battery protection and adequate load supply.

The series coil is set to hold the current at the rated output of the generator. The voltage coil when affecting the regulator prevents overcharging of the batteries, since the current to the batteries will then automatically taper down to a low value as the batteries become fully charged.

The curve showing the charging current to a car lighting battery with this regulator is shown in Fig. 1. As the output of the generator is held to rated capacity by the series coil, the generator cannot be overloaded either by connected load only or by charging an exhausted battery; at the same time the full output of the generator is available for battery or connected load whenever it is needed. An equipment with this system of regulation will maintain service with a higher connected load than an equipment with a system in which the regulator maintains only the battery current consistant regardless of lamp load, assuming generators of the same size are used with both equipments.

Each generator regulator is made so that it can be used for several values of generator current output without the necessity of changing any of the regulating coils.

This is accomplished by the use of a shunt on the back of the regulator having a terminal at the side or bottom of the current coil. The current coil itself is of the proper size to regulate the lowest amount of current which the regulator is to be set. Shunts are provided which can be thrown in parallel with this regulating coil, increasing the generator output to the point desired.

CARE AND ADJUSTMENT

Inspect and clean regulators, relays and lockers regularly.

Thoroughly clean regulator pin bearing "P" Fig. 2. Safety reamers No. 61965 (long) and No. 61966 (short) with holder No. 61964 provide the best means for cleaning the holes. The pins can be readily cleaned with fine sandpaper.

If the generator voltage regulator is out of adjustment, clean the carbon pile before resetting. To best accomplish this release the pressure on the carbons by lifting plunger "T" and blow the dirt out by means of a blast of air, or move the carbons up and down on the supporting rods by hand.

The voltage coil is set at the factory to maintain 73½ to 74 volts with lead batteries and should be maintained at this setting.

To set the voltage regulators on RDC cars, proceed as follows:

1. Check (peak) both engines for proper speeds.

2. Operate equipment for at least two hours to heat the coils. If adjustments are made on cold equipment, settings will change as the coils become hot.

3. Check the voltage (no load) as follows:

a. Isolate opposite engine. (Engine stop and isolation switch), and remove 250 Amp. generator fuse.

b. Pull voltage (inner) arm down on voltage regulator to be tested and place sheet of insulating material between contacts of reverse current relay of this circuit.

c. Connect voltmeter leads to #4 positive terminal and to #2 negative terminal on the regulator.

d. Set throttle lever in #2 position — voltage should regulate from 73½ to 74 volts. Make sure brakes are set or wheels are chocked before performing this operation.

4. To set voltage, (if necessary).

a. Perform operations (a) to (d) inclusive in Item 3.

b. Loosen top locknut "N", Fig. 2 on spring tension rod of voltage (inner) arm.

c. Adjust tension rod upward to increase voltage and downward to decrease voltage. Hold bottom locknut with wrench, when making adjustments, so that end play at adjusting screw is held to a minimum.

5. Check dash pots.

The voltage (inner) lever is set to allow lever to fall from its uppermost position to its lowest position in from 2 to 2½ seconds. This setting *MUST* be maintained. The current (outer) lever is set to allow lever to fall from its uppermost position to its lowest position in from 3 to 5 seconds. This setting *MUST* be maintained. These settings can be checked by raising the lever by hand and allowing it to fall. The dash pot vents should be adjusted by means of the adjusting screw located on the side near the top of the dash pots, to obtain the above mentioned settings.

6. The voltage regulator at the opposite end of the car is checked and adjusted in the same manner. ***The settings of the two units must be made as near alike as possible so as to equally distribute the load between the two machines.***

The adjustment of the carbon pile is covered by the following instructions. (This adjustment need only be made when regulators are overhauled or when renewing the carbons). The number of field carbons should be such; that, when the engine is shut down or when no voltage is on the regulator and the carbons are tightly compressed by the spring of the voltage coil, the face of the terminal lever (1) shown in Fig. 3 is in a vertical position.

If the regulator is hot, which would be the case after two hours operation, the adjusting nut (2) should be adjusted so that the cam follower linkage is horizontal. With this adjustment it should be just possible to slip a gauge (.0156") between the projections on the levers of the voltage and series coils, and the guide lever on top of the voltage coil should just barely come down to the coil supporting bracket.

If the regulator is cold, the same adjustment should be made with the addition of placing a gauge (.0056") between the pressure plate and the first carbon. After making all the necessary adjustments, the gauge should be removed.

Attention is called to the fact that locknut (4) has a right hand thread and locknut (3) has a left hand thread.

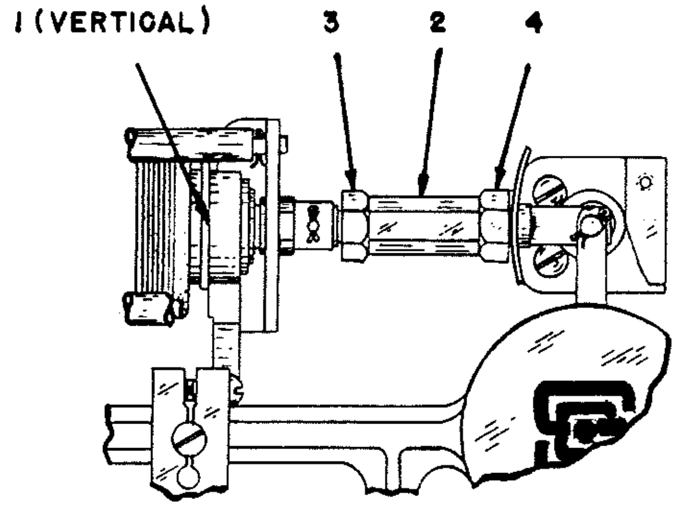


DIAGRAM FOR CARBON PILE ADJUSTMENT

FIG. 3

SECTION 17

GENERATOR REVERSE CURRENT RELAY

Two safety S-20-EADR reverse current relays are provided for each car, one located in each regulator locker.

The reverse current relay is of the closed magnetic circuit type with pivoted armature. It has three voltage coils and one series coil, so arranged that when the generator voltage equals that of the battery the armature is lifted and the circuit closed. The coil "D", Fig. 1, is connected across the contacts of the relay so that the voltage impressed across it is the difference between battery voltage and generator voltage, and if the generator is not operating the full battery potential is available. The pull of this coil on its plunger locks the relay in an open position. At the same time the current from the battery which energizes this coil also serves to energize the field of the generator so that it will always build up in the proper direction. The coils "J" and "H" are in series across the generator so that as the generator builds up, coil "J" tends to close the relay while coil "H" serves to replace coil "D" which becomes inoperative as the generator voltage approaches that of the battery. The design of these coils is such that the correct balance is obtained at any battery voltage encountered in service. Consequently when the armature is set with the proper gap, the relay closes when the generator voltage is slightly above battery voltage. The series coil "K" serves to lock the relay closed when the generator is charging the battery and also serves to neutralize coil "J" when the battery attempts to discharge through the generator. The tap from coil "J" brought out to the auxiliary contact on the relay serves to reduce the strength of coil "J" so that a very small discharge from the battery will open the switch. Due to the fact that the operation of this relay depends upon the balancing of the voltage coils "D", "H" and "J", the effects of the temperature changes in the coils cancel each other. It is therefore not necessary to place resistance with zero temperature co-efficients in series with the coils to obtain the same operation under various changes in temperature.

The reverse current relay is set at the factory to close at one volt above battery and should not require any adjustment in service.

TO CHECK SETTING OF REVERSE CURRENT RELAY

1. Check battery voltage without either generator charging.

(a) Connect voltmeter leads to #3 terminal on reverse current relay and #1 terminal on voltage regulator panel.

(b) Pull voltage (inner) arm of voltage regulator down to open reverse current contactor.

(c) Take voltage reading.

(d) Allow voltage arm to rise slowly and watch voltmeter reading. The reading on the voltmeter at the instant the contactor closes indicates the setting of the reverse current relay (one volt above battery voltage).

The reverse current relay should be examined, all contacts cleaned and so adjusted as to insure the relay breaking on the auxiliary contact. The brush should be renewed if it is distorted.

Auxiliary contacts are provided on the reverse current relay as shown in Fig. 1, these contacts "B1" should be adjusted to close before the main brush closes.

The pin bearings "P" of the relay should be thoroughly cleaned with fine sandpaper.

The pivot screws and bearing "K" should also be cleaned periodically by wiping the bearing points with a clean cloth. The pivot screws are adjusted to locate the armature centrally in the frame and in line with the centers of the holdout coils "H" and "D" and lifting coils "J" and "K". The adjustment when correct does not permit any side play of the armature.

To have an adjustment other than this, will result in improper opening of the relay.

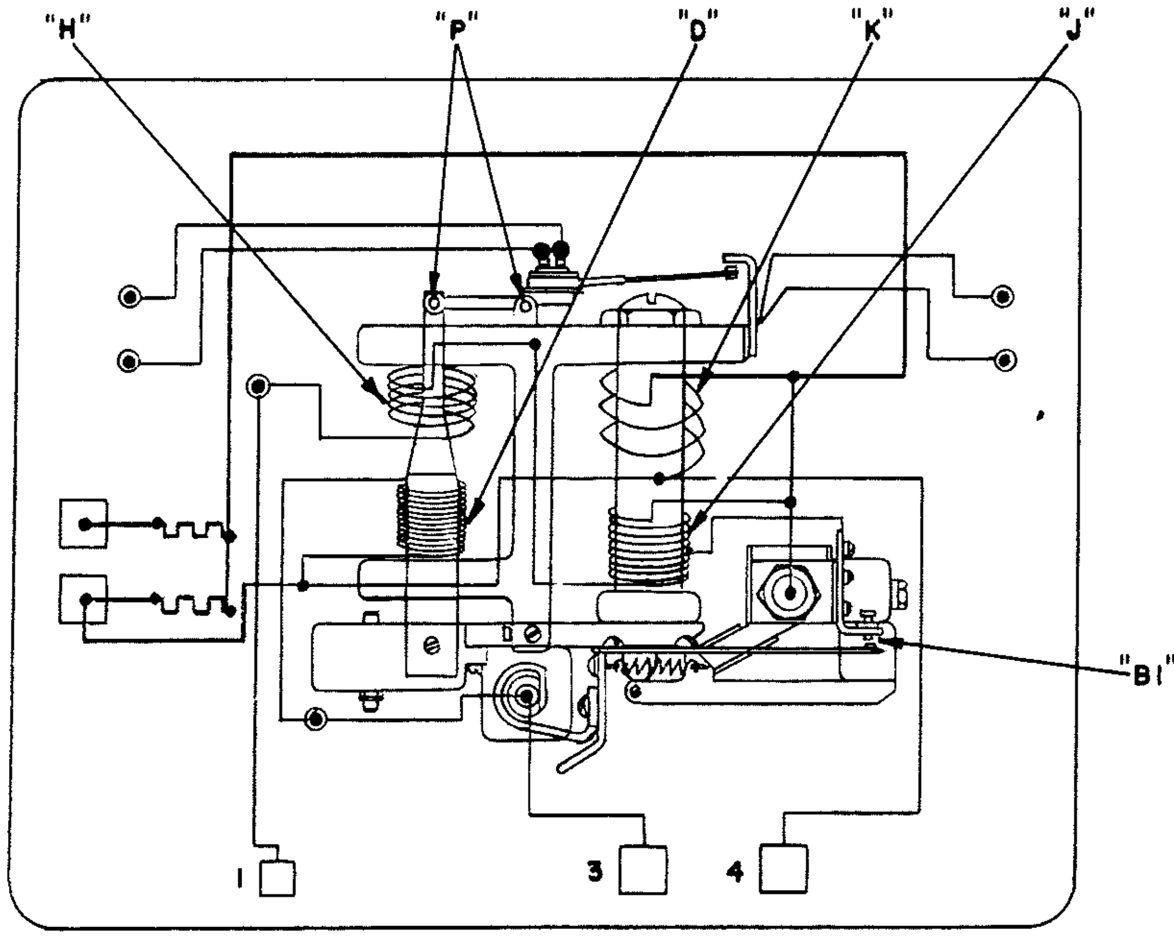


DIAGRAM FOR REVERSE CURRENT RELAY

FIG. 1

SECTION 18

LAMP REGULATOR

One Safety S-700-E Lamp Regulator is provided in the "B" end regulator locker.

The regulator is set for 61 volts and is capable of dissipating 700 watts in the carbon pile.

The regulator consists of two piles of carbon discs in series with the load; and two carbon piles are in parallel. The pressure on these carbons, and therefore their resistance is governed by the armature of a magnet, the winding of which receives the voltage of the load to be regulated.

The carbons are compressed by an adjustable spring connected to a link acting through a lever connection. The pull of the spring is opposed by the pull of the electromagnet, which is connected directly across the load mains and is so designed that the armature will stay in any position throughout its stroke when the load voltage is right. When the load voltage is high, the magnet becomes stronger and pulls the armature down against the pull of the spring and reduces the pressure upon the carbons, increasing their resistance and bringing the load voltage back to normal. If the load voltage is low, the magnet becomes weakened, the spring pulls the armature back and through the lever connection, exerts enough pressure on the carbon piles to decrease their resistance and bring the load voltage back to normal. The regulator coil is connected so that it is controlled by the main lighting breaker on the switch panel.

CARE AND ADJUSTMENT

The regulator should be checked periodically. This inspection consists of cleaning the carbons, pivot pins and removal of any friction in the pins or supports.

The cleaning of the carbons may be accomplished by releasing the pressure on the carbons and blowing out the dirt by means of an air hose, or moving the carbons up and down on their support rods by hand. The pressure on the carbons is released by drawing armature "A" down to stop "S", Fig. 1.

The pins to be cleaned are shown at "P". The pins may be readily cleaned by polishing with fine sandpaper and the pin holes by using Safety Reamer No. 61967 with holder No. 61964. The pressure plate guide rods at "B" should be cleaned and inspected to insure absence of binding.

The air gap at "G" between the armature and the magnet heads should also be cleaned to remove the accumulation of dirt or other foreign matter, such as steel chips, etc. which may have become lodged therein.

Check operation after regulator has been thoroughly cleaned. To do this, it is first necessary to be certain that the pressure on the carbon pile is correct. The procedure outlined below may be followed to determine this and should be done with carbons hot.

Disconnect the operating coil and pull the armature "A" against the stop "S". Upon releasing armature "A", the spring should pull the armature against stop "T". With the proper pressure, the carbons will be snug when attempting to move them by hand.

