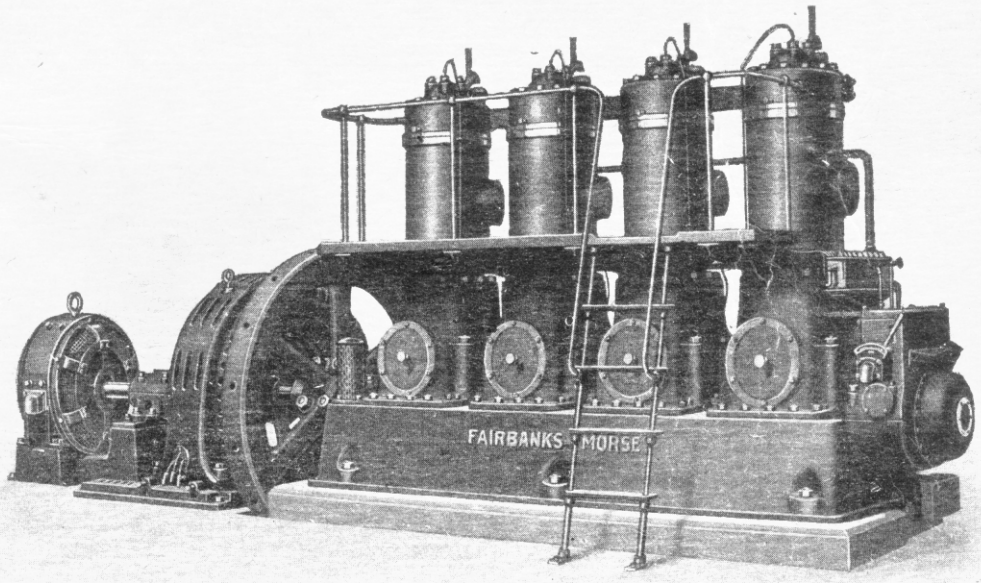
INSTRUCTIONS NO. 3200B

To Be Read Carefully Before
ERECTING AND OPERATING

Fairbanks-Morse Stationary Diesel Engines

Models 32A-12 and 32A-14
Models 32B-12 and 32B-14



ENGINE DIRECT CONNECTED TO AN ALTERNATOR
WITH DIRECT CONNECTED EXCITER

FAIRBANKS, MORSE & CO.
(INCORPORATED)
CHICAGO

Price One Dollar

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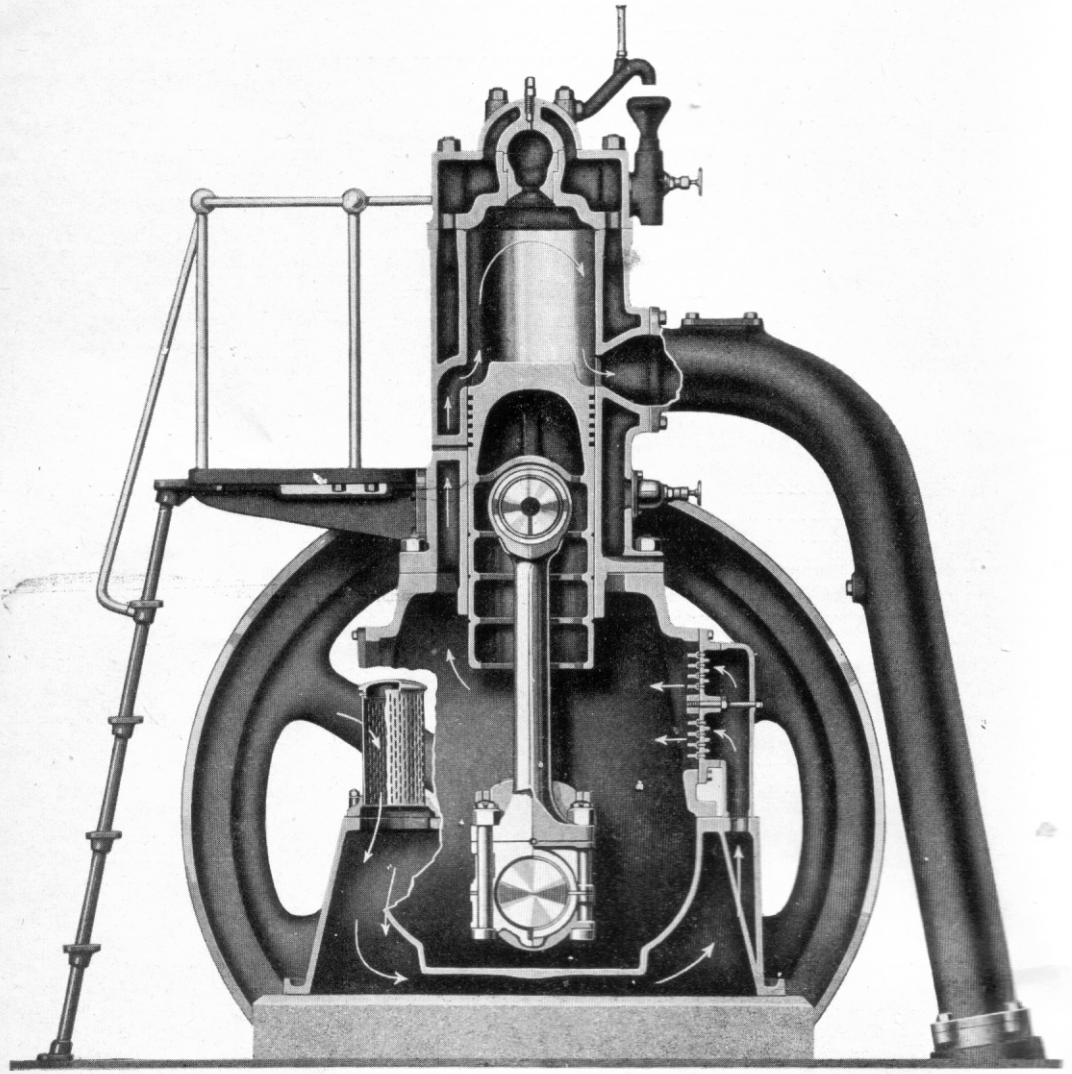


CROSS SECTION THROUGH MODEL 32B ENGINE (AORQ202.3)

INSTRUCTIONS NO. 3200B

For Setting Up and Operating Fairbanks-Morse Stationary Diesel Engines

GENERAL

Engine Designation

1. The engines covered by these instructions may be designated by the model number and horsepower rating on the nameplate. The Model 32B engines operate on the two stage combustion principle, and the Models 32C and 32D on the open head combustion principle.

Type of Engine

2. These engines are of the valveless, cold starting, airless injection type, and are designed to use a wide variety of low grade fuels. They operate on the two-stroke cycle or two cycle principle in which two strokes of the piston or one complete revolution of the crankshaft are required to complete the cycle.

Cycle of Operation

3. The cycle of operation may be divided into four parts; compression, combustion, expansion, and scavenging.

Compression

4. COMPRESSION begins when the upward moving piston closes the exhaust ports and ends just before the piston reaches its upper dead center, at which time the fuel injection starts.

Combustion

5. With the beginning of injection, the COMBUSTION periods starts and is carried out on the two-stage principle in the Model 32B engines. (In the Models 32C and 32D the "Open Head" principle is applied, covered by Instruction 3200D.) The fuel is injected into the combustion chamber where it is partially burned to an inflammable gas. As the piston reaches its upper dead center and moves downward, the pressure in the cylinder tends to fall below that of the combustion chamber; consequently, the gas flows through the combustion chamber neck into the cylinder where combustion is completed.

Expansion

6. At the end of the combustion period, EXPANSION takes place until the piston uncovers the exhaust ports, when a slight pressure expels the exhaust gases.

Scavenging

7. Shortly after the exhaust ports are uncovered, or about the time the pressure has dropped to atmospheric, the air inlet ports are uncovered, and SCAVENGING air, supplied by the piston and crank case acting as a pump, enters the cylinder, cleaning out the unburned gases and charging the cylinder with fresh air. The cycle is then repeated.

Read Instructions

8. Complete information for setting up and operating these engines is found in the following instructions which should be read carefully before doing any work on the engine. The operator should become thoroughly familiar with the engine and all of its parts in order to give it the intelligent care which it deserves.

Engines Packed for Domestic Shipment

9. When these engines are packed for domestic shipment, they are completely assembled with the exception of the flywheel, and several minor parts such as the stairs and handrail, cooling water thermometers, etc.

Engines Packed for Export

10. A stationary Diesel engine for export shipment is disassembled, and the following major parts are packed separately, the lower base, the crankshaft, each upper base with its cylinder, cylinder head and piston assembled, and the flywheel. On an engine having more than one cylinder, the lower base, upper bases, cylinders, etc., are marked 1, 2, 3, etc., beginning at the governor end. The lubricating oil and other tubes are assembled on the engine at the factory and fit certain cylinders. New gaskets are furnished for all surfaces requiring them.

LAYOUT OF PLANT

Floor Plan

11. Lay out the entire floor plan, carefully locating the exhaust and cooling water arrangements, foundations for auxiliaries, etc., before erecting the engine. Locate all auxiliary equipment so that the piping will be as short as possible. Leave plenty of space around the engine and auxiliaries, and provide for development and future extensions.

Engine Rotation

12. The standard rotation of the engine is clockwise, when facing the engine at the governor end. When specially ordered, the engine can be furnished for reversed rotation. Diagram 99YKA168 on page 52 shows the engine with standard and reversed rotations.