If the armature "A" does not return to the stop "T" the pressure is incorrect and the knurled nut "N" should be turned toward the regulator panel until the armature "A" just barely goes back to stop "T". The nut should then be loosened one-third of a turn.

To set the regulator for voltage, the following procedure may be followed. From the fore part of these instructions, it will be noted that the spring "C" is balanced by a magnetic pull and the setting of the voltage is made by adjustment of this spring only.

To adjust the spring tension, which is done with the regulator hot, short circuit the carbon pile across terminals 2 and 3. Have that voltage which it is desired to maintain (61 volts) across the load mains, from terminals 1 to 4. Now, adjust the spring tension by turning the spring adjusting screw nut "Y" until the armature will remain in any position throughout its stroke. Remove the short circuit from 2 to 3 and the regulator is ready to operate.

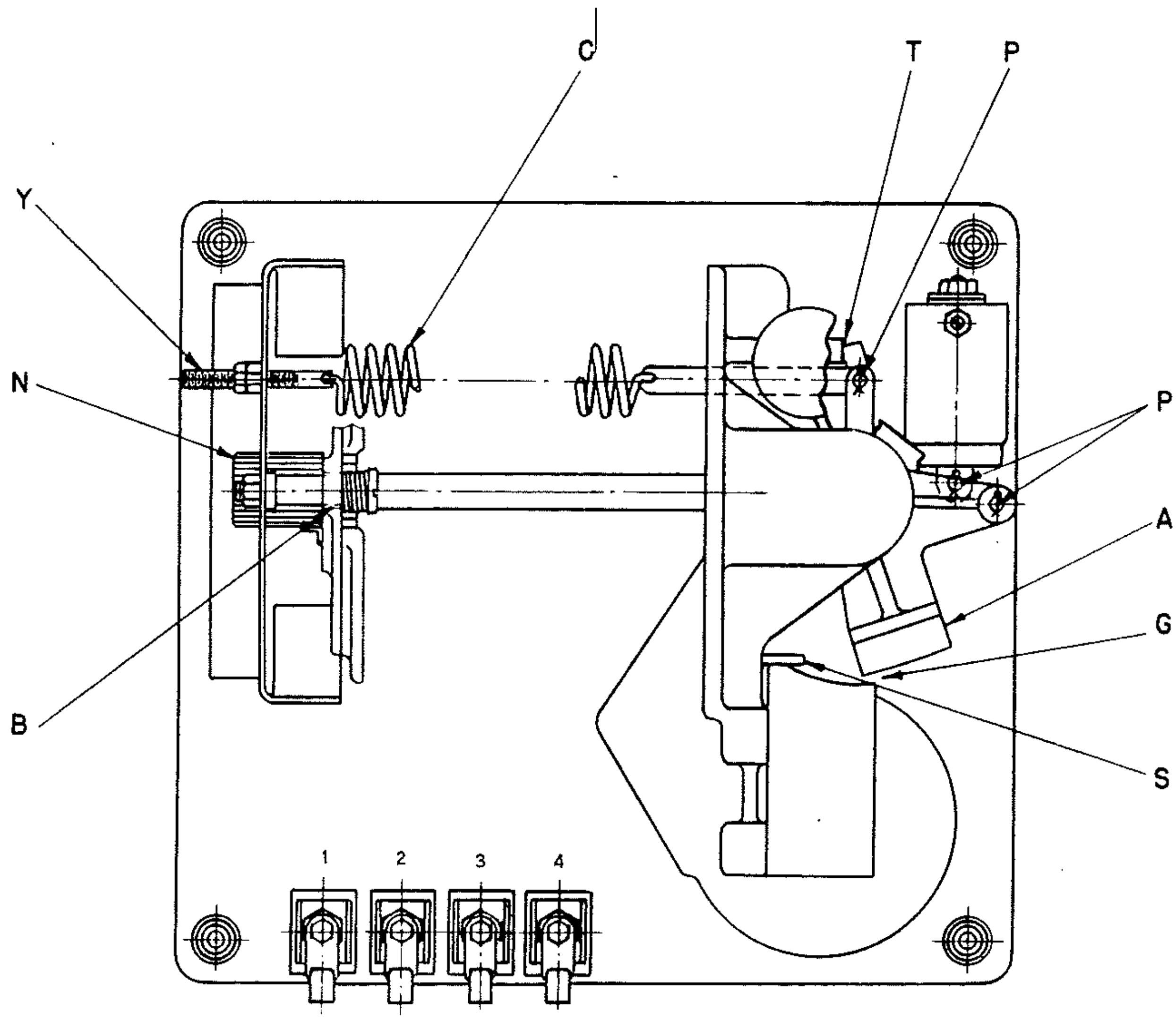
The air vent of the dash pot should be set to prevent any tendency to hunt.

The armature of the regulator is mounted on ball bearings to which it is not necessary to add grease.

It is advisable to inspect the bearings yearly. At this time a small amount of petrolatum should be applied if they are dry.

Under no circumstances should bearings be packed with any lubricant.

It is inadvisable to oil the pivot pins because of the accumulation of dirt in the oil which eventually will cause the regulator to operate sluggishly.



A=ARMATURE
B=GUIDE RODS
C=SPRING
G=AIR GAP
N=KNURLED NUT

P=PIVOT PINS
S=STOP
T=STOP
Y=ADJUSTING SCREW

ADJUSTMENT DIAGRAM FOR LAMP REGULATOR

FIG. I

SECTION 19

ELECTRICAL LIGHTING SYSTEM

(For lighting outlets and circuits see Wiring Schematics.)

The car receives current for lighting from the battery. The current first passes through a 70 Ampere De-ion no fuse circuit breaker and then to a lamp regulator where it is regulated to 61 volts.

On the RDC-1, 2 and 3 a 15 ampere circuit breaker controls the ceiling and cove lights in the passenger compartment, which are fluorescent, also toilet lights and platform lights which are incandescent. The platform lights are also controlled by a switch at the operator's position.

Two 15 ampere circuit breakers control the parcel rack lights which are incandescent.

A 15 ampere circuit breaker controls the number signs, gauge lights, classification lights and headlights on both ends of the car. Each of these lights also have an individual switch located at the operator's position.

The ceiling, cove lights and number lights are fluorescent and require 14W — 3500° white 15 inch tubes which are arranged to operate on 61 volts DC. These lights also require an FS-44 starter, a 10 V. 0.40 A. ballast lamp and a choke ballast. See Fig. 1 for wiring arrangement.

The toilet, parcel rack and classification light fixtures require a 25 Watt, 60 volt incandescent lamp in each.

The platform light fixtures require a 40 W, 60 V. incandescent lamp in each.

The gauge lights and speedometer lights require a 6S6 D.C., 115 V. miniature bayonet base lamp in each.

The regulator locker lights and plenum light are equipped with 15 watt, 60 volt lamps and are controlled by door operated switches.

The generator pilot lights have green lenses, one for each generator and are located on the panel over the windshield at the operator's position at each end of the car. They are labeled "Gen. #1" for the generator on the "B" end of the car and "Gen. #2" for the generator on the "A" end of the car. These lights indicate if the generators are charging and that the respective engine which drives the generator is running. These pilot lights are equipped with 6 watt, 115 volt GE-S6 candelabra base bulbs.

The air conditioning compressor pilot light has a white lens and is located over the switch locker door. This light indicates when the compresssor is in operation. This light requires a 6 watt, 115 volt GE-S6 candelabra base bulb.

The headlight unit consist of two sealed beam lamps set in recesses at each end of the car. The lamps are adjustable to control the light beam vertically and horizontally and are removable through the vestibule ceiling trap door. Each lamp is a GE Par 56 rated at 200 watts, 30 volts (two are operated in series on 61 volts providing full output). A resistor in series is provided for dimming.

A resistor is also provided for emergency lighting of the headlight in case of a filament failure in one of the lamps. Placing the emergency switch in "ON" position connects the good lamp in series with this resistor allowing the good lamp to light. (See Fig. 2).

In the event of a lamp failure, this procedure *MUST* be followed:

1. Position headlight control switch in either "DIM" or "BRIGHT" position, depending upon requirement.

2. Place the emergency switch in "ON" position.

This switch is provided with two "ON" positions, one position for each lamp. The "ON" position that will light the good lamp must be determined by trial.

A stainless steel guard is placed over the emergency switch to avoid accidentally placing this switch to "ON" position when no lamp failure exists. The normal position for this switch is "OFF".

Car number signs are located in the letterboard area near each platform and are illuminated by 14 watt fluorescent tubes previously mentioned. The opening in the letterboard is glazed with glass and has space for four numerals 4 inches high. A hinged access panel behind each light on the inside of the car provides access to tube, accessories and number signs.

Classification lights are provided, four per car, and are located in the upper corners of the cab end sheet. They are provided with watertight clear lenses for visibility from the side and ahead. Provisions are made for showing amber, red, green and white by the turning of the colored glass holder so that the color selected is between the light bulb and the clear lense. As previously mentioned, these lights are equipped with 25 watt — 60 volt lamps.

A 64 volt receptacle is provided near each engine box for use of a trouble light.

Marker light brackets are supplied at the corner posts for the mounting of signal oil lamps or a signal flag.

In the baggage sections of the RDC-2 and 3, two 50 watt, 60 volt incandescent lamps are provided on the ceiling and are controlled by fixed switches located on a bulkhead in the baggage section.

Each baggage door is provided with a 25 watt, 60 volt incandescent lamp controlled by individual fixed switches mounted on the light fixture.

In the RPO section of the RDC-3, four 50 watt, 60 volt incandescent lamps are provided on the ceiling and are controlled by a fixed switch located on the end of the paper box on the left hand side of the car facing the "B" end. Three 50 watt, 60 volt incandescent lamps are provided on the ceiling at the letter cases and are controlled by a fixed switch located on the end of the paper box near the letter case on the right hand side of the car facing the "B" end. Two 50 watt, 60 volt incandescent lamps are provided on the ceiling, one for each door and are controlled by fixed switches, one on the end of each paper box.

One 50 watt, 60 volt incandescent lamp is provided on the ceiling of the RPO toilet and is controlled by a wall switch located on the toilet partition.

On the RDC-4, the platform lights, number signs, classification lights, headlights, regulator locker lights, generator pilot lights, gauge lights and speedometer lights are identical to the RDC-1, 2 and 3.

In the baggage section of the RDC-4, three 50 watt, 60 volt incandescent lamps are provided on the ceiling and are controlled by a switch located on the toilet partition. A 25 watt, 60 volt incandescent lamp is provided over each baggage door, the desk, in the baggage toilet and each is controlled by individual fixed switches mounted on the light fixture.

In the RPO section of the RDC-4, seven 50 watt, 60 volt incandescent lamps are provided on the center ceiling and are controlled by fixed switches located on the ends of the paper boxes. Six 50 watt, 60 volt incandescent lamps are provided, two in the center ceiling area and four on the ceiling above the distributing tables, and are controlled by a fixed switch located on the end of a paper box.

Two 50 watt, 60 volt incandescent lamps are provided, one over each door and are controlled by fixed switches located on the end of the paper boxes.

One 50 watt, 60 volt incanescent lamp is provided on the ceiling of the RPO toilet and is controlled by a fixed switch located on the toilet partition.

One 25 watt, 60 volt incandescent lamp is provided in the RPO wardrobe and is controlled by a fixed switch located on the wardrobe partition

Provisions have been made in the lighting circuits to provide lighting in the RPO sections of the RDC-3 and 4 in the event that it is only necessary to use lighting in these sections. This arrangement provides a battery circuit to the RPO section when the 70 ampere main lighting breaker, located in the switch locker, is opened. This is accomplished by a relay which is energized by the closing of any one of the RPO light switches.

TO REPLACE LAMPS

1. Ceiling and Cove

The ceiling light fixtures are provided with removable plastic lenses for access to the fluorescent tube, starter and ballast lamp. Compress the lens by squeezing the sides toward the center, at each end.

2. Toilet and Platform

The toilet and platform lights are provided with hinged bezels. By loosening one knurled head screw, the bezel may be lowered.

3. Parcel Rack

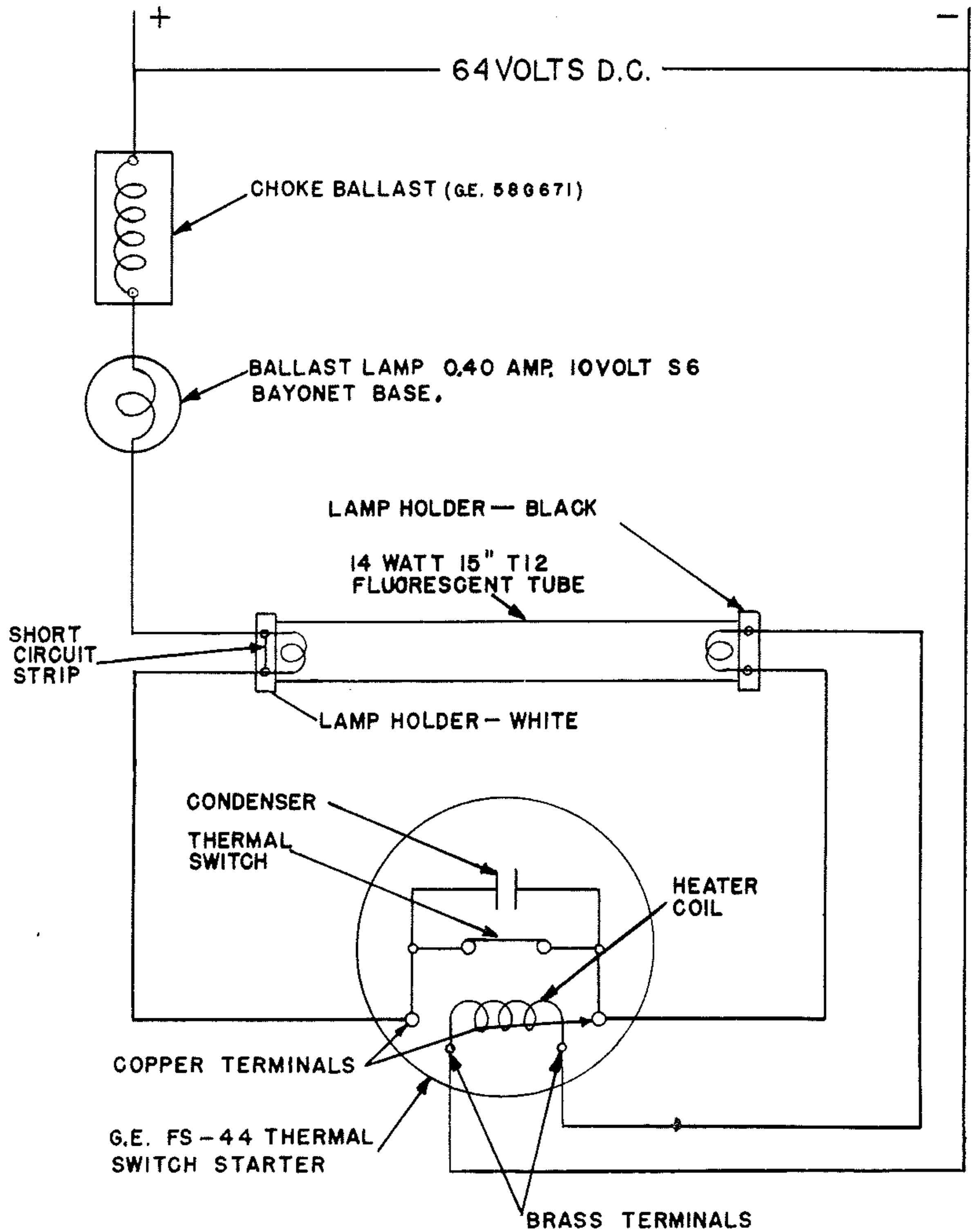
Access to the parcel rack lights is by means of a hinged panel on the top side of the fixture. To open the panel, loosen one slotted screw.

4. Generator and Cooling Pilot Light

Cooling pilot light is provided with removable cover plate. Access to generator pilot lights is through classification light access door above windshield.

5. Gauge Lights

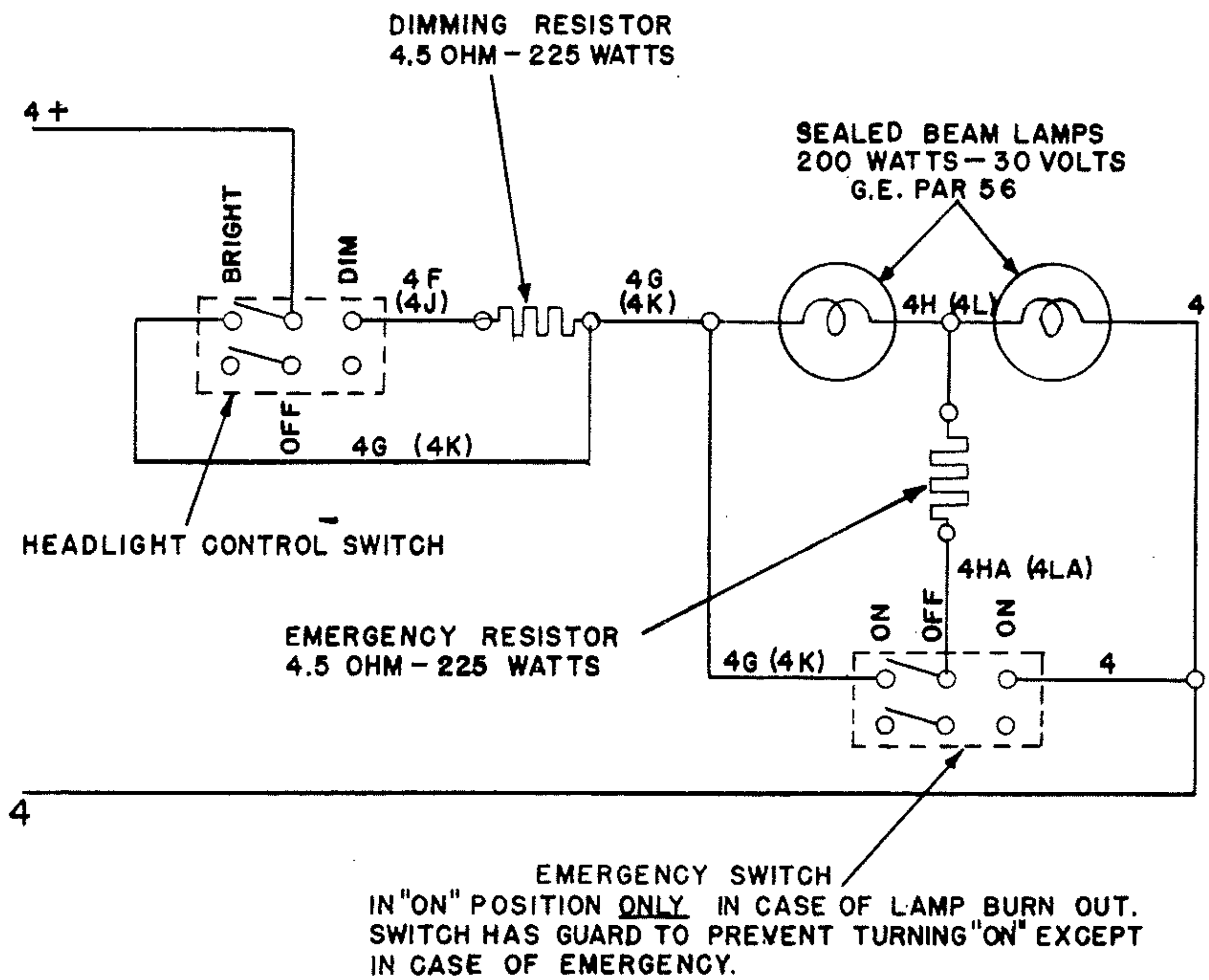
Remove the knurled nut which retains the socket in the gauge housing.



FLUORESCENT LAMP WIRING

FIG. 1

NOTE: WIRE DESIGNATIONS IN PARENTHESIS ARE FOR "A" END OF CAR-OTHERS ARE FOR "B" END OF CAR



HEADLIGHT CIRCUIT

FIG. 2

SECTION 20

ELECTRICAL CAB HEAT

(See Wiring Schematics)

Cab heat is provided by means of a super Glocoil heater unit. One unit located on the collision post at the operator's stand at each end of the car.

Each unit is equipped with five Super Glocoil heat elements. A perforated stainless steel guard is provided around each unit. This guard is readily removed for replacing Glocoil elements by loosening three slotted fasteners.

A squirrel cage type blower is mounted above the Glocoil heating unit to force heated air down to the foot level of the operator. This blower is wired to the heat switch and operates whenever the cab heat is turned on.

At the beginning of the heating season, the blower unit should be cleaned and inspected. The brushes and commutator should be inspected for wear and cleanliness. Motor should be lubricated periodically during the heating season. (See The Budd Company Rail Diesel Car Lubrication and Fuel Chart).

The current supply to the cab heat circuit is normally available only when the engine and generator at the corresponding end of the car is operating. However, an emergency feature is provided to energize the cab heat circuit directly from the battery in the case of one engine or generator failure.

Two fuse cutouts are provided under the Engine Stop and Isolation Switch in each regulator locker. The right hand cutout is the "NORMAL" operating position and the left hand is for "EMERGENCY" operation.

A 50 ampere fuse is placed in the right hand cutout for normal operation.

In the event of a failure of one engine or generator, the 50 ampere fuse is removed from the "NORMAL" location and placed in the "EMERGENCY" location. Under no circumstance should a fuse be installed at both locations; and the fuse *must* be returned to the normal location immediately upon shut down or repair.

SECTION 21

ELECTRICALLY HEATED WINDSHIELD

(See Figure 1)

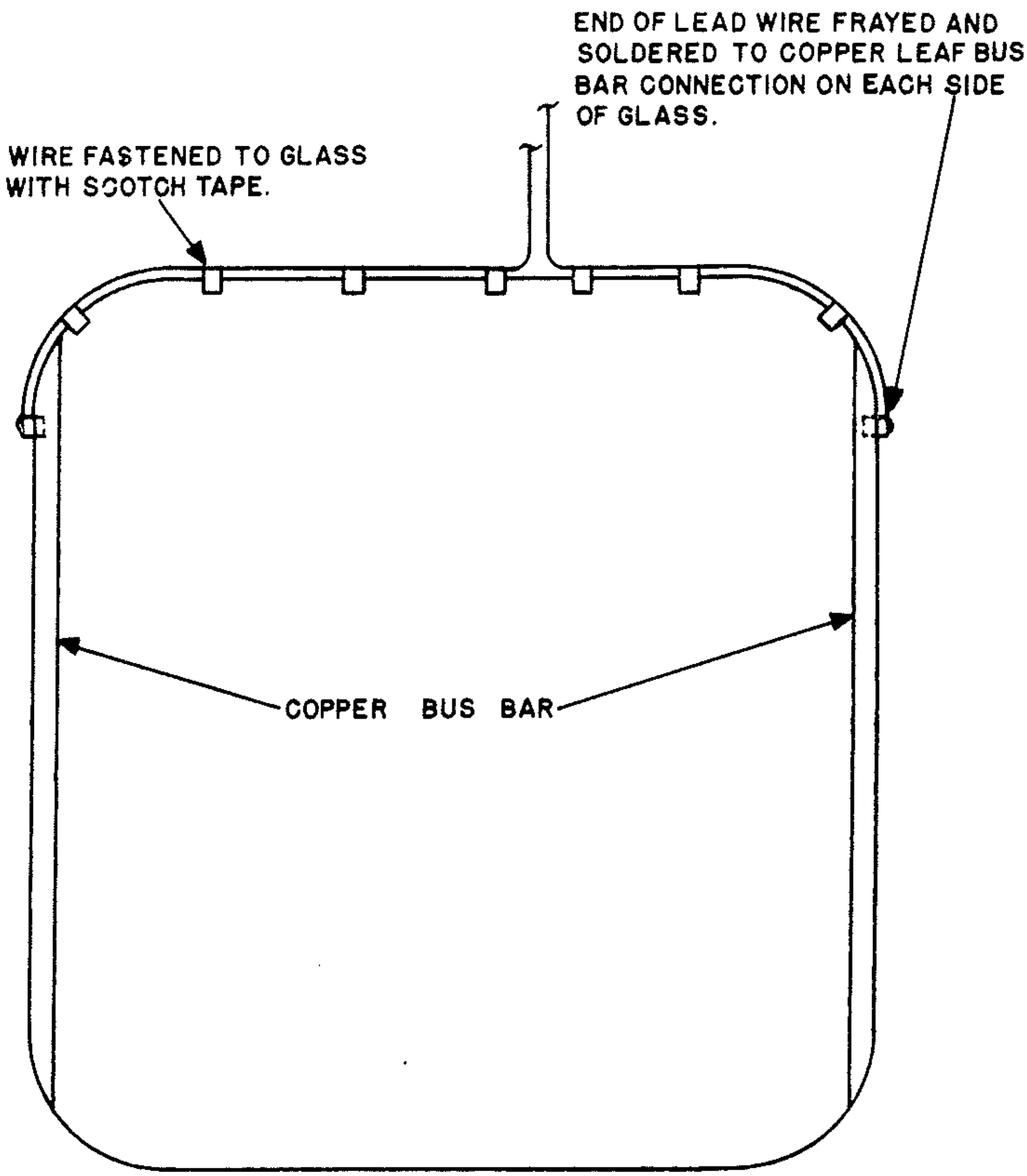
The window directly in front of each operator's position is made of two layers of glass. The inner surfaces of the glass are treated with a transparent electrically conductive coating. Copper ribbons along the edges provide the connections from the external electric supply to the conductive coating.

Upon passing a current through this coating, heat is produced across the inner surfaces of the glass. This heat, approximately 100 watts per square foot at 72 volts DC, provides the defrosting action.

This heating of the glass is controlled thermostatically according to the outside temperature. The thermostat is mounted directly on the inside face of the end sheet above the windshield. The outside face of the end sheet is exposed to the outside air temperature. The thermostat is non-adjustable, set to close at 50° and open at 65°. The contacts are suitable for 5 amperes at 60 volts.

If it should become necessary to replace a windshield, care should be used when attaching the lead wires. Small metal pads will be found on each edge of the glass near the top. The strands of the lead wires should be fanned out and tinned. Then, placing the fanned wires against the metal pads and heating with a clean tinned soldering iron, a quick well bonded joint will result.

It is recommended that overheating the metal pads be avoided to prevent the cracking of the glass or damaging the connection between pad and copper ribbon.



COPPER LEAF BUS BARS ARE LOCATED BETWEEN THE INNER SURFACES OF THE GLASS SO AS TO CONTACT THE ELECTRICALLY CONDUCTIVE COATING ON THE GLASS. THE LEAD WIRES ARE FASTENED TO THE GLASS WITH SCOTCH TAPE AND EXTENDED FROM THE TOP EDGE.

HEATED WINDSHIELD GLASS

FIG. I

SECTION 22

ENGINE CONTROL

The direction of car movement and amount of power developed by the engines is regulated by a controller located in the cab at each end of the car. Movement of the reverse lever and throttle lever of this controller, closes contacts to energize trainline wires running the length of the car. These trainline wires terminate in receptacles and plugs at each end of the car. The plugs can be inserted into corresponding receptacles at the ends of other cars permitting the coupling together of RDC cars, all controlled from the same cab. All plugs and receptacles are connected in parallel so it is only necessary to make up one cable connection between cars.

The trainline wires, in turn, energize certain traction relays located in the "B" regulator locker of each car.

The closing of these traction relays connects the positive side of the battery of each car to one or more of the engine solenoids (depending on the position of the controller levers) thus, selecting the direction of movement and amount of power developed by the engines. The direction of movement is controlled by the transmission solenoids and amount of power developed by the engine is controlled by the throttle solenoids.

Each power plant is provided with three protective switches: lube oil pressure, water temperature, and transmission oil temperature. The operation of any of these protective devices will energize the air shut down damper solenoid. This solenoid closes the damper in the engine combustion air stream, thus stopping the engine. At the same time, it opens the switch in the negative circuit and de-energizes all throttle and transmission solenoids, thus disconnecting the engine from the driving axle. Since this function is confined to the engine in trouble, it has no effect on the other engine on the car or on any other cars in the train.

Each engine circuit is provided with an isolation switch located in the regulator locker. Throwing this switch from "Normal" to "Isolate" opens the negative wire to the throttle and transmission solenoids, de-energizing them. Thus, the operation of the isolation switch will disconnect the clutch and throttle solenoids, permitting the engine to operate at idle speed regardless of the position of the controller levers. The isolation switch for the #1 engine is in the "B" regulator locker and for the #2 engine, in the "A" regulator locker.

A plug is provided and attached to the reverser lever handle by means of a chain. The insertion of this plug into the master plug switch receptacle, just above the controller, connects the car battery to both the TB+ and TB— trainline wires, thus setting up the sanding, signaling, air compressor, and engine control circuits.