Cylinder Position

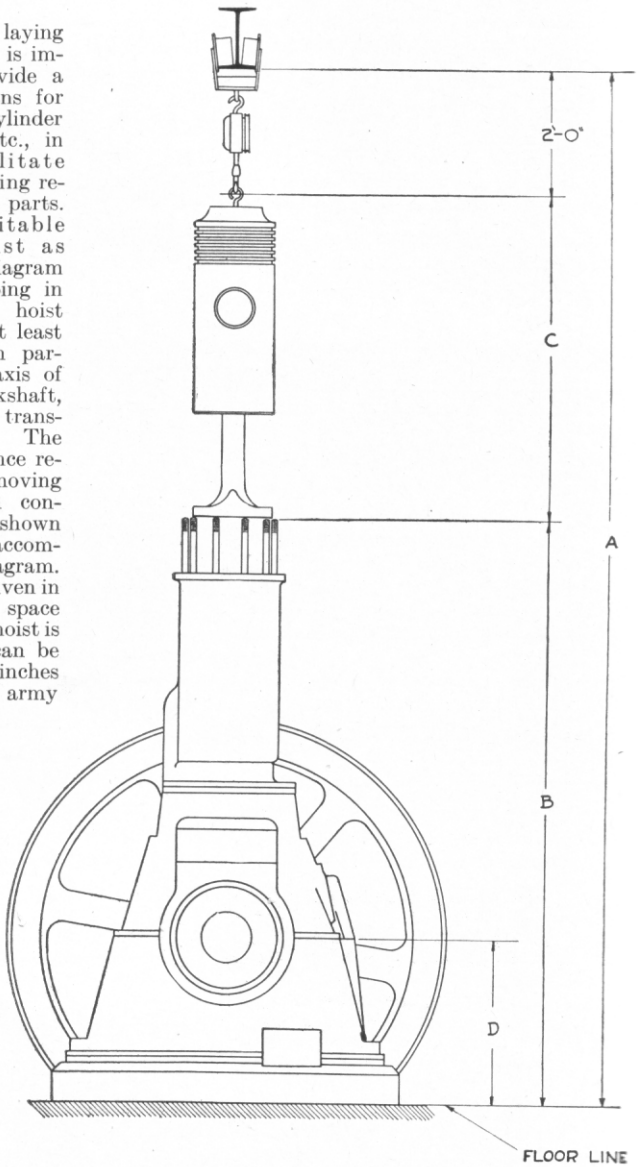
13. The standard position of the cylinder is with the exhaust ports on the right-hand side when facing the engine at the governor end. See page 52. When specially ordered, the engine can be furnished with the exhaust connections at the left-hand side.

Completely Reversed Engine

14. When specially ordered, the engine can be furnished with both reversed rotation and reversed cylinders.

Overhead Clearance for Removing Pistons

15. When laying out the plant it is important to provide a convenient means for removing the cylinder head, piston, etc., in order to facilitate cleaning or making repairs on these parts. Provide a suitable overhead hoist as illustrated in diagram 99YKA32, keeping in mind that the hoist should travel, at least in the direction parallel with the axis of the engine crankshaft, and if possible, transversely as well. The overhead clearance required for removing the piston and connecting rod is shown in the table accompanying the diagram. The dimension given in the cut for the space occupied by the hoist is 2′-0″, but this can be reduced several inches byt the use of an army type hoist.



PISTON REMOVAL DIAGRAM (99YKA32)

HEAD ROOM REQUIRED FOR REMOVING PISTONS
STANDARD LOW MOUNTED ENGINES

ENGINE SIZE	A	B	C	D
12″ x 15″	13′ 7″	7′ 5½″	4′ 1½″	22″
14″ x 17″	15′ 2″	8′ 6⅝″	4′ 7⅜″	2′ 3″
SPECIAL HIGH MOUNTED ENGINES				
12″ x 15″	15′ 0″	8′ 10½″	4′ 1½″	3′ 3″
14″ x 17″	16′ 5″	9′ 9⅝″	4′ 7⅜″	3′ 6″

Hoists

16. The following table indicates the size of hoist required when removing various parts of the engine. For general servicing work, a hoist of sufficient capacity to remove the cylinders will be suitable. For removing the crankshaft or flywheel, the size must be increased accordingly.

SIZE OF HOIST (TONS) REQUIRED TO REMOVE THE FOLLOWING PARTS

Engine Bore and Stroke	12″ x 15″			14″ x 17″					
No. of Cylinders	1	2	3	1	2	3	4	5	6
Cylinders	1	1	1	1	1	1	1	1	1
Crankshaft	1	1½	1	1	2	2	3	4	3
Flywheel (Belted Commercial)	1½	1	1½	3	2	1½	1½	1½	1½
Flywheel (Belted Electric)	4	1½	1½	5	2	3	2	1½	1½
Flywheel (Direct Connected Electric)	4	2	3	6	4	3	3	3	2

Piping

17. To improve the general appearance of the plant, lay the fuel, water, and air pipes below the floor level wherever possible. Make a channel in the floor, to receive the pipes, and cover it with floor plates, or pack the channel with sand and cover the top with a thin layer of cement. If necessary to remove or repair the pipes, the thin layer of cement can be broken easily, the pipes repaired, and the cement readily replaced.

Lighting

18. Provide an abundance of light on all sides of the engine at all times. This is important from the standpoint of safety as well as economical operation. A well lighted engine room makes it possible for the operator to detect promptly, any slight irregularity of operation and to make the necessary adjustments before any serious results develop.

FOUNDATION

Standard Mounting of Engine

19. The standard mounting for any 14″x17″ engine is that in which the engine base is set upon a concrete foundation, projecting 7 inches above the floor line. On a 12″x15″ engine, the foundation projects 4 inches above the floor line. For any size of engine, a pit must be provided for the flywheel and belt pulley, as shown on the foundation plan furnished for each engine.

Special Mounting of Engine

20. When specially ordered, a foundation plan will be prepared showing the engine mounted on a higher foundation with the flywheel and pulley above the floor line.

Generator Mounting

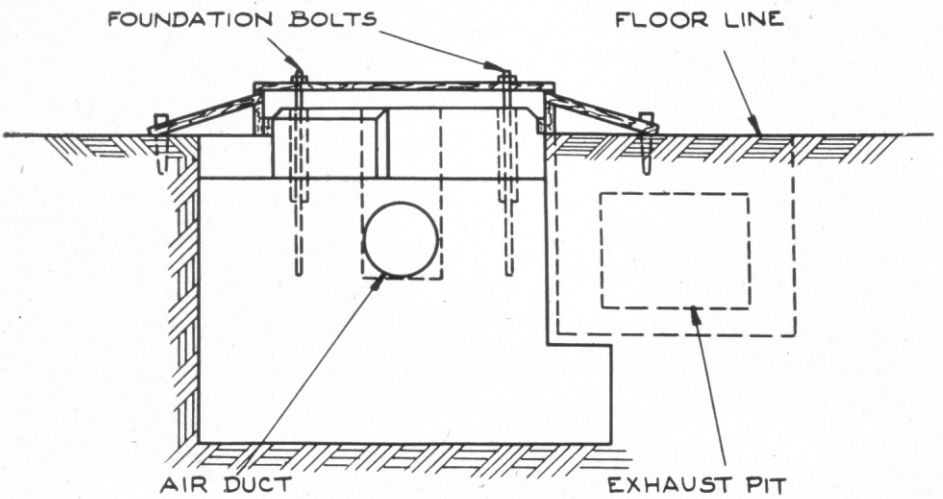
21. On a direct connected outfit, the engine foundation is extended to support the generator, as shown on the foundation plan furnished for each engine.

Foundation Plan

22. Prepare the foundation in accordance with the foundation plan furnished for each engine. This plan gives the location of the foundation bolts, driving belt, exhaust equipment, and all outside dimensions. Follow these dimensions carefully.

Foundation

23. Extend the foundation deep enough into the ground to secure a solid footing; that is, one that will not settle when the engine is mounted. The foundation plan shows a depth that is sufficient for solid ground, but Fairbanks, Morse & Company will not be responsible for the failure of a foundation. Provide a space of at least three feet all around the engine for easy access by the attendant.



FOUNDATION FROM GOVERNOR END (35YKA)

Foundation Mixture

24. Make the foundation from a mixture of cement, sand, and crushed stone or gravel, in the proportion of one part of cement, two parts of clean, sharp sand, and four parts of gravel or crushed stone, of a size that will pass through a ring 1 inch inside diameter. Increase the cement proportion for the upper half of the foundation. Mix the cement thoroughly with the other ingredients, and add sufficient water to make the mixture pour easily.

Foundation Bolts

25. Set the foundation bolts in tubes or boxes, extending from the top of the foundation well down into the concrete, with the ends of the foundation bolts extending above the foundation, the distance shown on the foundation plan. The object in using the tubes is to allow the foundation bolts to be sprung slightly, so as to enter the holes in the engine base. It is therefore important to exclude all concrete from the tubes while pouring the foundation, as the bolts cannot be sprung if imbedded in the concrete. Fill the tubes with a thin, rich grout at the time the finish grouting is poured. See paragraph 44.

Reinforcing Rods

26. The foundation may be strengthened by the addition of reinforcing rods, but their use is not considered necessary if the foundation is properly constructed.

INSTALLING THE ENGINE

Erector's Level

27. The erector should use a good level. It should be at least as accurate as the L. S. Starrett No. 98 machinists' level and have a cross level in the base. Check it for each job by trying it on a smooth surface and noting the position of the bubble with respect to the graduations on the bubble tube. Reverse the level and again note the position of the bubble. If any variation exists, correct the error before attempting to level the engine. An 8 inch level is the longest that can be used on certain parts of the engine.