When RDC cars are operated in multiple there must *never* be more than one plug in place in the train. The plug should only be inserted in the receptacle in the cab from which the train is being operated.

Since the cab controller energizes the trainline wire, which in turn, energizes the traction relays in each individual car when coupled together, a consist of cars may be controlled from any cab in the train.

The various items comprising the engine control system are as follows:

1. Master Plug Switch

This is a three point plug switch mounted in the collision post just above and to the left of the controller in each cab. Normally, its three contacts are open. The insertion of the plug closes these three contacts. As shown on Wiring Schematic No. 3, one contact connects the FC1 or FC2 wire to the TB+ trainline wire and the other contact connects the FC3 wire to the TB— trainline wire. The third contact is used to energize "Train Control" circuits on certain models. As mentioned before, the plug must be in place in order to have sanding, signaling, or air compressor controls effective in a car or train of cars.

2. Controller

The controller consists of two sets of contacts enclosed in an aluminum housing. Each set of contacts is operated by means of a removable lever inserted through an opening in the cover. These levers are mechanically interlocked so that the reverser lever can be moved only when the throttle lever is in "OFF" position, and the throttle lever can be moved only if the reverser lever is in forward or reverse position.

The throttle lever has five positions, (See Wiring Schematic No. 3) OFF, #1, #2, #3 and #4. In "OFF" position all contacts are open and no trainline wires energized. In #1 position the "C" contact closes setting up the circuit to the reverser contacts, energizing the "F" or "R" trainline wire depending on the position of the reverser lever. In #2 position the "A" contact closes, energizing the T1 trainline wire. At the same time, the "D" contact closes, energizing the "DD" trainline wire, this provision is made for interchangeability since earlier model engines were equipped with a fly ball operated speed switch type lockup governor. Lockup governors on later model engines are a hydraulic type and do not require the use of the direct drive circuit. In #3 position the "A" contact drops out and "B" contact closes energizing the T2 trainline wire. In #4 position the "B" contact remains closed and the "A" contact again closes and both the T1 and T2 trainline wires are energized.

The controller should be inspected periodically. The cover should be removed and all contacts checked for arcing and dressed if necessary. The terminal posts should be checked to see that all screws are tight and the interior of the controller should be blown out with dry compressed air. Lubricant should be applied to the oil holes in each end trunion and to each cam roller. (See The Budd Rail Diesel Car Lubrication and Fuel Chart). ***Do not*** oil the contact rollers.

3. Traction Control Relays

These relays have double pole single throw normally open contacts. There are four of these relays mounted on a panel in the "B" regulator locker. One side of the coil of each relay is connected to its associated trainline wire and the other side to the common CR— wire.

These relays energize the traction solenoids mounted on each engine.

The contacts of these relays are extra heavy for the duty they perform and should need very little attention. However, they should be examined periodically and if found pitted should be polished with Crocus cloth to prevent further arcing or pitting. At the same time the action of the armature should be checked by pushing it closed several times to see that it is free in the hinge and the return spring is working properly.

4. Sanding Switch

The bellows of this switch is connected to #15 port of the D22 control valve in the air brake system. When an emergency brake application occurs this port is charged with air which closes the sanding switch contacts and starts sanding. The sanding switch is mounted in the "B" end engine casing and should be examined and oiled yearly. All terminals should be checked for tightness and the contacts examined for pitting. Every two years the switch should be removed and sent to the air brake department for dismantling and cleaning.

5. Traction Solenoids

There are four traction solenoids on each engine. Two are located on the throttle box and control the setting of the injector racks. Two are located on the transmission, one controlling the forward clutch and the other the reverse clutch. These solenoids are of the double coil type. They have a heavy coil for pull-in and a light coil for holding. When first energized both coils are in the circuit. As the core moves into position it opens a contact which de-energizes the heavy pull-in coil leaving the light coil in the circuit to hold the core in position.

6. Isolation Switch and Engine Stop Button

These two items are combined on one double throw switch located in the regulator locker. This switch has two fixed positions: "Normal" and "Isolate" and a momentary contact position, "Stop". As shown on Wiring Schematic No. 4, positioning the switch in the "Normal" position completes the negative side of the circuit to the engine solenoids. If the switch is moved to the "Isolate" position, the circuit is broken and no traction solenoid will function even though their corresponding traction relay contacts are closed. Thus, one engine on the car can be left in the "Idling" position but cut off from propelling the car while the other is used for propulsion. Moving the switch to the "Stop" position and holding it there, energizes the fuel shut off solenoid on the engine. This shuts off the fuel to the injectors and the engine will stop. If the engine is stopped as above, the switch should *always* be thrown back to the "Normal" position after the engine has come to a stop.

7. Engine Protective Devices

Each engine is equipped with three protective switches as follows:

a. Lube oil pressure switch.

This switch is set to close if the oil pressure is less than 12 pounds, either due to loss of engine crankcase lube oil pressure or engine overspeed. The overspeed governor is arranged to lower the oil pressure at the switch in the event that the engine speed exceeds 2100 R.P.M.

b. Water temperature switch.

This switch is set to close if the temperature of the water in the engine manifold is over 200°.

c. Transmission oil temperature switch.

This switch is set to close if the temperature of the oil leaving the torque converter is over 255°.

The operation of the above switches is explained below.

8. Air Damper Solenoid and Switch

All of the above engine protective switches are connected in parallel and in series with the air damper solenoid. In the event, any of these protective switches close their contacts due to abnormal conditions of oil, water, or speed, the air damper solenoid will become energized. Energizing this solenoid trips a latch permitting a damper on the engine to shut off the combustion air to the cylinders, stopping the engine.

When the damper closes it opens the air damper switch. Since this switch is the final connection to the B— wire of all the solenoids, and protective switches on the engine, its opening "Clears the board" and all solenoids drop out disconnecting the engine and transmission from the drive shaft on the car.

The only way the engine can be restarted and restored to normal operation is to reset the air damper manually and push the start button.

9. Circuit Breakers

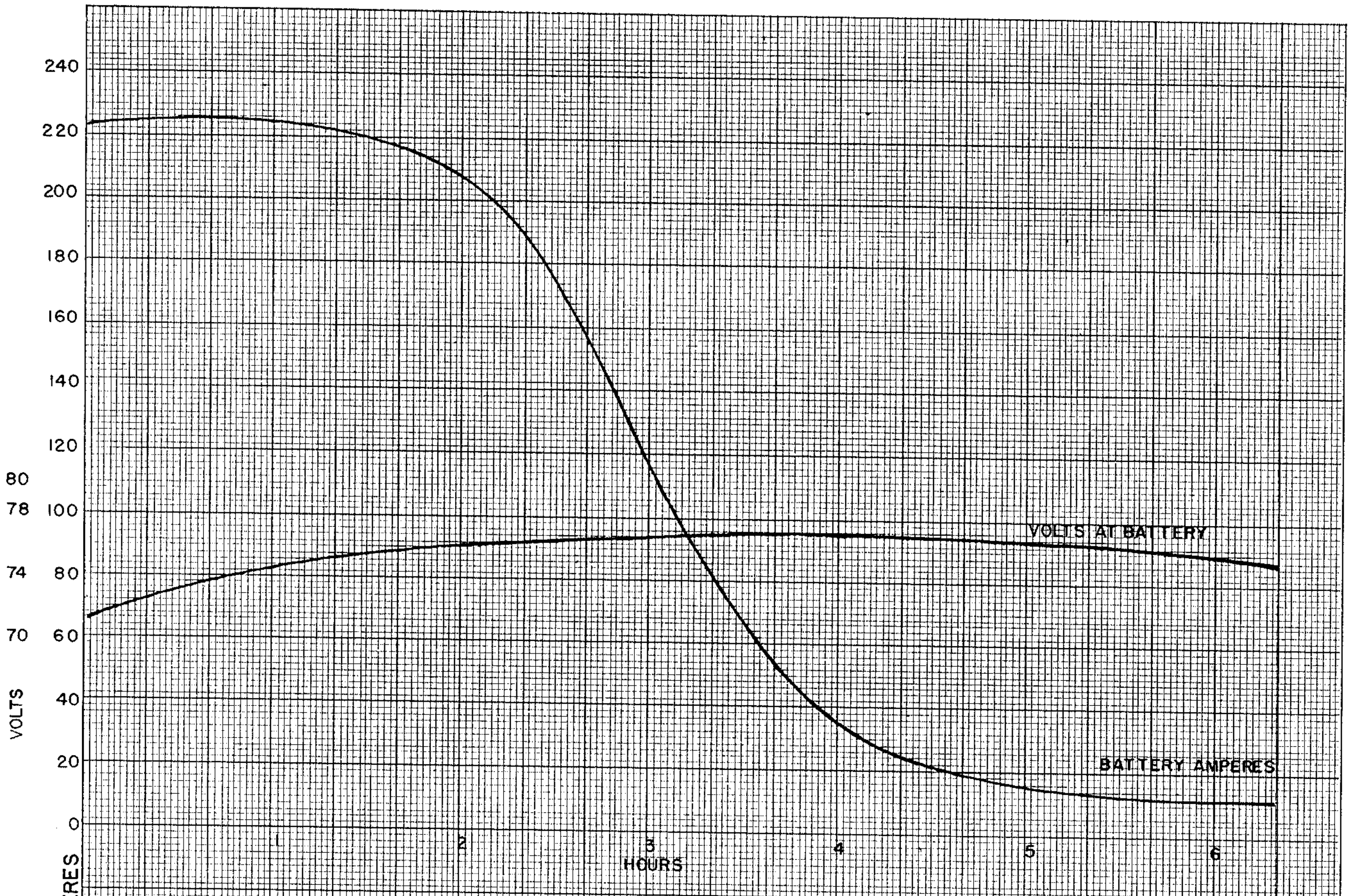
All circuit breakers in the engine control circuits are located in the switch locker at the "B" end of the car. These circuit breakers are:

a. Cab #1 Controller — 10 Amp.
b. Cab #2 Controller — 10 Amp.
c. Trainline Supply — 20 Amp.
d. Engine #1 Solenoids — 10 Amp.
e. Engine #2 Solenoids — 10 Amp.

10. Trainline Plugs and Receptacles

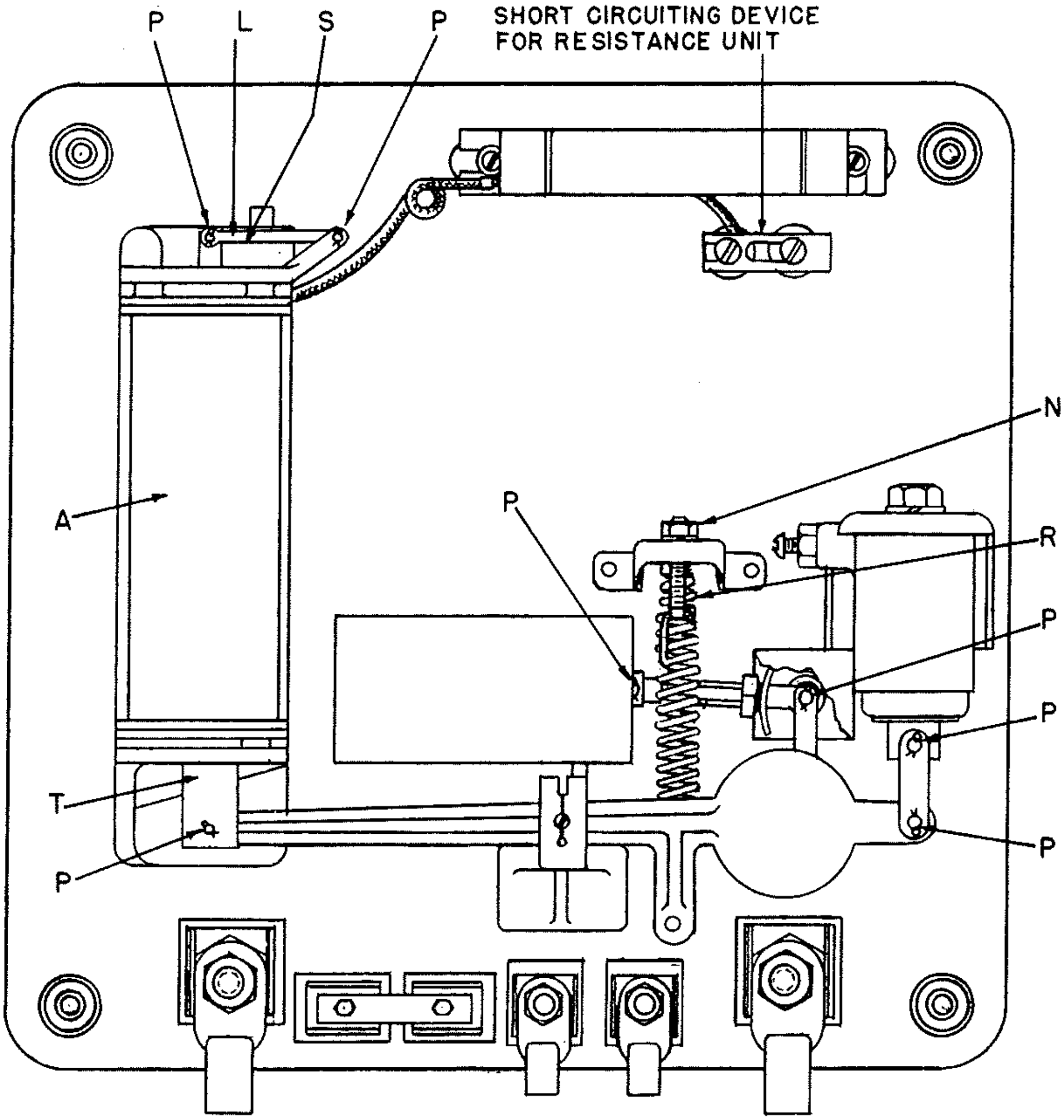
A trainline plug and a receptacle is provided on each end of the car. The receptacle is provided with a gasketed cover. Although this cover is watertight, under certain atmospheric conditions condensation may collect inside the receptacle and create grounds on the trainline circuits if not removed periodically. The covers of the receptacles should be opened frequently and the interior checked for moisture. If any is detected it should be blown out with dry air. Careful inspection of the surface around the metal contacts should be made and if any carbonizing is found, the plug should be replaced.

The connections and detail wiring of these plugs and receptacles is shown on Wiring Schematic No. 3. If a plug or receptacle has been removed; when replacing, care should be taken to position the F and R wire on the proper terminal of the terminal strip. It is to be noted that these wire are alternated in #4 or #5 position, depending on the location of the plug and receptacle in the car. This transition is made in order to provide proper directional control.