Examine Drain Pipes

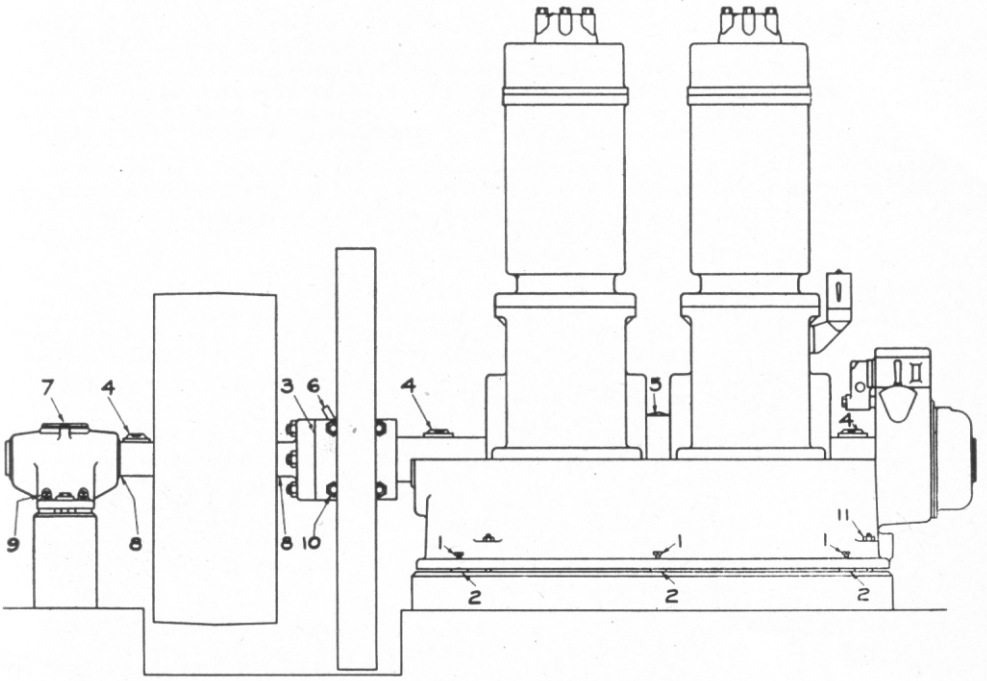
28. Before the engine is set on the foundation, examine the drain pipes from the crankcase to the sump box to see that they have not been loosened or damaged in transit.

Set the Engine

29. Set the engine over the foundation bolts and support it with the leveling screws 1 and the steel bearing plates 2 (see diagram 99YKA1 on page 7), allowing at least ¾ inch clearance for grouting. These leveling screws are to consist of ¾ inch by 4 inch, cup point, square head, set screws.

Foundation Bolts

30. **Do not tighten the foundation bolt nuts until the cement is thoroughly dry and hard.**



LEVELING AND ALIGNING DIAGRAM (99YKA1)

Flywheel

31. Wedge the flywheel hub apart slightly and place it on the crankshaft in the position shown on the foundation plan, being careful to align the keyway in the flywheel with the keyway in the shaft. Place the flywheel on the shaft **before** setting the engine on the foundation, unless the flywheel pit is wide enough to permit placing the flywheel after the engine is in position. When the flywheel is in its proper location, the crankshaft will extend through the hub about ¾ inch. Remove the wedges 6, but be sure that the outer ends of the hub, on both sides of the split, are even, so that one side does not extend beyond the other. Tighten the clamp bolts evenly and firmly by going over them several times, then drive the key into place.

Direct Connected Outfit

32. With a direct connected unit, on account of the generator foundation, the flywheel must be put in place before the engine is lowered on the foundation.

Level the Crankshaft

33. Next remove every other main bearing cap and upper shell, beginning at the governor end. Then remove the shims from between the shells still in place and tighten the caps; so that the crankshaft is held firmly in the base. Try the level 4 on each of the journals then exposed, being sure that it is parallel with the shaft and not crosswise or rocking in the slightest degree. Adjust the leveling screws 1 by consecutive progression around the base, to bring the shaft to a true level throughout its entire length.

Level the Base

34. On each side of every main bearing, scrape sufficient paint from the top of the lower base to provide a smooth bearing for the level. Place the level on each of the surfaces, and adjust the leveling screws until an accurate cross-level is obtained. Next check the lengthwise level of the lower base to insure the uniform support of the main bearings and the correct alignment of the crankshaft and the lower base. In some cases, when leveling a base, it may be necessary to draw down on one or two of the foundation bolts.

Level

35. The alignment and level of the engine are satisfactory when the bubble of the level does not vary more than one-half of one graduation from the center.

Outboard Bearing Sole Plate

36. Place the sole plate, for the outboard bearing 7 (see diagram 99YKA1) over the foundation bolts on the outboard bearing foundation. With the cap and upper half of the shell removed, set the outboard bearing on the sole plate.

Fitting Shaft Extension

37. The shaft extension 8 must now be fitted to the engine. A relief, turned in the face of the flywheel hub, is located so that the filing can be done while the studs are in place. File the flywheel hub; **not** the shaft extension. It is essential to fit the extension shaft accurately to a good contact over the entire bearing surface. Adjust it carefully until it runs as true as possible so as to prevent vibration and bearing trouble. Tighten down all nuts evenly and securely.

Fitting Flexible Couplings

38. If the extension shaft is connected to the engine by means of a flexible coupling, instead of by a rigid flanged coupling, **use the same care in aligning the flexibly coupled shaft as would be used in the case of a rigidly coupled shaft.** Then the flexible coupling takes care of any misalignment due to expansion or to the wear of the parts.

Outboard Bearing Assembly

39. Next replace the upper half of the bearing shell and the bearing cap over the shaft and bolt the cap and box together, omitting the shims between the two halves to insure that the shaft bears the full length of the outboard bearing. Tighten the cap screws holding the bearing to the sole plate to insure evenly distributed support of the bearing. This will also raise the sole plate to its proper position with relation to the shaft.

Level the Shaft Extension

40. Now level the shaft extension accurately and support the sole plate on the foundation with leveling screws until the finishing grouting is poured.

Outboard Bearing Adjustment

41. To adjust the outboard bearing, turn the set screws that raise or lower the bearing. Then fit shims between the bearing and sole plate, equal to the amount that it is raised. After the shims are properly fitted, release the pressure on the set screws. After the bearing has been adjusted, tighten the screws that hold the bearing to the sole plate.

Check Shaft Extension

42. Check the alignment of the faces of the joint 3 with a set of micrometer thickness gauges or "feelers." If the faces of the two halves of the split flywheel are offset, jar the offset side with a blow from a heavy bar or sledge and at the same time tighten the flange nuts to bring the joint between the hub and flange into perfect contact. Test the alignment of the shaft extension by loosening the flange nuts and noting with the "feelers" whether the joint between the two faces 3 opens up on one side only. Turn the flywheel and shaft to several different positions and repeat the check for each position. Loosen the tightened bearing caps before turning the flywheel, and tighten them before making each separate check. After each check, re-tighten a few of the flange nuts. If the two surfaces show out of parallel, make a readjustment by moving the outboard bearing slightly. Finally tighten the flange nuts firmly. On a single cylinder engine, the weight of the flywheel and shaft extension may overbalance the governor end of the crankshaft. For this reason, set the outboard bearing in place before removing the governor end main bearing cap. When leveling the crank shaft and shaft extension, raise the outboard bearing gradually until the governor end of the crankshaft rests lightly on its bearing shell. It should not rest so heavily as to prevent rolling out the bearing shell when tapped with a wood driver or a hammer handle.

Recheck Alignment

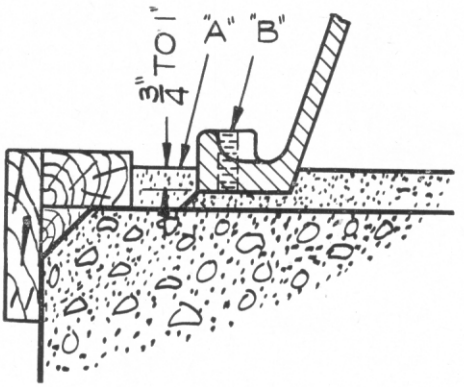
43. The entire alignment of the engine should be gone over again; first testing the level; then applying it to each of the journals of the crankshaft and also on the shaft extension, between the flywheel and the outboard bearing.

Finishing Grouting

44. After checking the engine accurately, grout it in and allow it to set firmly before removing the leveling screws and tightening the main foundation bolt nuts 11. See diagram 99YKA1 on page 7. After removing the leveling screws, fill the holes B with lead, asphaltum or tar, and make them oil tight, to prevent any oil from getting under the base through these holes. See diagram 64YKA on page 9.

The foundation plan calls for ¾ of an inch of finish grouting to be poured after the engine is carefully leveled and blocked in place. Make this finish grouting from one part of cement to two parts of sand, with sufficient water added to make it flow freely. This finish grouting applies to the outboard bearing and to the driven machine foundations as well as to the engine foundation. When pouring the final dressing, build a 1 inch board form around the top of the foundation to retain the grouting. Be sure that the grouting does not fill up the space under the lower part of the crank case and thus interfere with the passage of air. Extend the grouting from ¾ to one inch up on the base. Remove the portion outside of

the base, marked A, before it gets hard, and finish with a neat bevel around the lower edge of the base, as shown in diagram 64YKA. Pour a thin grouting of cement between the outboard bearing sole plate and the foundation. When this grouting is thoroughly set, tighten the foundation bolt nuts and adjust the outboard bearing. In making the horizontal alignment, the box should bear slightly against the belt side of the shaft. To improve the appearance of the foundation above the floor, plaster it with a rich mixture of cement and sand.



ENGINE GROUTING DIAGRAM (64YKA)

Clean Top of Foundation

45. The air used by the engine is drawn in from the space below the crank case and above the concrete capstone portion of the foundation. Before the engine is set, remove all dust, chips, dirt, etc., from the bottom of the crank case and the top of the foundation. If the finish grouting is not applied to the foundation after setting, the surface of the foundation beneath the crank case must be coated with linseed oil or hot tar to prevent any free particles of dirt or dust from being caught up by the air suction. If dirt in the air reaches the cylinders, it will cut the working surfaces.

Final Check of Alignment

46. After the engine, outboard bearing, generator, and any other related parts are finally grouted in and the cement is hardened, the entire leveling of the installation should be rechecked very carefully before starting up the engine.

EXHAUST

Correct Exhaust Conditions Necessary

47. The satisfactory operation of a Diesel Engine depends a great deal upon correct exhaust conditions. These conditions will be in effect if one of the three approved exhaust arrangements as outlined in the following discussion is used. If any departure from these arrangements seems necessary, approval must be obtained from Fairbanks, Morse & Co.

Do Not Combine Exhausts

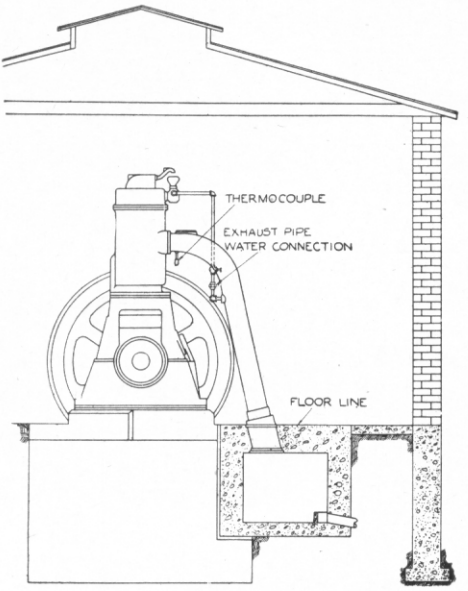
48. Do not combine exhaust discharge in multiple unit plants. Under no circumstances will Fairbanks, Morse & Co., approve an installation in which the exhausts from two or more engines are combined; therefore, in every case, each engine must have an individual exhaust system from the engine to the atmosphere

1. Exhaust Arrangements

(A) INDIVIDUAL EXHAUST PIPE AND UNDERGROUND CONDUIT ARRANGEMENT

Preferred Arrangement

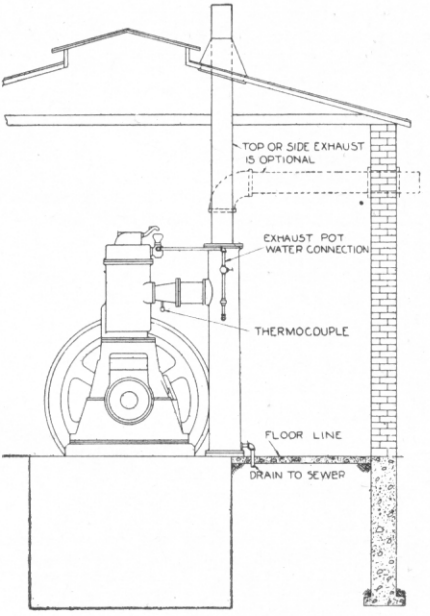
49. An individual exhaust pipe and underground conduit arrangement as shown in diagram 99YKA62 is preferred. It provides especially favorable exhaust and scavenging conditions under practically all field applications, and results in the most satisfactory engine operation and economy together with the best appearance of the installation.



INDIVIDUAL EXHAUST PIPE AND
UNDERGROUND CONDUIT ARRANGEMENT (99YKA62)

Description

50. A reinforced concrete conduit extending along the exhaust side of the foundation and adjacent to it is required. Individual pipes from each cylinder lead through expansion joints into this conduit which in turn is vented to the atmosphere through a stack. The individual pipes may be covered with magnesia lagging if desired to prevent heat from radiating into the engine room.



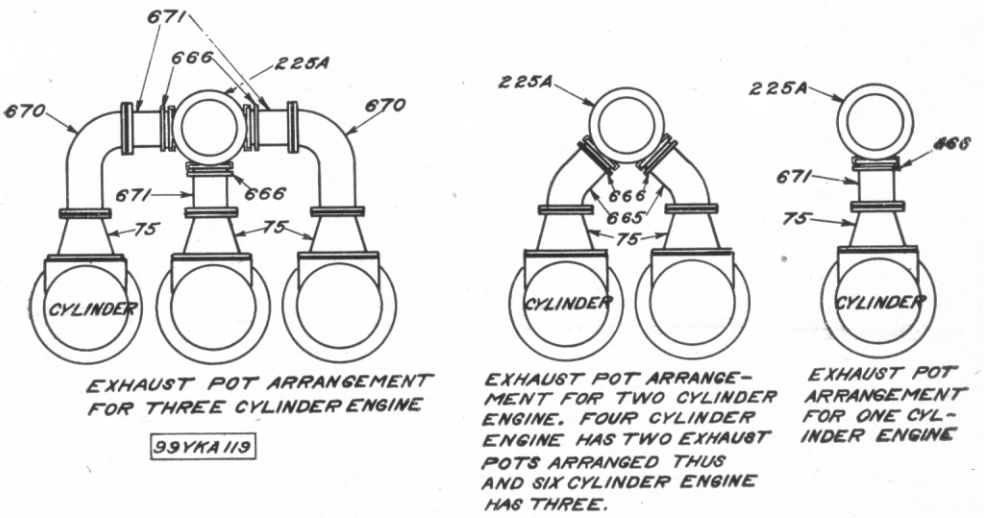
EXHAUST POT ARRANGEMENT (99YKA63)

51. When an exhaust conduit is used, an exhaust stack is required to carry the exhaust gases from the conduit to the atmosphere. For this purpose we recommend an 18-inch diameter stack, not to exceed 60 feet long, for 1, 2, and 3 cylinder engines and a 20-inch diameter stack, not to exceed 200 feet long, for 4, 5 and 6 cylinder engines. The Factory does not furnish exhaust stacks, as these usually can be secured locally to advantage. **Exhaust Stack**

(B) EXHAUST POT ARRANGEMENT

52. If preferred, an exhaust pot arrangement as shown in diagram 99YKA63 may be used. With this arrangement, the exhaust gases pass from the cylinder through exhaust nozzles and a length of exhaust pipe into a cast iron exhaust pot. The gases then pass from the top of the pot to the atmosphere through exhaust pipes. An exhaust pot must never be vented from the bottom. The exhaust nozzles are fitted with hand hole covers to permit inspection and cleaning; also, provision is made for attaching instruments for measuring exhaust gas temperatures. **Description**

53. One exhaust pot with exhaust nozzle and pot connection for each cylinder is used on 1, 2, and 3 cylinder engines, two exhaust pots with connections are used on 4 cylinder engines, and three exhaust pots with connections are used on 5 and 6 cylinder engines. See diagram 99YKA119. **Exhaust Pots**



EXHAUST POT ARRANGEMENT FOR THREE CYLINDER ENGINE

99YKA119

EXHAUST POT ARRANGEMENT FOR TWO CYLINDER ENGINE. FOUR CYLINDER ENGINE HAS TWO EXHAUST POTS ARRANGED THUS AND SIX CYLINDER ENGINE HAS THREE.

EXHAUST POT ARRANGEMENT FOR ONE CYLINDER ENGINE

EXHAUST POT CONNECTIONS

54. When it is necessary to set the pots farther from the engine than shown on the foundation plan, the distance from the center line of the engine to the center line of the pots must not exceed 8′-6″ on the 12″x15″ engines and 12′-0″ on the 14″x17″ sizes. Use 8-inch diameter inlet pipe for 12″x15″ engines and 8-inch diameter inlet pipe for 14″x17″ engines. A separate exhaust pot for each cylinder is positively necessary with this exhaust arrangement. **Variations From Foundation Plans**

55. For an installation in which the exhaust discharges from the pots, through pipes, directly into the atmosphere, use for each pot an exhaust outlet pipe 10 inches in diameter, 12 feet long, with not more than one 90° or two 45° elbows in the line. If an additional elbow is required, use a pipe 12 inches in diameter, 12 feet long. If conditions are such that a longer pipe is necessary, use a 12-inch diameter pipe, 18 feet long, with not more than one 90° or two 45° elbows in the line. **Exhaust Pot Outlet Pipe**

Installation In Frame Building

56. Where an engine is located in a frame building that is not provided with a fireproof roof, the exhaust pipe should be extended through a side wall to lessen any danger from sparks. Where the exhaust stack or pipe extends through a wooden roof or side wall, a thimble 12 inches larger in diameter than the outside diameter of the pipe should be used.

Water Inlet to Exhaust Pot or Pipe

57. Under normal operating conditions, the interior of exhaust pipes, pots, etc., will become coated with carbon, which may burn unless periodically removed. To insure against the burning of this carbon it is recommended that a water connection be made to the exhaust pipes or pots just below the exhaust nozzles, and that a small amount of water be allowed to run into the system while the engine is in operation. Suitable drains must of course be provided to carry away excess water from the exhaust pots or conduits. See diagram 99YKA62 and 99YKA63.