BATTERY CHARGING CURVE WITH TYPE SM-150 REGULATOR

FIG. 1



A = VOLTAGE COIL
N = NUTS
P = PIN BEARINGS
R = SPRING
S = STOP
T = PLUNGER

GENERATOR REGULATOR

FIG. 2

SECTION 23

AIR COMPRESSOR MOTOR

The air compressor motor is ball bearing, compound wound and is rated at 1750 RPM, 75 volts D.C., continuous service at 75° C. rise, 5½ H.P. with 15 minutes on and 15 minutes off.

This motor is equipped with splash proof covers at both front and rear ends. It is also provided with a single straight shaft having a standard keyway. It is also provided with a water tight junction box to accommodate wire terminal splices.

MAINTENANCE

Once a month or oftener, if found necessary, the carbon dust and dirt should be blown from the motor coils and air passages of the armature. Brushes and commutator should be inspected at this time for any unusual wear conditions. Brushes should be free in the holders and pigtail shunt connections tight. Worn brushes should be replaced when the limit of travel is reached.

Any oil or grease on commutator should be wiped off with a cloth.

LUBRICATION

This motor is equipped with sealed ball bearings lubricated at the factory and do not require any additional lubrication for the life of the bearing. Lack of lubricant or wear, indicate the need for replacement of the bearings.

SECTION 24

SPEEDOMETER

The speedometer equipment consists of an A.C. generator and a round flush wide flange D.C. indicator.

The generator is located on and driven by the Diesel engine transmission output pump shaft.

The indicator is located in the center of the controller. It is a D.C. meter with built-in copper oxide rectifiers and is calibrated in MPH on a black dial with green phosphorescent figures.

A zero adjusting screw is provided in the center of the non-shatterable glass lens. Adjustment is accomplished by turning the slotted adjustment screw: slightly counterclockwise to lower the reading and clockwise to increase the reading. This adjustment is made with the car standing still.

The generator is connected to the indicator wiring by means of a two pin quick-disconnect plug located at the generator.

The indicator is connected to wires "6M" and "7M" of the car wiring by means of a quick disconnect plug located on the inside of the controller case.

MAINTENANCE

Aside from occasional lubrication, this equipment needs no maintenance or servicing.

In the event that a generator is removed, it is important that the ball protected oil receptacles are at the top when reinstalling.

SECTION 25

SIGNAL SYSTEM

The RDC-1, 2, 3 and 4 signal system consists of a push button located in the collision post door header in each vestibule and a buzzer located at each operator's position. The signal buzzer is located above operator's windshield.

On the RDC-2, 3 and 4 cars there is an additional push button located next to the light fixture over the right side baggage door.

The buzzers are for operation on 64 volt D.C. ungrounded systems.

The signal system is trainlined so that communication is available throughout all cars in multiple operation.

The master plug switch must be inserted into its receptacle on the collision post in order to operate the signal system.

SECTION 26

FUEL TANK, GAUGES AND ASSOCIATED EQUIPMENT

The center sill mounted, 250 gallon, fuel tank is constructed of stainless steel. A two gallon sump is provided on the bottom at the center of the tank to collect condensate and sediment. The fuel to the engines is drawn from the top of this sump; thus allowing the water and sediment to settle at the bottom where it can be drained off by means of a drain cock.

The tank is filled through a fuel fill assembly provided with a screen to exclude foreign matter from the tank. Two fuel fill assemblies are provided per tank, one on each side of the car.

The tank is provided with a whistle alarm to prevent overfilling. The alarm will sound until the tank is nearly full at which time the whistleing stops.

The tank is vented from the top and is provided with a vent cap.

Two Glo Rod type of liquid level gauges are provided, one at each side of the car. The fuel level is indicated where the series of dots (oil) changes to a series of horizontal bars (no oil).

The fuel is piped from the tank to the engines through steel tubing; electrically grounded to the car frame and provided with flexible connections with quick disconnect self-sealing fittings at the engines.

An emergency safety cut-out valve is located adjacent to the sump in the fuel feed pipe to the engines. The valve is cable operated by emergency pull rings stenciled "FUEL SHUT OFF". One ring is provided at each fuel fill assembly and one at each operator's position.

Once the valve is tripped it must be reset by hand. This must be done at the valve by grasping the yoke and pulling straight out in line with the valve stem. This will reset the toggle to hold the valve in the open position.

WARNING

This method should *never* be used as a means of normal shut down of engines but only in the case of an extreme emergency — fire, etc. The injectors may be ruined by this method of shutdown.

SECTION 27

COMBUSTION AIR SYSTEM

Combustion air for the engines is taken from the roof of the car. This air is drawn through a removable louvred plate along the lower portion of the dome area into a triangular shaped space. A 6" stainless steel pipe mounted vertically in the stack area connects this space with the top of an oil bath air cleaner.

This air cleaner is attached to the car floor by means of 3 wing brackets located around the upper edge. A top air connection is butted against the vertical 6" pipe and sealed with a sheet metal clamp.

The air cleaner consists of 2 removable wire mesh filter elements located above an oil pan in such a way that the force of the air passing through the oil in the pan, sprays the oil on the filter elements and keeps them soaked to remove fine particles of dust from the air.

There is an outlet in the side of the cleaner to which is attached a 6" flexible hose which in turn is connected to a 6" stainless steel pipe running along the side sill of the car into the engine compartment. This connection must be air tight.

A 6" flexible hose connects the opposite end of the horizontal 6" stainless steel pipe to an aluminum elbow adaptor mounted and attached to the blower intake on the engine. A 1/4" mesh screen is inserted with a gasket at the latter connection to prevent the entrance of large articles into the blower.

A quick disconnect fitting is used to fasten the flexible hose to the adaptor elbow. This connection is made air tight by means of a gasket inserted under the clamp.

The various joints between the air cleaner and the blower flange should be checked frequently for tightness. Any dust entering through these joints will enter the blower and cylinders of the engine and accelerate the wear in pistons, rings, and liners.

The air cleaner has a removable pan containing the filtering oil. There is an oil level mark on this pan. The pan should be removed periodically and oil level checked. (See The Budd Company Rail Diesel Car Lubrication and Fuel Chart). It is not necessary to remove this oil unless there is an excessive amount of grit (1/8 to 1/4" in the bottom of the pan.

The lower portion of the air cleaner element should be removed periodically, washed in fuel oil, and replaced.

The upper portion of the air cleaner element should be removed yearly and washed in fuel oil.

Since the engine combustion air is drawn directly from the atmosphere through the louvers in the roof, there are times when it is impossible to prevent the entrance of a small amount of snow. When this condition occurs, it is necessary to make more frequent checks of the oil level in the air cleaner. The snow will become trapped in the oil, melt, causing a high oil level. This level may become high enough to choke off the air flow and partially starve the engine, resulting in loss of power and engine shut down. If the engine is erratic in starting after a run, the air cleaner should be checked to see that water has not raised the oil level.

SECTION 28

EXHAUST SYSTEM

One stainless steel muffler is provided for each engine, two per car, and are mounted vertically in a stainless steel stack, one at each side near the center of the car. Each stack is wrapped with two layers of asbestos cell insulating board.

The muffler is bolted to and supported on a steel bracket at the lower end. The bracket is welded to the exhaust pipe assembly and is supported at two points on vibration absorbing coil springs. The springs are mounted on supports attached to the car body.

The upper end of the muffler is steadied by means of a loose fitting collar at the tail pipe.

Each end of the muffler is provided with a four bolt flange for attachment of the exhaust pipe and tail pipe. No gaskets are required at the flanges due to the fire seal construction of the flanged end of the tail pipe and both ends of the exhaust pipe.

The exhaust pipe between the muffler and the engine is a stainless steel tube mounted under, and running parallel to the floor. The pipe assembly consists of three sections. The section of pipe at the lower end of the muffler is bolted to the muffler flange and supported on coil springs as mentioned previously. A bolted slip joint is provided at the end of this section for convenience when removing or installing the exhaust pipe. The section attached to the engine exhaust manifold flange is provided with a slip joint which permits fore and aft movement for expansion purposes and provides flexibility in the exhaust pipe to take up lateral movement and vibration of the engine.

The exhaust muffler can be removed from the car by lifting vertically out of the exhaust stack after first removing the tail pipe collar, and unbolting thte lower flange of the muffler.

The exhaust pipe slip joints should be checked whenever an engine is removed to see that they move freely fore and aft. If the joints are found to be tight, the pipe should be dismantled and the carbon deposits removed.

The engine exhaust manifold is attached to the engine by means of seven studs and nuts. Like any other combustion engine, these bolts have a tendency to loosen due to expansion and contraction. A check should be made periodically to see that nuts are tight. A loose nut will permit exhaust blow-by resulting in damage to the gasket. Whenever it is found necessary to replace manifold gaskets, be sure to apply a double gasket at this point.

SECTION 29

WINDSHIELD WIPER

One air operated windshield wiper motor is provided at each cab windshield. The motor is controlled by a valve at the air inlet. Turning the knurled control valve screw in a counterclockwise direction allows air to flow to the wiper motor causing it to operate.

INTERNAL MOTOR CHECKS (See Fig. 1)

If a wiper motor fails to operate, the following check should be made:

1. Open the control valve allowing air pressure to enter the motor. Operate the motor by hand through a few cycles. If unable to operate the motor by hand with the air on, turn off the air and operate through a few cycles by hand. This test checks the seating of the valve in air chamber and in the majority of cases will clean the valve seat which may have become dirty due to foreign particles being forced in through the air line.

2. Remove the exhaust nut and check for dirty filter or plugged hole.

3. Remove reverser ball housing and check for broken or jammed reverser ball spring.

4. Remove air chamber cap assembly and check for:
   a. Sufficient lubrication.
   b. Broken wings on timer valve.
   c. Broken wings on timer reverser.
   d. Broken valve spring.

5. Replace reverser ball housing complete with spring and ball, then hand operate the motor (with air chamber cap removed) to check whether timer reverser is riding on the greatest diameter of the ball bearing. If it is overriding or underriding on the ball bearing, the timer reverser will wear an egg-shaped hole where it turns on the main bearing.

If the timer reverser is overriding or underriding the ball bearing, completely disassemble the parts in the valve chamber as follows:

a. Loosen the lock nut and the nut below it in the valve chamber, remove timer (degree of sweep control), (See "Changing Degree of Sweep").

b. Loosen the lock nut which is riding on the face of the rotary seal and twist the main bearing up or down in the main chamber so that the point of the timer reverser will be seen centered in the hole when placed in position on the main bearing and viewed through the hole where the reverser ball housing has been removed.

6. Blow out the holes in the valve chamber by removing the cylinder end caps, also blow into exhaust — this is a complete check for internal air flow continuity.

7. With both cylinder caps off, check for cylinder lubrication.

8. Assemble and turn on air.

If motor does not operate now, check for air leaks — sometimes, a leak will be found near the rotary seal. If a leak is found, the rotary seal has popped out and the shaft should be replaced. However, some cases can be remedied by placing a gasket, such as used on the reverser ball housing, between the rotary seal lock nut and the casting where the threaded end of the main bearing protrudes.

If the above field checks have been made, the motor should run. If not, the motor should be returned to the factory for overhaul.

CHANGING DEGREE OF SWEEP

Remove the air chamber cap and remove the first two nuts. Then remove the degree of sweep control by removing the reverser ball housing (complete) and inserting a small prying tool through the ball housing hole. Pry under the degree of sweep control to free it from the shaft. Replace with a sweep control marked with the desired degree. Fit the sweep control to the shoulders of the shaft, and lock in place with the two nuts.

Replace the air chamber cap and gasket.

Note: If the connecting rod and piston cups have been removed during the above disassembly — it is highly important that, in putting the assembly back together, the connecting link ***MUST*** have its loose end pointing in the same direction as the exhaust port.

CHANGING SHAFTS

1. Remove air chamber cap and gasket.
2. Remove the two nuts.
3. Remove the reverser ball housing, spring and ball.
4. Remove the degree of sweep control.
5. Remove the timer reverser.
6. Unscrew the back bearing plate assembly and remove from the shaft.
7. Remove the transmission screw attached to the shaft arm.
8. Pull shaft out of main bearing.

The following to be removed only if a main bearing is being replaced:

a. Remove main bearing lock nut and washer.
b. Remove main bearing from inside of air chamber.
c. To assemble reverse the above procedure (Fig. 1).

ASSEMBLING TIP

Be sure that the timer valve, timer, reverser and the sweep control are assembled as shown in Fig. 2.