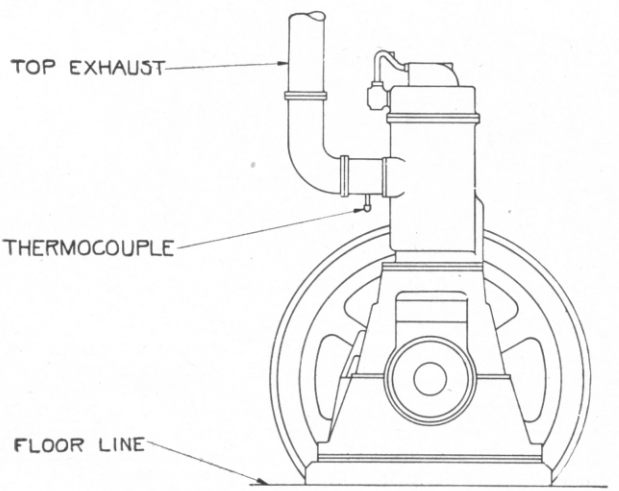
(C) DREDGE EXHAUST

When to Use Dredge Exhaust

58. Engines used in dredge or similar service, where the noise of the exhaust is not particularly objectionable, can be fitted with the Dredge exhaust which is shown in diagram 99YKA60. Each cylinder is fitted with an individual exhaust as follows:

Description

59. An exhaust nozzle, the same as used with the exhaust pot arrangement, is bolted to the cylinder exhaust connection; a long sweep elbow is bolted to the nozzle, and to the upper end of the elbow is bolted a tapped flange. On the 12″x15″ engines, a 6′-0″ length of 6″ pipe is screwed into this flange, and on the 14″x17″ engines an 8′-6″ length of 8″ pipe is used.



DREDGE EXHAUST (99YKA60)

2. WATER WASHED EXHAUST STACK

(A) DESCRIPTION AND OPERATION

When to Use Water Washed Exhaust Stack

60. For installations in which it is desired to eliminate all traces of tar, soot, odor, oily vapor, etc., a water washed exhaust stack is recommended. The stack can be used in conjunction with either the individual exhaust pipe and underground conduit or exhaust pot arrangements. A constant and adequate supply of water for the stack is desirable although not essential. For installations where the supply of water is limited, water can be supplied intermittently to the stack, but in any case, connections should be made so that water will be available in case of fire in the exhaust system.

Description

61. The exhaust stack is a compact cylindrical unit having an exhaust inlet in the bottom head. The inlet is extended into the stack a short distance, and carries a cast iron deflector at the upper end, the lower edges of which dip into water, forming a seal. The lower head also contains water drain, inlet and over-

flow connections and a clean out and inspection flange. Water is supplied to the stack through the water inlet connection, and is conducted through a short pipe to a point above the water level. A definite water level is maintained in the bottom of the stack by means of the overflow pipe which extends through the bottom head.

Operation

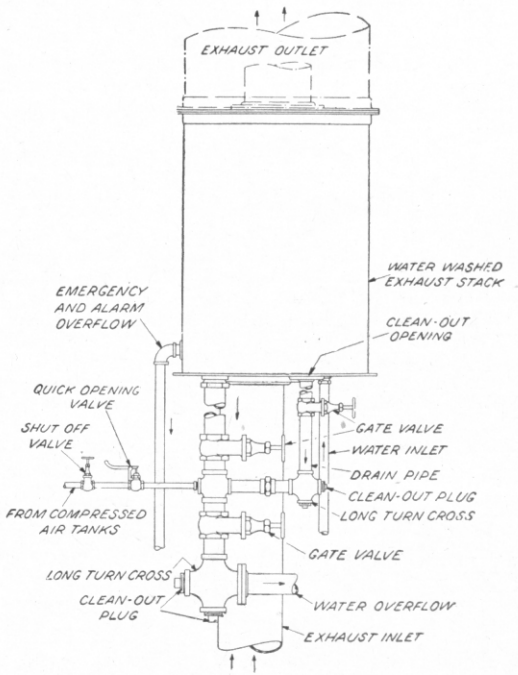
62. In operation, the exhaust gases pass into the exhaust stack through the exhaust inlet and through the water seal, which thoroughly washes and cools them. The gases then pass through a stationary centrifugal water separator located above the deflector, and thence to the atmosphere. In conducting the gases from the water washed exhaust stack to the atmosphere, the upper head can be omitted.

Water Overflow Connection

63. The water overflow connection from the water washed exhaust stack is made amply large to carry away flakes of carbon, tar, etc., which may enter with the exhaust. To prevent the overflow line from being clogged, the size should not be reduced, and the line should lead directly to the point of waste and be kept free from any sharp bends. Long sweep ells or long radius bends should be used where necessary, rather than standard short radius ells. This is important, for should the overflow line become obstructed, the stack will become flooded, and water may pass back to the engine through the exhaust pipe in case the stack is installed at a point higher than the engine. Diagram RTD30A shows the recommended method of piping the overflow and drain connections.

Drain Connection

64. The drain connection can be piped into the overflow line, and a ¾ inch air blow ou line should be connected from a source of compressed air so that either the overflow line or drain can be blown out quickly should it become obstructed. The arrangement consists of a quick opening valve in the air line, two gate valves in the overflow line and a gate valve in the drain line. The air and drain lines should be connected to the overflow line between the two gate valves. By first shutting off the water supply, then closing each gate valve in turn, and injecting a blast of air by means of the quick opening air valve, the overflow line



PIPING ARRANGEMENT FOR WATER WASHED EXHAUST STACK (RTD30A)

Air Blow Out Connection

can be kept clear of obstruction. The drain line can be blown out by closing both valves in the overflow line and opening the drain valve. When not blowing out the line, the overflow line valves should be locked in the open position and the drain valve closed. All piping subject to the compressed air blast must be connected with extra heavy fittings.

Use Air Blow Out Frequently

When to Drain Stack

65. It is recommended that the overflow line blow out be used quite frequently while the engine is in operation rather than wait until the overflow line becomes obstructed. When the engine is to be shut down for a period of four hours or more, the stack should be drained, and all connections blown out. The drain connection is located in a large clean out flange which is bolted to the bottom head of the stack. This flange should be removed periodically and the interior of the stack cleaned.

Flushing with Ample Water Supply

66. The water inlet and overflow connections are proportioned to properly flush the stack and carry away all tar, soot, carbon, etc., that will enter with the exhaust. When an ample water supply is available, and the stack is to be flushed continuously, it is recommended that the rate of flow should not exceed from 6 to 12 gallons per minute. If this rate is exceeded, the water will leave the inlet pipe at such a velocity that it will be carried up into the stationary water separator, and part may leave the stack, thus creating an untidy condition.

Flushing with Limited Water Supply

67. When the water supply is limited, it is recommended that the stack be thoroughly flushed several times each day, using the maximum recommended water rate, rather than reduce the rate to a point where it can be used continuously, but not in a quantity sufficient to properly flush the stack.

(B) INSTALLATION OF WATER WASHED EXHAUST STACKS

Use One Stack Per Engine

68. As mentioned before, the Water Washed Exhaust Stack may be used in conjunction with either the Individual Exhaust Pipe or Exhaust Pot arrangements. In all multiple unit installations it is essential that at least one water washed exhaust stack be used for each engine, or each exhaust pot. Where space requirements demand that one water washed exhaust stack be used for two or more engines, the Manufacturing Division must be consulted and full details submitted.

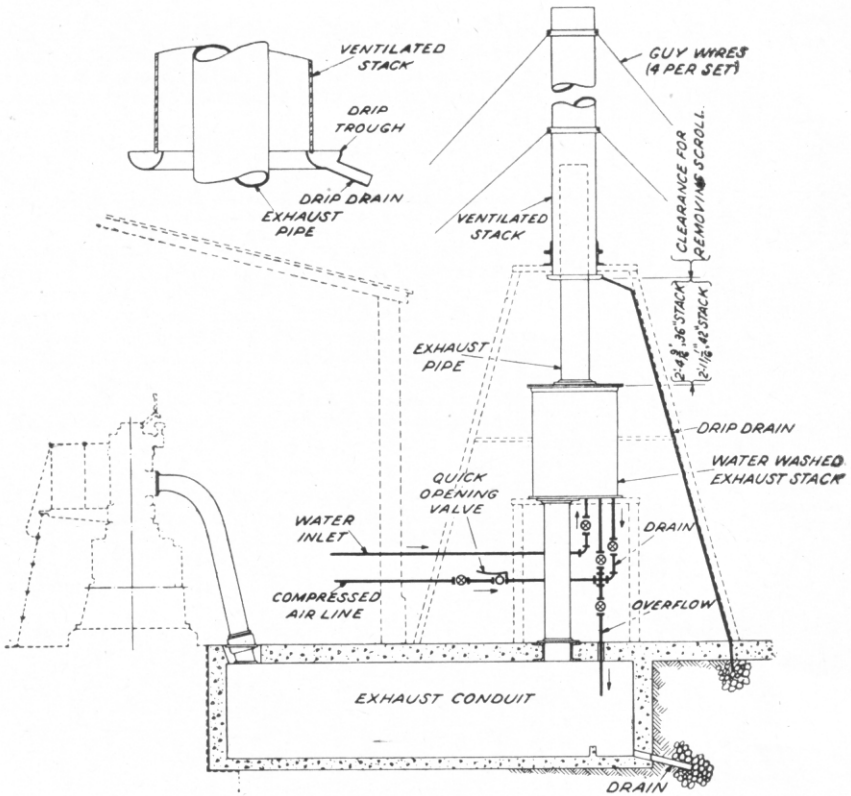
Multiple Inlet Stacks Not Recommended

69. Multiple inlet stacks are not generally recommended, due to the danger of water passing back through the exhaust pipe when one engine is idle and the other is in operation. When the nature of the installation is such that no water can possibly reach the engine by way of the exhaust pipe, a multiple inlet exhaust stack can be used, but only on approval of the Manufacturing Division. **On no account will an installation be approved where the exhaust pipes from two or more engines are connected and carried into a single inlet water washed exhaust stack.** If a multiple installation using a single exhaust stack or other special installations not covered by these instructions are contemplated, full details must be submitted to the Manufacturing Division for approval. Deviation from approved installations will void all factory guarantees and release the Manufacturing Division from all responsibility for the satisfactory operation of the engine.

How to Install Stack

70. Due to the construction of the Water Washed Exhaust Stack, it must always be installed in a vertical position. Sufficient clearance must be provided underneath the stack to accommodate all pipe connections and to allow the removal of the clean out flange in the lower head for cleaning or inspection. The stack and all piping must be supported independently.

71. Some method of taking up expansion must be used when these strains would be transmitted to the engine. The use of flexible metal hose or expansion joints is recommended.



WATER WASHED EXHAUST STACK (RTD51)
WITH INDIVIDUAL EXHAUST PIPES AND CONDUIT

(a) Water Washed Exhaust Stack With Individual Exhaust Pipes And Conduit.

Diagrams

72. Diagram RTD51 on page 15 shows this installation with a ventilated stack, but if desired an exhaust pipe screwed into the upperhead may be used instead. The ventilated stack is the preferred arrangement.

Position of Stack

73. The water washed exhaust stack must be supported on a frame work above the conduit so that sufficient clearance can be obtained to accommodate the pipe connections to the lower head, and leave room for the operation of the blowout arrangement. The water overflow pipe from the exhaust stack may be led into the conduit, providing it is properly drained, otherwise it should discharge directly to waste.

Recommended Sizes of Stacks and Pipes

74. The following tabulation shows the recommended sizes of water washed exhaust stacks, pipe sizes, etc., for each engine when installed with individual exhaust pipes and underground exhaust conduit.

RECOMMENDED EXHAUST PIPE SIZES AND WATER WASHED EXHAUST STACKS

(Individual Exhaust Pipes and Underground Conduit Arrangement)

No. of Cyls.	Bore and Stroke Inches	Water Washed Exh. Stack			Dia. Max. Length of Pipe From Conduit to Exh. Stack	Dia. Max. Length of Pipe From Stack to Atmosphere
		Size Inches	Inlet Con. In.	Outlet Con. In.		
1, 2, 3	12x15	14	14	14	14″x6′-0″	14″x24′-0″
1, 2 3 4, 5 6	14x17	14	14	14	14″x6′-0″	14″x24′-0″

Ventilated Stacks

75. If the distance from the exhaust stack to the atmosphere exceeds the pipe lengths given, a ventilated stack as shown in diagram RTD51 must be installed. The minimum diameter of this stack should be 18 inches and the maximum length 200 feet. The smaller pipe should extend into the ventilated stack a distance not less than 6 feet.

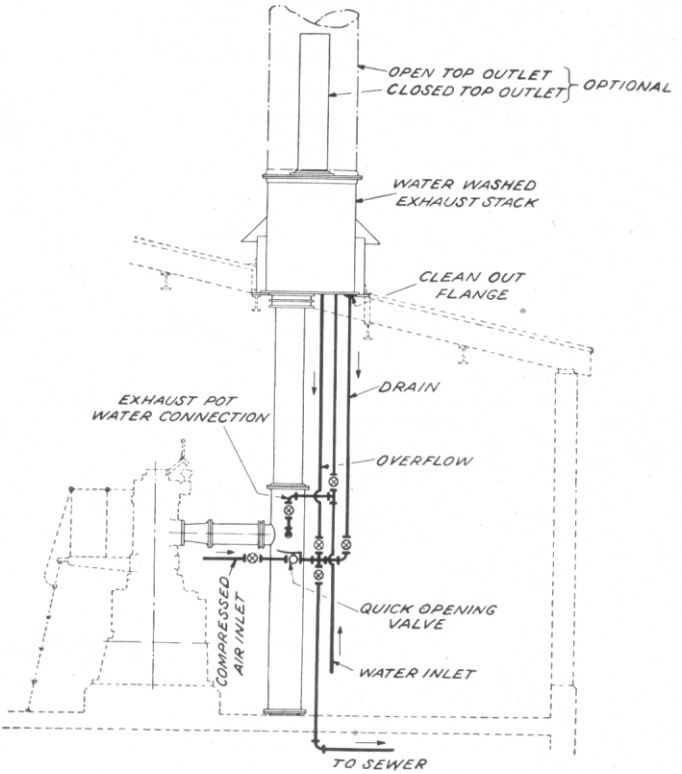
(b) Water Washed Exhaust Stack With Exhaust Pots

When to Use

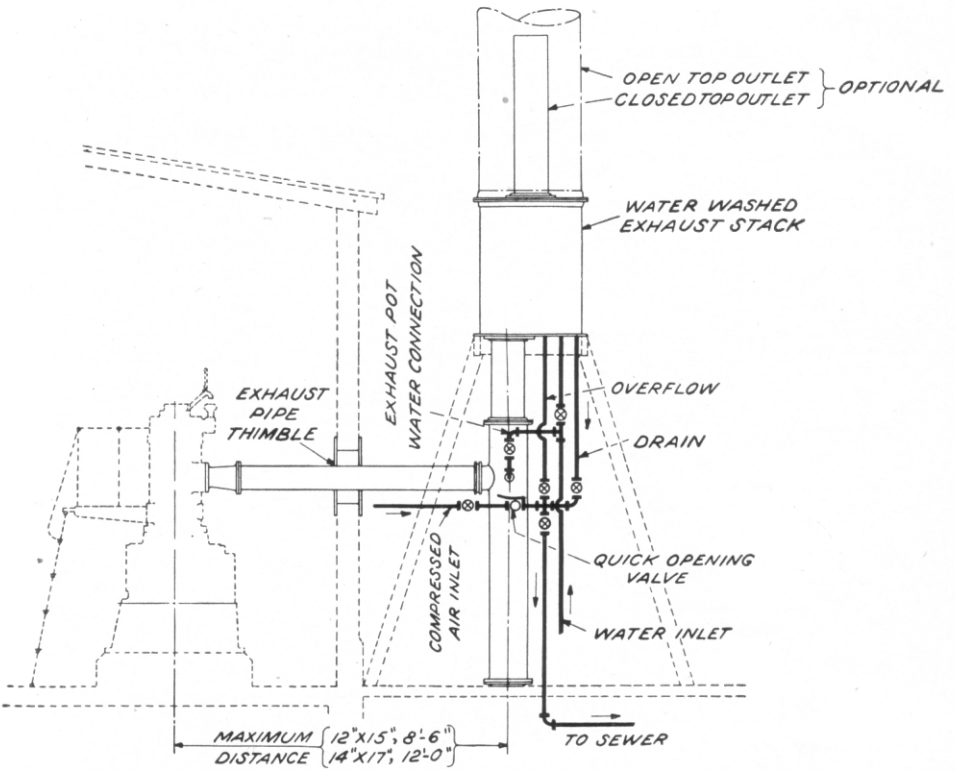
76. Diagrams RTD53 and RTD52 on pages 16 and 17 show this arrangement for both inside and outside installations. This application is very satisfactory for small installations of one to three cylinders where it is permissible to run an exhaust pipe through a side wall or through the roof, and where the installation of an underground exhaust conduit is undesirable. It is essential that one individual water washed exhaust stack be installed with each exhaust pot, and for this reason the application is not generally desirable for four or six cylinder engines. The individual exhaust pipe and underground conduit arrangement will be more satisfactory, as only one water washed exhaust stack is required for each engine.

Position of Stack

77. The water washed exhaust stack must be properly supported in such a position that all pipe connections can be made to the lower head and that there is sufficient clearance to remove the clean out flange.



INSIDE INSTALLATION WATER WASHED EXHAUST STACK WITH EXHAUST POT (RTD53)



OUTSIDE INSTALLATION WATER WASHED EXHAUST STACK WITH EXHAUST POT (RTD52)

Recommended Sizes of Stacks and Pipes

78. The following tabulation shows the recommended sizes of water washed exhaust stacks, pipe sizes, and lengths for each engine when installed with exhaust pots.

RECOMMENDED EXHAUST PIPE SIZES AND WATER WASHED EXHAUST STACKS
(Exhaust Pot Arrangement)

No. of Cyls.	Bore and Stroke Inches	Water Washed Exh. Stack			Dia. Max. Length of Pipe From Exh. Pot to Exh. Stack	Dia. Max. Length of Pipe From Exh. Stack to Atmosphere
		Size Inches	Inlet Con. In.	Outlet Con. In.		
1, 2 3	12x15	14"	14"	14"	12"x6'-0"	12"x12'-0"
1 to 6	14x17	14"	14"	14"	12"x6'-0"	12"x18'-0"

Ventilated Stacks

79. If the distance from the water washed exhaust stack to the atmosphere exceeds the pipe lengths given, a ventilated stack must be installed as shown in diagram RTD51 and previously described. The ventilated stack is the preferred arrangement.

3. Pyrometer Equipment

Measuring Exhaust Temperature

80. Instructions 2666, latest edition, cover the installation, care and operation of the Pyrometer Equipment offered for use in connection with the operation of these engines.