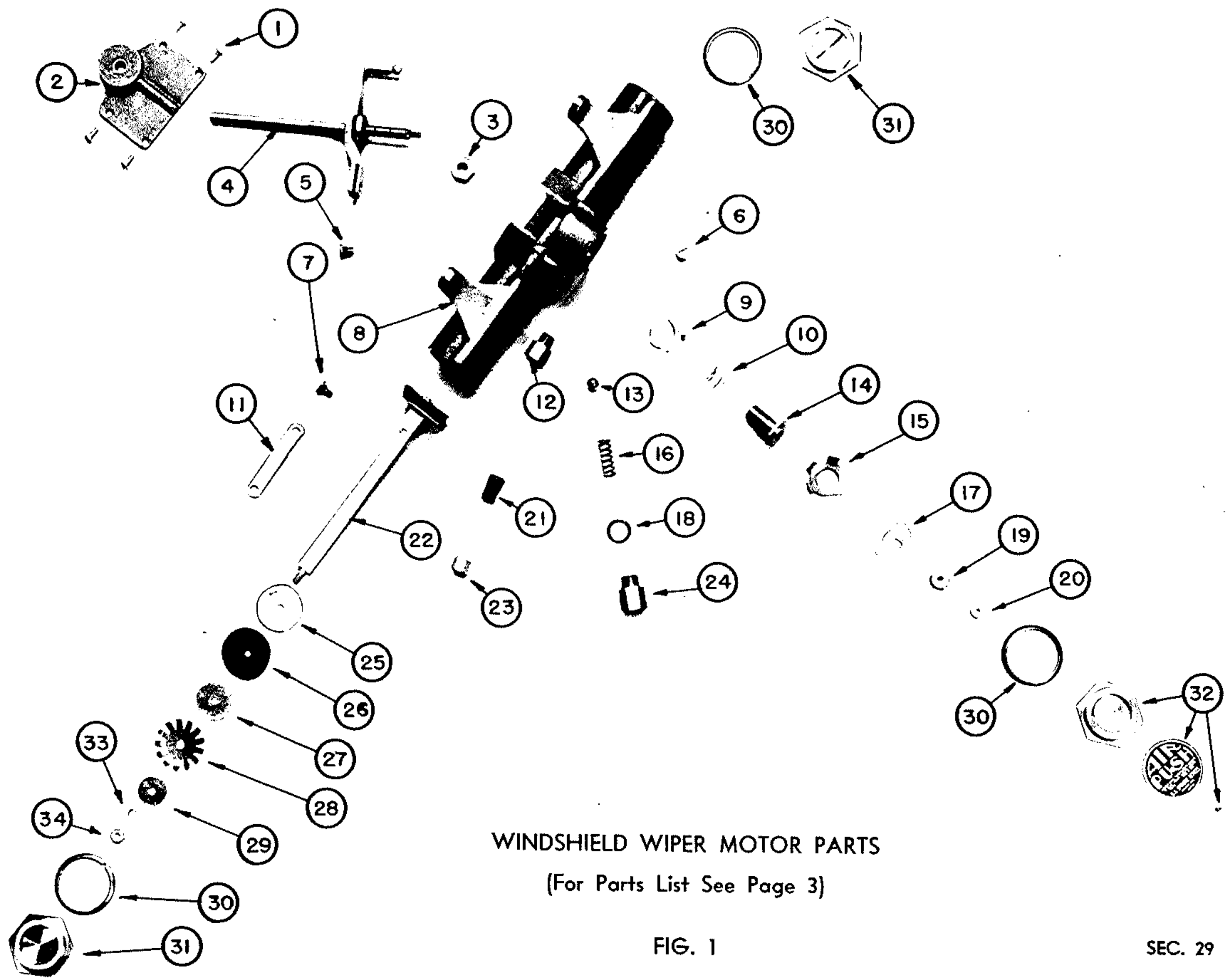
EXTERNAL WIPER ASSEMBLY

Connecting the Arm to the Motor Shaft

Turn the shaft clockwise or counterclockwise until the motor clicks and slip the mounting head onto the shaft. Apply the two mounting bolts and nuts to the mounting head. Tighten the nuts just enough so the arm will turn on the shaft. Using hand power on the arm, determine if the sweep pattern center is the same as the center of vision of the operator; back off the two mounting nuts and turn the arm to the left or right — sweep boundry required and tighten the nuts.

Adjustment of Pantograph Arm (See Fig. 3)

Position arm to the center of the sweep pattern. Turn the adjusting nut to obtain a firm pressure of the wiper blade against the glass. Adjust the rod to obtain a 90° angle between the swivel assembly and the blade clip assembly and a 90° angle between the blade clip assembly and the arm.



WINDSHIELD WIPER MOTOR PARTS

(For Parts List See Page 3)

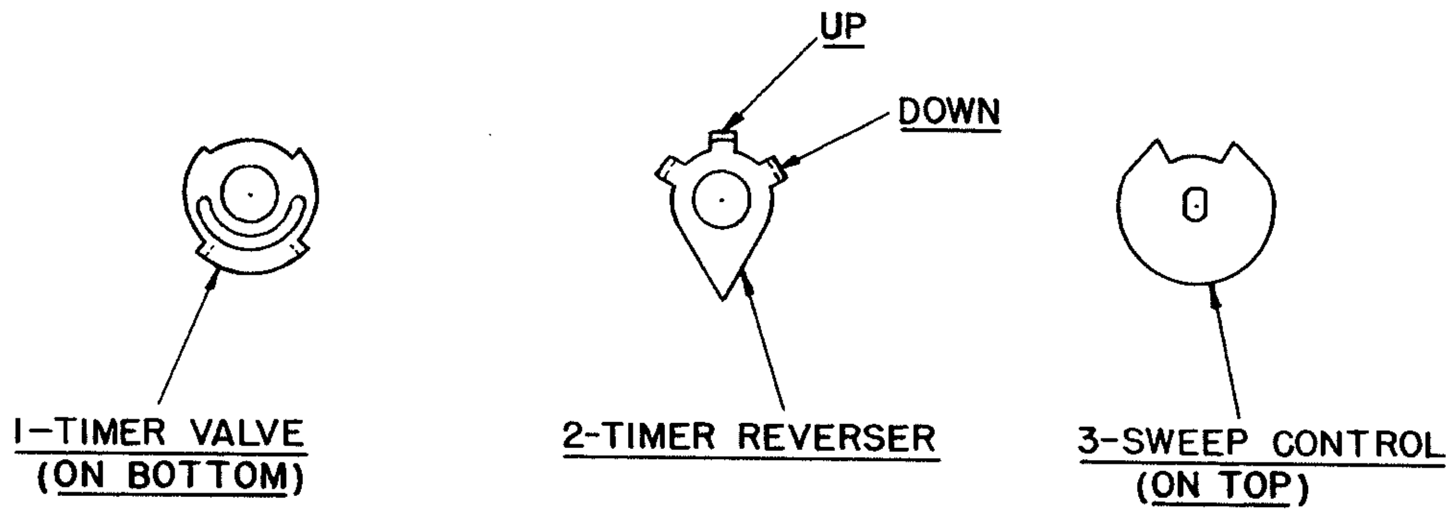
FIG. 1

WINDSHIELD WIPER MOTOR

PARTS LIST

(See Fig. 1)

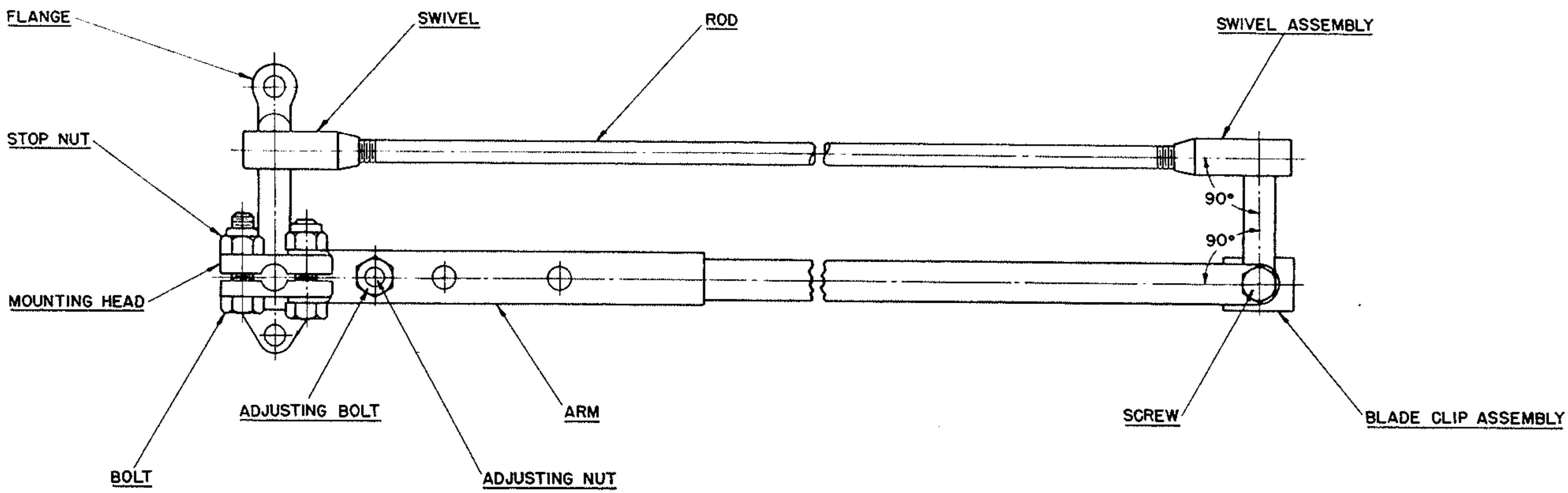
Item No.	Description	Item No.	Description
1.	Back Bearing Plate Screws	19.	Timer Nut
2.	Back Bearing Plate Assembly	20.	Timer Lock Nut
3.	Main Bearing Nut Rotary Seal	21.	Felt (Exhaust) Muffler
4.	Rotary Seal Transmission Shaft	22.	Connecting Rod
5.	Transmission Screw	23.	Exhaust Nut
6.	Pipe Plug	24.	Reverser Ball Housing
7.	Connecting Link Screw	25.	Piston Outer Plate
8.	Rotary Seal Wiper Body	26.	Piston Cup
9.	Timer Valve	27.	Piston Inner Plate
10.	Valve Spring	28.	Piston Spreader
11.	Connecting Link	29.	Spreader Plate
12.	Intake Fitting	30.	Cylinder End Cap Gasket
13.	Reverser Ball	31.	Cylinder End Cap
14.	Main Bearing	32.	Air Chamber Cap Assembly
15.	Timer Reverser	33.	Lock Washer
16.	Reverser Ball Spring	34.	Nut
17.	Timer (Degree of Sweep Control)	35.	Rotary Seal
18.	Reverser Ball Housing Gasket		



NOTE: ASSEMBLE THE THREE PIECES ON TOP OF EACH OTHER AND IN THE ORDER SHOWN.

ASSEMBLING TIPS

FIG. 2



PANTOGRAPH ARM

FIG. 3

SECTION 30

SERVICE WATER SYSTEM

Service water for the RDC-1 is gravity fed from an overhead 75 gallon stainless steel insulated tank, strap supported from the roof structure above the ceiling at the "A" end of the car. The tank is made accessible through a trap door in the vestibule. A grille is provided in the low ceiling area, at the "A" end of the car, for circulation of warm air to the tank.

The tank is filled through spud fillers. One filler located under the skirts on each side of the car at the "A" end. As one spud is being used to fill the tank, the other acts as a vent and overflow.

The water piping from the tank to the "B" end of the car is routed inside of the heater guard on the left hand side of the car ("B" end considered forward). Type "K" copper tubing is used for the service supply water.

Cold water only is supplied to the basins and hoppers.

The service water system for the RDC-2 is similar to that of the RDC-1 except that the 75 gallon tank is uninsulated and is supported from the ceiling in the baggage section. The fill spuds are located under the skirt on both sides, at about the center of the car.

The water is supplied to only one annex on the RDC-2 and is also routed through the heater guards on the left hand side of the car.

The service water system for the coach section on the RDC-3 is the same as for the RDC-2.

Hot water is supplied to the R.P.O. section, on the RDC-3, from a 6 gallon galvanized tank supported from the ceiling over the toilet section. This tank is supplied with water from the 75 gallon service water tank located in the baggage section.

The 6 gallon hot water tank is provided with an immersion heater mounted in the tank and is controlled by an immersion thermostat set for 140° to 190°. The immersion heater will operate only when an engine is running.

The cold water for the basins and hoppers in the R.P.O. and passenger sections are supplied from the 75 gallon service water tank.

The fill spuds for the 75 gallon supply are located under the skirt on both sides at about the center of the car.

Shut-off valves are provided in the feed lines from the tanks to the basins and to the hoppers.

Drain valves are provided in the feed lines (in heater guards) to each basin and hopper for draining tanks and piping.

On the RDC-4, the cold water for the basin and hopper in the baggage section is supplied from a 20 gallon service water tank. The tank is suspended from the ceiling above the toilet area in the baggage section. The fill spuds for this tank are located under the skirt at the "B" end on each side of the car.

The cold water for the basin and hopper in the RPO section is supplied from a 30 gallon service water tank. The tank is suspended from the ceiling at the "A" end of the car. The fill spuds for this tank are located under the skirt at the "A" end on each side of the car.

Hot water is supplied to the RPO basin from a six gallon galvanized tank supported from the ceiling over the toilet section. This tank is supplied with water from the 30 gallon service water tank located in the RPO section.

The six gallon hot water tank is provided with an immersion heater mounted in the tank and is controlled by an immersion thermostat set for 140 to 190°. The immersion heater will operate only when an engine is running.

SECTION 31

SASH GLASS

The large sash in the coach compartment are provided with single fixed laminated glass set in glazing rubber and mounted in an extruded frame of aluminum. The glass size is ¼" x 25½" x 55¾" with a 3⅜" corner radius.

The glass in the car body end doors are single fixed laminated, set in glazing rubber in the door proper, requiring no sash frame. The glass size is ¼" x 14¼" x 23½" with a 3⅛" corner radius. There are two per car.

The toilet sash are provided with single fixed laminated prism glass, set in glazing rubber and mounted in an extruded aluminum frame. The glass size is ¼" x 25½" x 14⅜" with a 3⅜" corner radius.

The side door of the operator's cab, at each end of the car, is equipped with a drop sash known as a "Jump The Fence Type". At the top of the sash are two handholds for lifting or lowering the sash. The sash lowers into a recess in the door. When in a raised position, a turned down lip at the bottom of the sash unit engages over the outer edge of the window opening of the door; holding the sash in place. The glass size is ¼" x 23¾" x 22½" with square corners.

The operator's cab windshield is a single fixed laminated glass set in glazing rubber. The inner surfaces of the glass are treated with an electrically conductive coating. The glass size is ¼" x 26¼" x 24¾" with a 3⅛" corner radius. There are two per car.

CAUTION: In handling the above windshield, such as during application, care must be exercised to avoid placing strain on wire leads. The wires are easily torn from the connection to the glass. The wires are passed through a slit cut in the glazing rubber.

The standard collision post end doors are provided with single fixed laminated glass set in glazing rubber in the door proper. The glass size is ¼" x 21 15/16" x 25½" with 3⅛" corner radius.

The fireman's windshield is single fixed laminated glass 7/64" polished plate outside. A .030" thick vinyl bonding layer and 3/16" semi-tempered polished plate inside. The glass size is .334" x 26¼" x 24¾" with a 3⅛" radius and is set in glazing rubber.

The vestibule side door (non-cab side) has single fixed laminated glass, set in glazing rubber in the door proper. The glass size is ¼" x 23⅝" x 26¼" with a 3⅛" radius. There are two per car.

Sash glass, except in the doors and cab windows, must be replaced from the inside. The trim must be removed which consists of the window capping, moulding, shade guides and the shades. This will expose the screws which retain the sash unit in place. These screws can then be removed and the sash unit removed from the side frame of the car.

The glass can then be replaced and the unit reapplied to the car.

The glass in the doors and cab windows, except the drop sash at the operator's door are replaced from the outside. Remove the rubber retaining strip from glazing rubber. The glazing rubber is then removed, releasing the glass.

When removing the retaining strip and glazing rubber, care must be taken to avoid damage by stretching and tearing.

When installing the glazing rubber, apply a light coat of liquid soap or glycerine to aid in inserting the glass into the rubber. The glazing rubber is of a given length and must be uniformly applied around the window opening, to avoid stretching or crowding.

Before applying the retaining strip to the glazing rubber, apply a light coat of liquid soap or glycerine. When applying the retaining strip, start at a point beyond the joint in the glazing rubber to avoid having both joints at the same location. Work the retaining strip into the glazing rubber uniformly being careful to avoid stretching. This strip is also of a given length and should not be cut. If when approaching the point where the two ends will meet and an excess is found, indicating that the retaining strip has been stretched, work the excess back uniformly to relieve the stretching.

The following Glazing Tools are required for the proper application of the retaining strip and glazing rubber:

Tool for installing Retaining Strip —

Inland #756460, Budd Tool Code #855-125

Seal Tool for Glazing Rubber —

Inland #756475, Budd Tool Code #855-126

SECTION 32

EXTERIOR CLEANING SOLUTIONS

The following cleaning solutions were tested by THE BUDD COMPANY Laboratory. They are approved for cars when used as prescribed by the Manufacturer of each respective cleaner. Under such prescribed methods these cleaners will leave no streaks where the washed areas overlap and will not damage painted areas. They are inhibited-alkaline or neutral cleaners.

Oakite #70 4-6 dry oz/gal luke-warm water	Oakite Products Co. 19 Rector Street New York 6, New York
Turco RR1 Turco RR3 4-6 dry oz/gal luke-warm water	Turco Products 6135 S. Central Ave. Los Angeles,1, Calif.
Kelite EX-1600 1-3 dry oz/gal luke-warm water	Kelite Products, Inc. 1250 N. Main Street Los Angeles 1, Calif.
Wyandotte "Rillor" 4-8 dry oz/gal luke-warm water	Wyandotte Chemicals Corp. Wyandotte,Michigan

If it is deemed necessary to use an acidic cleaner to remove certain roadway file discolorations, Oakite #88 (4 to 6 dry ounces per gal. of water for hand cleaning) followed by a thorouth rinsing with clear water may be used. However, the next three or four cleanings should be done with one of the above cleaners to neutralive the acid cleaner and minimize any possible corrosion of the steel by the acid cleaner.

SECTION 33

WIRING SCHEMATICS

NOTES:

AIR BRAKE COMPRESSOR

WHEN A PRESSURE SWITCH ON ANY CAR CLOSES DUE TO DECREASED AIR BRAKE PRESSURE, ALL AIR BRAKE COMPRESSORS IN TRAIN CONSIST ARE SYNCHRONIZED TO OPERATE TOGETHER THROUGH TRAINLINE WIRE ABC.

GENERATOR MUST BE RUNNING AT SAME TIME.

TIME DELAY RELAY WILL BE ENERGIZED, THEREBY OPENING MAIN POWER CONTACTS TO MOTOR. MOTOR CONTACTOR WILL BE ENERGIZED BY ANOTHER TD CONTACT, AND STARTING RESISTORS WILL REDUCE STARTING CURRENT. MOTOR CONTACTOR WILL SEAL ITSELF IN AND DE-ENERGIZE TIME DELAY COIL.

FLUX DELAY ACTION AT TDI WILL KEEP MAIN TDI CONTACT OPEN UNTIL MOTOR CAN OPERATE ON FULL LINE VOLTAGE IN 1½ SECONDS.

ROLOKRON OPERATION

DURING NORMAL DECELERATION OF WHEEL RC CONTACTS REMAIN OPEN. ON EXCESSIVE DECELERATION OR ACCELERATION OF WHEEL FOR 3 SECONDS RC CONTACTS WILL CLOSE. CIRCUIT ENERGIZES RELEASE RELAY AND PROTECTIVE RELAY OPERATING S1 SOLENOID WHICH CLOSES AIR INTAKE VALVE AND OPENS EXHAUST VALVE TO BRAKE.

S2C CONTACT IS OPENED UPON COMPLETION OF CLOSING OF AIR INTAKE VALVE. S2 COIL IS ENERGIZED WHICH HOLDS VALVE CLOSED AT A REDUCED CURRENT.

AFTER ONE SECOND (APPROX.) ELAPSES RC CONTACTS WILL OPEN DE-ENERGIZING RELEASE RELAY AND PROTECTIVE RELAY. AIR INTAKE VALVE OPENS AND EXHAUST VALVE CLOSES APPLYING AIR PRESSURE TO BRAKES.

IF PROTECTIVE RELAY IS ENERGIZED FOR NINE SECONDS (APPROX.) PR CONTACTS WILL OPEN AND SOLENOID IS DE-ENERGIZED. CONTACTS WILL REMAIN OPEN UNTIL RELEASE RELAY IS DE-ENERGIZED.

NOTE:

FOR ADDITIONAL ROLOKRON INFORMATION SEE BUDD ROLOKRON INSTRUCTION AND PARTS MANUAL.

SANDING

1. DIRECTIONAL SELECTION
WHEN FORWARD OR REVERSE CAR MOVEMENT IS CHANGED IN THE CAB, A MECHANICAL LATCH IN RELAY WILL ADJUST ITS CONTACTS ACCORDINGLY, TO ARRANGE FOR SANDING AT THE LEADING FLANGE OF EACH WHEEL ON THE TRUCKS. WHEN SANDING IS REQUIRED THIS CONTROL FEATURE IS CARRIED OVER THE TRAINLINE TO ALL OTHER CARS.

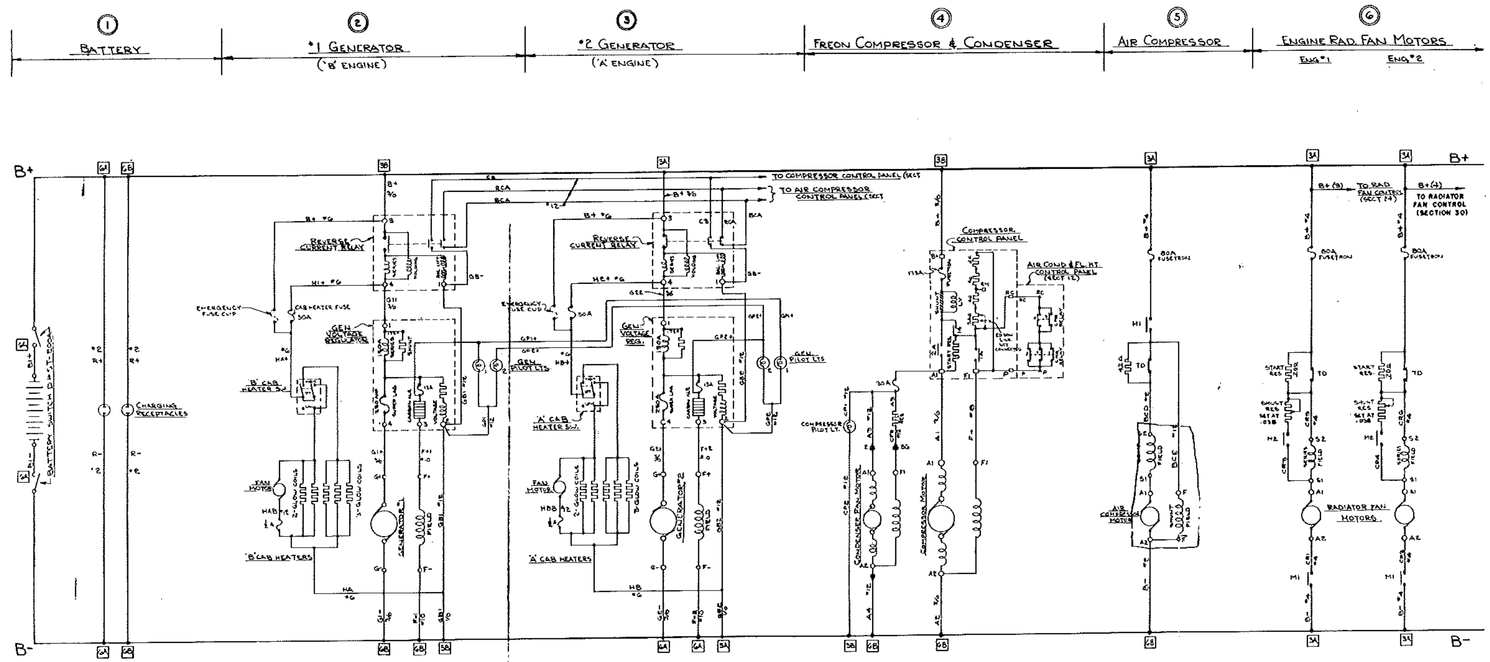
2. ENGINEER'S SANDING
TO OBTAIN BETTER ADHESION TO RAILS AT STARTING OR AT ANY OTHER TIME, ENGINEER MAY PRESS SANDING BUTTON ON MASTER CONTROLLER, WHICH WILL ENERGIZE THE SANDING RELAY VALVES DESIRED.

3. EMERGENCY SANDING
ON APPLICATION OF EMERGENCY BRAKES, AIR PASSING THROUGH PORT 15 OF THE D22 VALVE WILL BUILD UP TO 25 LBS. TO OPERATE A 3 POLE PRESSURE SWITCH UNTIL PRESSURE DROPS TO 15 LBS.

TWO (2) CONTACTS NOT USED.

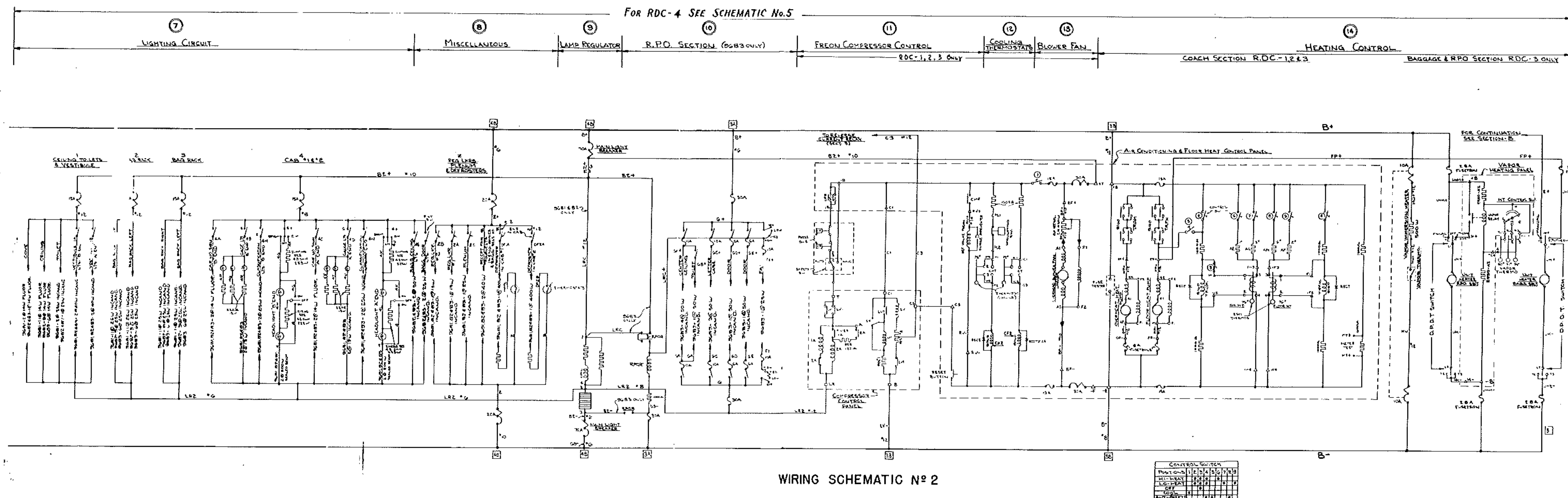
THE THIRD CONTACT WILL CLOSE A CIRCUIT TO THE COIL AND CONTACT (NORMALLY CLOSED,—OPENS AFTER 30 SECONDS) OF A RELAY WHICH COMPLETES THE EMERGENCY SANDING CIRCUIT THROUGH THE DIRECTIONAL RELAY TO THE ELECTRO-PNEUMATIC SANDING VALVES.

ROLOKRON SANDING
SINCE THE ROLOKRON ACTS EVERY TIME THE WHEELS DECELERATES OR ACCELERATE ABOVE A GIVEN RATE FOR 3 SECONDS, AUTOMATIC SANDING IS TIED INTO ROLOKRON ACTION BY THE USE OF A ROLOKRON SANDING TIMER RELAY, THE COIL RESPONDING TO ROLOKRON ACTION. THE PNEUMATIC TIMER PROVIDES A QUICK MAKE SLOW BREAK OF 3 SECONDS WHICH PROVIDES SANDING DURING THE DECELERATING AND ACCELERATING PERIODS.