The pyrometer equipment gives the operator the most effective method of instantly checking the load balance on a multi-cylinder engine. This equipment measures the exhaust temperature of each cylinder, on an instrument which is connected by wires to thermocouples exposed to the exhaust gases. These thermocouples must be cleaned at regular intervals; especially should they be cleaned just before any final adjustment of the engine is made for balance, be-

cause any carbon deposit will insulate against the heat of the exhaust, resulting in inaccurate temperature readings. The instrument should be mounted on the wall or other support not subject to vibration. If the building vibrates excessively a spring suspension can be used to support the panel on which the switch and recording instrument are mounted.

Temperature Variation

81. For the best operation of the engine, the exhaust temperature of all cylinders should be practically the same. The amount of variation or difference between the highest and lowest temperatures (comparing the reading of any one cylinder with the reading of any other cylinder) should not exceed 30° Fahrenheit at full-load. A greater difference in temperature indicates that the load is not proportionately balanced between cylinders and the necessary engine adjustment should be made at once. The temperature at full load may vary in different installations therefore the temperature recorded when the engine was first installed should be used as a basis for balancing.

Method of Adjustment

82. To correct the temperature variation, should the same exceed 30° Fahrenheit, proceed as follows: (1) See that the water is circulating through the cylinder properly and that the valves are not clogged. (2) Check the lubricating system to insure proper lubrication. (3) See that the injection pump valves seat properly. (4) Clean injection nozzles. If, upon examination, the above are found to be all right, the fuel injection balance should be checked. Should there be any necessity for readjustment, see Paragraph 251 on valve adjustment.

ENGINE COOLING

1. Water Supply

Adequate Supply Essential

83. An adequate supply of cool soft water is essential to the satisfactory operation of an internal combustion engine. Only clean soft water or water which is free from scale forming ingredients, should be used in the cooling system. Even a thin layer of scale or dirt on the cylinder jacket walls will act as an insulator and cause overheating and possible breakage. If clean rain water is available, it is suitable for cooling purposes without previous treatment. Salt water should not be used for cooling, as it may cause corrosion in the water jackets. Any hard water containing lime or magnesia is almost certain to cause scale and must be treated. To prevent scale deposit, the best cooling system and the one recommended, is the closed system using only soft water in the engine jackets.

2. Treatment of Hard Water

Methods of Water Treatment

84. When the cooling water supply is known to contain scale forming ingredients, a reliable manufacturer of water softening systems should be consulted. Two general methods of water treatment are in general use, the proper one of which should be prescribed by a competent authority after an analysis and survey has been made of the particular case in question. Such a diversity exists in the characteristics of water found in different localities that no intelligent recommendation can be given until all data are available.

The general methods of water treatment are:

(a) Chemical Treatment.
(b) Zeolite Treatment.

Chemical Treatment

85. Method (a) consists of the addition of certain chemicals to the water, which react with the salts, sulphates, carbonates, etc., held in solution. This reaction precipitates most of the scale forming ingredients so that they can be removed by settlement, or it may leave them in solution but so change them that no scale will be deposited.

Zeolite Treatment

86. Method (b) consists of forcing the water to be softened through a bed of "Zeolite" sand. This mineral, commonly known as the green sands of New Jersey, has the property of removing calcium and magnesium elements from the water and replacing them with sodium, or in other words, changing the scale forming lime and magnesia salts to sodium salts, which are not scale forming. By properly regulating the flow of water through the "Zeolite" sand, all traces of scale forming salts can be removed. After a certain amount of water has been treated, the active sodium in the Zeolite becomes so far exhausted that the water is no longer properly softened. The Zeolite is then rejuvinated by passing brine (made from common salt) through it. During this process, the lime and magnesia elements held by the Zeolite, are exchanged for the soda element in the salt, the lime and magnesia being carried away to waste as calcium and magnesium chlorides. After a short time, usually from 10 to 25 minutes, the Zeolite will have resumed its original state and the treatment can be stopped. Salt consumption and the frequency of regeneration will be governed by the hardness of the water

and the amount to be treated. If absolutely uninterrupted service is required, either a duplicate plant or a storage tank of proper capacity must be installed.

3. Cooling Water Circulation

Indirect Cooling System

87. With an indirect cooling system employing a tubular heat exchanger or similar equipment and using soft water in the engine jackets the maximum outlet temperature of 140° F. must not be exceeded. It will require approximately 30 gallons of water per H. P. hour of both raw and soft water to maintain this maximum outlet temperature with a soft water inlet temperature of 120° to 122° F. A similar quantity of raw water will be required for the heat exchanger.

Atmospheric Cooling System

87a. With a cooling system using soft water which is recooled atmospherically and in which concentration of scale forming ingredients may take place, the maximum outlet temperature of 120° F. should not be exceeded. Approximately 20 gallons per H. P. hour of cooling water will be required for this method of cooling. The inlet water temperature will be about 100° F.

Direct Cooling System

88. With a direct cooling system using a supply of raw water having a temperature of 100° F. or lower the outlet temperature must not exceed 120° F. and the circulation rate should not be less than 20 gallons per H. P. hour. If the temperature of the supply is lower than 100° F. the 20 gallons per H. P. hour should be maintained and the hot discharge water by-passed to the pump suction so as to maintain 120° F. temperature of the discharge water. In this case the cold water supply to the pump will be found by the following formula:

$$G = \frac{400}{T' - T.}$$

where G = Gallons of cooling water required per H. P. per hour.
T′ = Cooling water outlet temperature, degrees Fahrenheit.
T = Cooling water supply temperature, degrees Fahrenheit.

Temperature Range

88A. **Under no circumstances should the difference in inlet and outlet water temperature exceed 40° F. It is strongly recommended to** restrict the temperature range to 20° F. and any recooling equipment should be selected for this range.

4. Circulation Methods

Positive Circulation

89. In any type of cooling system for these engines it is necessary to positively circulate the cooling water through the engine water jackets. Positive water circulation can be insured either by pumping the water directly through the water jackets or by pumping the water to an overhead tank and allowing the water to circulate by gravity.

Gravity System Preferable

90. The gravity system is preferable, as practically a constant pressure is imposed on the water jackets at all times. The tank may be installed to give a static head of from 15 to 30 feet which is sufficient to insure positive circulation, but not great enough to cause water leaks through the gaskets. By installing an overhead tank with a capacity of 5 gallons or more per rated engine horsepower, minor repairs can often be made on circulating pumps or recooling apparatus without the necessity of shutting down the engine, otherwise a tank of about 2 gallons per rated horsepower capacity may be installed.

5. Circulating Pumps

Pump Capacities

91. The capacity of the water pumps depends upon the type of cooling system installed. In paragraphs 87, 87A and 88 will be found recommended rates of circulation for the various systems.

Centrifugal Pumps

92. Centrifugal pumps are recommended for circulation of cooling water when the total dynamic head is within their range of performance. When the head is beyond this range or if a suction lift is imposed then reciprocating pumps must be used.

Reciprocating Pumps

93. When reciprocating pumps are used they must be fitted for hot water. A pressure relief valve must be installed in the discharge line close to the pump without a shut-off valve between it and the pump. Set the relief valve 5 pounds per square inch higher than the discharge pressure.

Location of Pumps

94. All centrifugal pumps should be located in such a position that the top of the pump is below the low water level in the suction well.

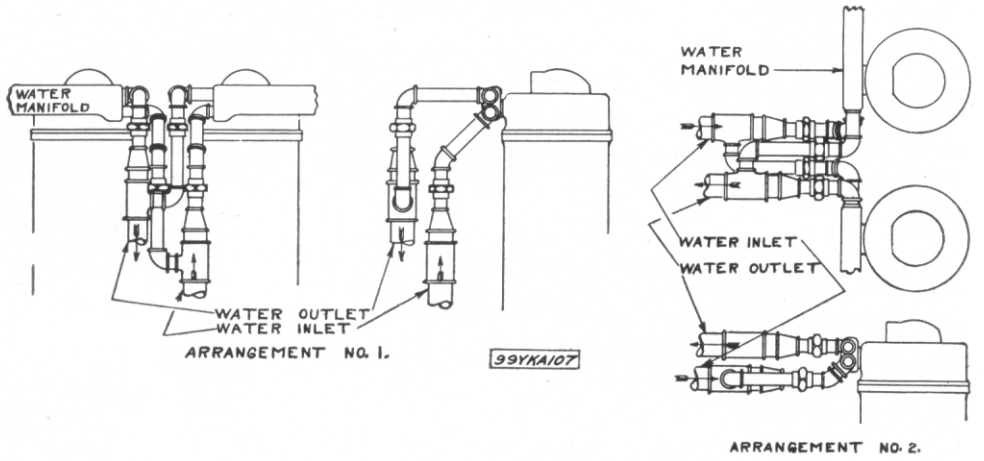
6. General Installation Data on Cooling Systems

Schematic Layouts

95. Diagrams 99YKA103, 99YKA104, 99YKA121, 99YKA106, 99YKA105, and 99YKA122 on pages 24, 24, 27, 29, 30 and 31, respectively, are schematic layouts showing in a general way only, the method of connecting up the various types of cooling systems described later in the text.

Manifold Pipe Connections

96. All 1, 2 and 3 cylinder Model 32 engines are equipped with a one piece water inlet and outlet manifold. On the 4 and 6 cylinder engines, the manifolds are in two parts and must be connected to the main inlet and outlet pipes by standard pipe and fittings as shown in diagram 99YKA107 below. Pipe sizes tabulated on page 22 refer to the main inlet and outlet pipes. The piping should be run down into a trench under the floor, by the shortest route; otherwise, run the pipes horizontally to the wall and then down making the neatest and most convenient arrangement possible.