WIRING SCHEMATIC Nº 1

FIG. 1 SEC. 33



WIRING SCHEMATIC Nº 2

FIG. 2 SEC. 33

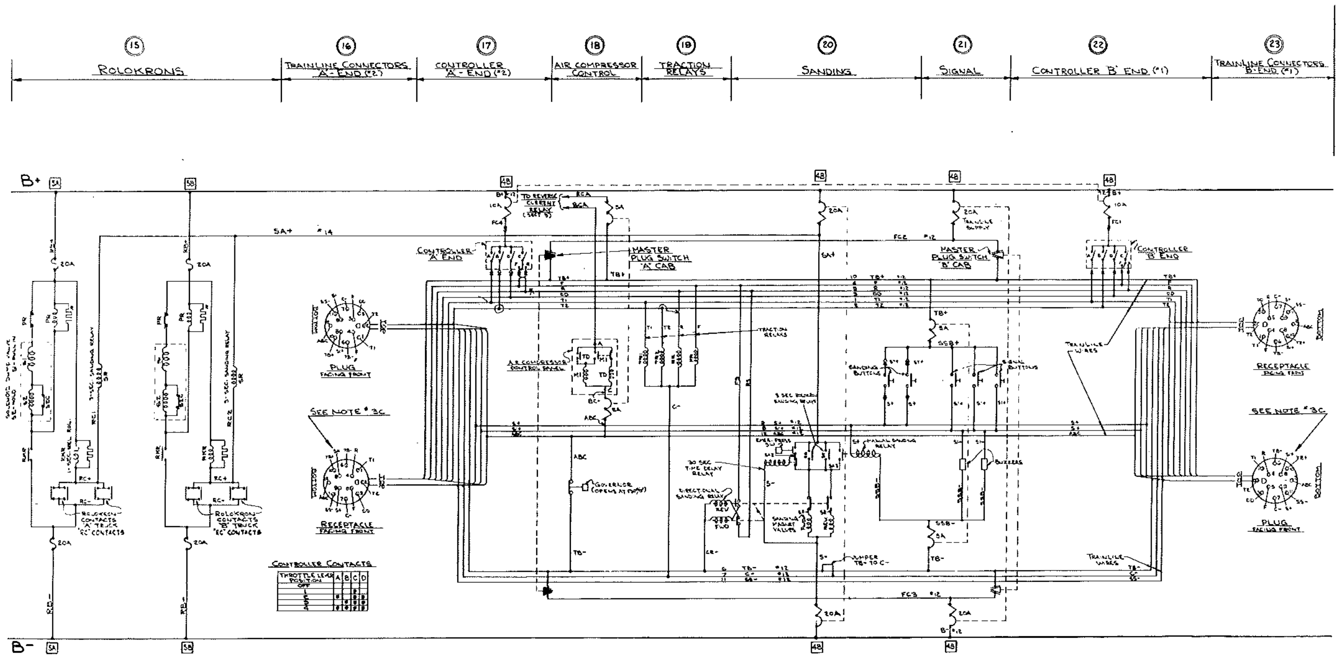
ENGINE CONTROLS

1. THE CLUTCH LEVER CANNOT MOVE INTO OR OUT OF THE ENGAGED POSITION (FORWARD OR REVERSE) UNLESS THE THROTTLE LEVER IS IN THE "OFF" POSITION.
2. THE THROTTLE LEVER CANNOT MOVE OUT OF THE "OFF" POSITION UNLESS THE CLUTCH LEVER IS IN THE ENGAGED POSITION (FORWARD OR REVERSE).
3. TO START THE ENGINE THE DAMPER LEVER MUST BE PULLED OUT AND HELD, THE STARTING BUTTON ON ENGINE PANEL PRESSED UNTIL THE ENGINE STARTS AND ENGINE OIL PRESSURE REACHES 15 P.S.I. OR HIGHER.
4. WITH FORWARD OR REVERSE CLUTCH SELECTION MADE, AND THE THROTTLE PLACED IN #1 (IDLE) POSITION, THE DIRECTIONAL ENGINE SOLENOIDS WILL BE ENERGIZED TO ARRANGE FOR PROPER CAR MOVEMENT FROM BOTH ENGINES OF ALL CARS IN THE TRAIN. THIS IS OBTAINED BY PROPER REVERSAL OF WIRES AT EACH ENGINE CONTROL RELAY, AT THE TRAINLINE CONNECTIONS, AND AT THE TRAINLINE JUMPERS. FORWARD MOVEMENT ALWAYS REPRESENTS MOVEMENT IN THE DIRECTION OBSERVED FROM THE CAB CONTROLLING THE CAR OR TRAIN.

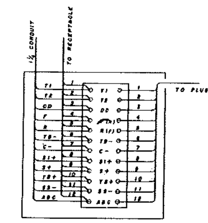
   AT THE SAME TIME, THE SANDING DIRECTIONAL RELAY WILL ASSUME THE DESIRED POSITION FOR APPLICATION OF SAND TO THE LEADING AXLE OF EACH TRUCK. THIS FEATURE IS CARRIED OVER THE TRAINLINE TO OTHER CARS IN THE TRAIN.
5. PLACING THE THROTTLE IN #2, #3, OR #4 POSITIONS, WILL CONTROL A WALKING BEAM CONNECTED TO THE FUEL OIL SUPPLY, WHICH INTRODUCES MORE FUEL AND MORE SPEED, TO PROVIDE 1/3, 2/3 AND FULL TORQUE.
6. THE ENGINE SOLENOIDS ARE IN SERIES WITH AN ISOLATION SWITCH IN THE LOCKER, WHICH PERMITS THE ENGINEER TO DECLUTCH AND SHUTDOWN ONE ENGINE OF A CAR IN CASE OF TROUBLE. HE SHOULD ALSO PUSH THE FUEL CONTROL ENGINE SHUTDOWN BUTTON.
7. NORMAL SHUTDOWN OF AN ENGINE IS ACCOMPLISHED BY SHUTTING OFF THE FUEL SUPPLY BY FUEL SHUTDOWN BUTTONS AT THE ENGINE, OR IN THE LOCKER. THE STARTING CYCLE MUST BE PERFORMED AGAIN THEREAFTER.
8. SHUTDOWN UNDER ABNORMAL CONDITIONS IS OBTAINED BY SHUTTING OFF THE AIR SUPPLY THROUGH A SOLENOID, WHICH RESPONDS TO A CIRCUIT CLOSED THROUGH SAFETY SWITCHES. THESE SWITCHES INCLUDE RESPONSES TO A DROP IN LUBRICATING OIL PRESSURE. THIS WILL OPEN UP AFTER THE ENGINE BUILDS UP SPEED. OTHER SWITCHES RESPOND TO A RISE IN WATER TEMPERATURE OR TRANSMISSION OIL TEMPERATURE, AND WILL CLOSE UNDER SUCH CONDITIONS. THE HYDRAULIC OVERSPEED GOVERNOR IS CONNECTED TO THE LOW OIL PRESSURE SWITCH.
9. IN ALL CASES, THE CONTROL CIRCUITS MUST PASS THROUGH A DAMPER SWITCH, CAM-OPERATED FROM THE BUTTERFLY VALVE IN THE AIR INTAKE. THE AIR SHUTDOWN SOLENOID WILL OPEN THIS DAMPER SWITCH, DE-ENERGIZING ALL CONTROLS. ENGINE AND COOLING FAN ARE INTERLOCKED. FAILURE OF ONE UNIT WILL CAUSE SHUTDOWN OF THE OTHER UNIT.
10. ALL SIGNAL, SANDING, AND ENGINES AND AIR BRAKE COMPRESSORS ARE CONTROLLED FROM THE LEADING CAB, THROUGH A PLUG SWITCH WHICH MUST BE PLUGGED IN BY OPERATOR.

ENGINE COOLING FAN OPERATION

1. THE THERMO-PNEUMATIC CONTROL VALVE CLOSES AT 176° DIVERTING WATER TO OVERHEAD RADIATORS.
2. WHEN THE 165° COOLING THERMO. CLOSES IT WILL ENERGIZE THE TIME DELAY RELAY. CLOSED "TD" CONTACT ENERGIZES "M1" COIL AND LOCKS "M1" RELAY IN. THE "M1" COIL ALSO DE-ENERGIZES "TD" COIL CIRCUIT AFTER 1½ SECONDS, THROUGH "M1" INTERLOCK CONTACT. MAIN "M1" CONTACT CLOSES AND PLACES START RESISTOR IN SERIES, DECREASING CURRENT DURING STARTING PERIOD. AFTER THE 1½ SECOND DELAY THE "TD" CONTACT CLOSES AND THE FAN IS IN RUNNING SPEED.
3. HIGH SPEED IS OBTAINED WHEN 176° THERMO. IS CLOSED, ENERGIZING "M2" COIL. THE "M2" CONTACT CLOSES REDUCING FIELD CURRENT BY APPLYING SHUNT RESISTOR ACROSS MOTOR FIELD.

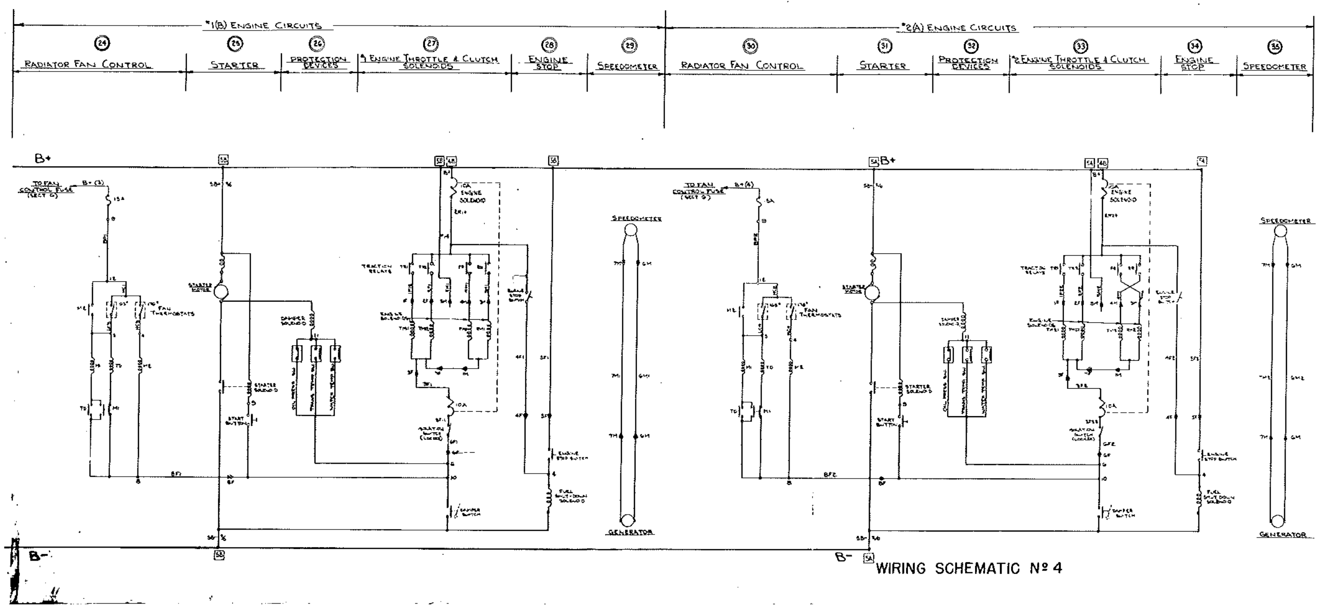


WIRING SCHEMATIC Nº 3

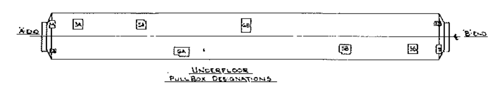


TRAINLINE TERMINAL BLOCK CONNECTIONS AT ENDS OF CAR

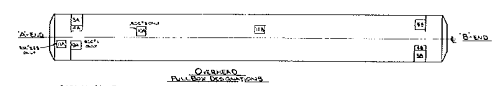
FIG. 3 SEC. 33



WIRING SCHEMATIC Nº 4



UNDERFLOOR
PULLBOX DESIGNATIONS



OVERHEAD
PULLBOX DESIGNATIONS

SPECIAL NOTE

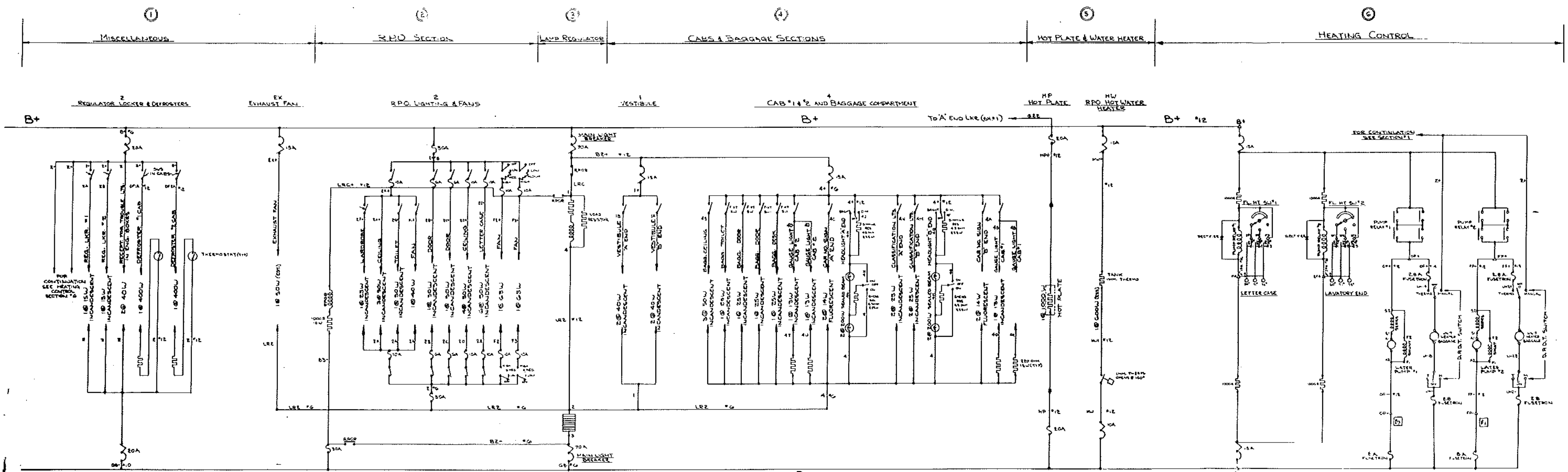
THE ABOVE PLANS INDICATE THE LOCATION AT WHICH MAJOR CONNECTIONS OCCUR IN PULL BOXES, BETWEEN INDIVIDUAL CIRCUITS AND THE SOURCE OF SUPPLY, AND ARE INDICATED BY SYMBOL □(TYP)

NOTES

1. ALL WIRES NOT DESIGNATED ARE #14
2. GENERAL NOTES APPEAR ON SHEET #2
3. WARNING: OBSERVE REVERSAL OF FORWARD & REVERSE WIRES AT THREE LOCATION
   A. #2 ENGINE FORWARD & REVERSE SOLENOID WIRES AT TRAINLINE RELAY
   B. TRAINLINE FORWARD & REVERSE RELAY COIL WIRES AT #2(A) CONTROLLER
   C. (JUMPER 'B' END #4 CONTACT TO REVERSE (#5) TRAINLINE WIRE, #5 CONTACT TO FORWARD #4 TRAINLINE WIRE
   (RECEPTACLE 'A' END #4 CONTACT TO REVERSE (#5) TRAINLINE WIRE, #5 CONTACT TO FORWARD #4 TRAINLINE WIRE

LEGEND

- M1 - ENGINE COOLING LOW SPEED CONTACTOR
- M2 - ENGINE COOLING HIGH SPEED CONTACTOR
- TD - TIME DELAY RELAY
- PR - PROTECTIVE 8-SECOND RELAY
- RKR - ROLOKRON 1-SECOND RELAY
- CPR - COOLING PILOT RELAY
- CMR - COOLING MODULATING
- LV - RELAY POTENTIAL COIL
- LV1 - RELAY COIL
- TRFH - RELAY THERMOSTATIC FLOOR HEAT
- TROH - RELAY THERMOSTATIC OVERHEAT HEAT
- LV - RELAY POT & CUR. COILS



WIRING SCHEMATIC Nº 5 FOR RDC-4

FOR SECTIONS NOT SHOWN SEE WIRING SCHEMATICS Nº 1,2,3 & 4

FIG. 5 SEC. 31