COOLING WATER PIPING ARRANGEMENT
FOR 4 AND 6 CYLINDER ENGINES

Connection Between Upper and Lower Water Manifold

97. The engines are furnished with standard pipe and fittings to connect the upper and lower water manifolds. The connection is made at the opposite governor end, and is the same on all engines. On 1, 2 and 3 cylinder engines, this connection forms a branch from the main inlet pipe.

Emergency Cooling Water Connection

98. When running water under pressure or from a high tank is available, the piping should be so arranged that in an emergency, the regular cooling water supply can be shut off and the running water used instead. Such a precaution may eliminate costly shut downs, if repairs in the cooling water system should become necessary. The inlet and outlet connections are made to the opposite end of the manifold from that used for the regular cooling water system and are shown at F and H respectively. The outlet is piped to waste, as raw water should be used only for the duration of the emergency. Valves B and C must be closed when the emergency supply is being used, and valves F and H in the emergency lines must be closed when the regular circuit is being used.

Engine Control Valves

99. The engine is furnished with valves to control the cooling water to each cylinder. As shown on the charts, one valve E controls the amount of water supplied to the cylinder head water jacket, and the other D, controls the amount to the lower part of the cylinder water jacket. The valve D should be kept slightly open at all times to prevent stagnation in the lower parts of the water jackets. These regulating valves should be used to equalize the temperatures of the cylinder and cylinder head and of all cylinders.

Water Supply Valves

100. A valve C should be placed in the main supply line as shown in the diagrams. This valve should not be used to regulate the flow of water to the engine, unless the rate is in excess of the recommended rate. See paragraphs 87, 87a and 88. It should be closed when the emergency supply is being used.

Water Outlet Valves

101. A gate valve B is placed in the water outlet line to keep the water in the engine while the system is being filled, and to shut off the regular outlet when the emergency supply is being used.

"Open" Engine Outlet

102. When the cooling water outlet is piped to a hot well or to waste, at a point below the water manifold, an open overflow pipe is provided for each cylinder. These overflow pipes connect to the upper part of the combustion chambers and discharge into individual funnels attached to the water overflow manifold. Such an arrangement enables the operator to observe the water circulation and also permits any steam or air to escape to the atmosphere. This is the preferred arrangement, and should be used wherever possible.

"Closed" Engine Outlet

103. When the cooling water must be discharged at a point above the water manifold, individual closed overflow pipes are provided from the combustion chambers and the water manifold. These pipes have two tapped holes, one at the highest point for $\frac{3}{8}$" pipe to accommodate a vent or riser, and the other for $\frac{1}{2}$" pipe to take the cooling water thermometer.

Thermometers

104. Screw the thermometers G into the openings provided in each water overflow pipe. These thermometers indicate the temperature of the cooling water as it leaves each cylinder, and their location should not be changed.

Risers for "Open" Outlets

105. On engines with the "open" overflow pipes, short risers may be installed in the water manifold between the funnels. They should extend about 2 inches above the funnels. The manifold is tapped for $\frac{1}{2}$" pipe to accommodate these risers.

Risers for "Closed" Outlets

106. On engines with the "Closed" overflow pipes, provision must be made for venting to the atmosphere any steam or air which may separate from the cooling water. To provide for proper venting of each cylinder jacket, a $\frac{3}{8}$" pipe tap is provided, at the highest point of each overflow pipe. These openings can be provided with individual vent pipes and funnels as shown in diagram RTD73, or they can be connected to a header pipe which is given a slight upward slope toward the outlet end and which is connected to a high grade air trap located n the engine room. See diagram RTD74.

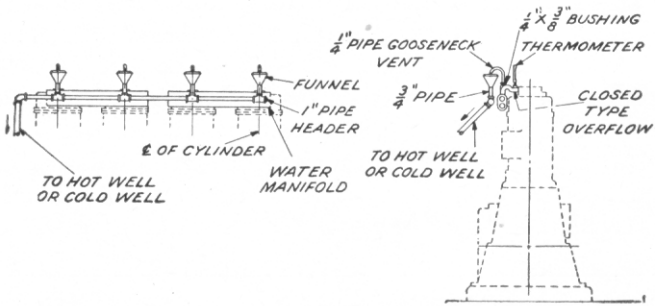


DIAGRAM OF VENT PIPING FOR CLOSED OVERFLOW PIPES WITH INDIVIDUAL VENT PIPES AND FUNNELS (RTD73)

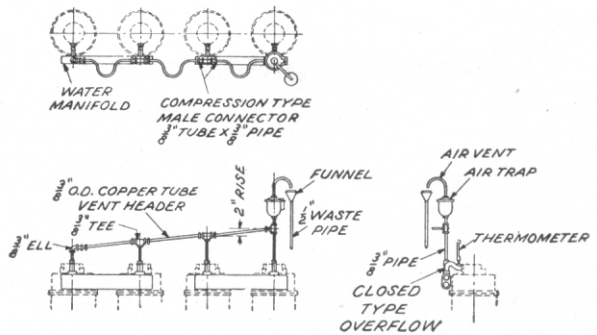


DIAGRAM OF VENT PIPING FOR CLOSED OVERFLOW PIPES WITH SINGLE VENT HEADER AND AIR TRAP (RTD74)

Pressure Relief Valves

107. On cooling systems using a displacement pump which discharges directly to the water jackets, a pressure relief valve must be installed near the pump discharge. This valve should be set to open at a pressure of 5 pounds per square inch higher than the working pressure in the system.

Pump Valves

108. All water pumps should be equipped with valves on both the suction and discharge sides. These valves allow the removal of the pump without draining the system.

Low Water Alarms

109. Low water alarms of a good commercial type should be installed in the gravity tank and hot well to warn the operator when the supply has reached the low level.

Overflow Connections

110. All tanks, hot or cold wells, catch basins, etc., should be provided with overflow pipes connected to some other part of the system or to the sewer.

Drains

111. The lower water manifold is equipped with a drain valve to which a waste pipe should be connected. A ¾" plugged opening is provided in the lower flange of each cylinder for completely draining the cylinders. On multi-cylinder engines, where frequent draining is necessary a drain header should be connected to these openings. All other low points in the system should be provided with proper drains.

Connections and Fittings

112. Make all water connection joints tight, using white lead. Avoid unnecessary bends, and use gate valves throughout the cooling system to minimize pipe friction.

Recommended Pipe Sizes

COOLING WATER PIPE SIZES

Engine		*Water Pipe Size, Inches		
			Outlet	
No. of Cylinders	Bore and Stroke In.	Inlet	Closed Overflow	Open Overflow
1	12x15	1½	1½	2
1	14x17	2	2	2½
2	12x15	2½	3	3
3	12x15	2½	3	3
2	14x17	2½	2½	3
3	14x17	3	3	4
4	14x17	3	3	4
5	14x17	4	4	5
6	14x17	4	4	5

* These pipe sizes are based on a friction head corresponding to that of 100 feet of straight pipe. Should this value be exceeded by the length of run, or by the use of an excessive number of fittings in the line, a correspondingly larger pipe size must be selected.

7. Cooling Systems

General

113. After the cooling water has been circulated through the engine water jackets, the temperature is raised and the water must either be wasted or recooled. No general recommendations can be made in this direction, as every engine installation is an independent problem, and will require a survey of local conditions before the proper cooling system can be applied. The following outline and descriptions cover the more important points in connection with each system. The piping layouts show in a general way only, the method of connecting the various types of cooling systems. They are not intended to give the exact location of equipment or piping, as local conditions must determine the most convenient and practical arrangement.

Outline of Cooling Systems

114. The following outline shows the principal cooling arrangements available for Stationary Diesel Engine installations, in their order of desirability.

I. **Closed Cooling System:**
Each closed cooling system is divided into two individual circuits; that is, the primary or engine cooling water circuit which handles the water circulated through the engine water jackets, and the secondary water circuit which handles the water used to cool the engine cooling water.
Engine cooling water recooled in

1. Commercial Tubular Cooler, or
2. Pipe Coil Cooler

By means of water in secondary circuit which is

1. Recooled by
   (a) Spray Tower, or
   (b) Cooling Tower, or
   (c) Spray Pond, or
2. Wasted.

II. **Atmospheric Cooling System:**

Engine cooling water recooled directly by means of

1. Spray Tower, or
2. Cooling Tower, or
3. Spray Pond, or
4. Cooling Screen (for small units only)

III. **Running Water Cooling System:**

Engine cooling water circulated and run to waste.
Water may be,

1. Untreated when suitable.

Closed Cooling Or Atmospheric Cooling Systems Preferable

115. In the above outline of cooling arrangements, closed cooling or atmospheric cooling systems are shown as preferable to running water systems because in a great majority of installations, the available water supply is limited or if not limited, will not be suitable for cooling purposes on account of hardness. In localities where an unlimited supply of suitable water is available, the running water system is obviously preferable.

Closed Cooling Systems Recommended

116. If either a closed cooling or atmospheric cooling system must be used, on account of scarcity or scale forming properties of the available water supply, a closed cooling system is strongly recommended as the engine cooling water is not exposed to the atmosphere and evaporation losses are negligible. For installations where the water is treated, the hardness is not always reduced to "Zero" and in an atmospheric cooling system, where evaporation losses are greater, it will be only a matter of time until the scale forming ingredients are so concentrated that the water will be unsuitable for cooling. Although the water in the secondary circuit of the closed cooling system is also cooled atmospherically, concentration of scale forming ingredients will not have as harmful effects as in the primary circuits.

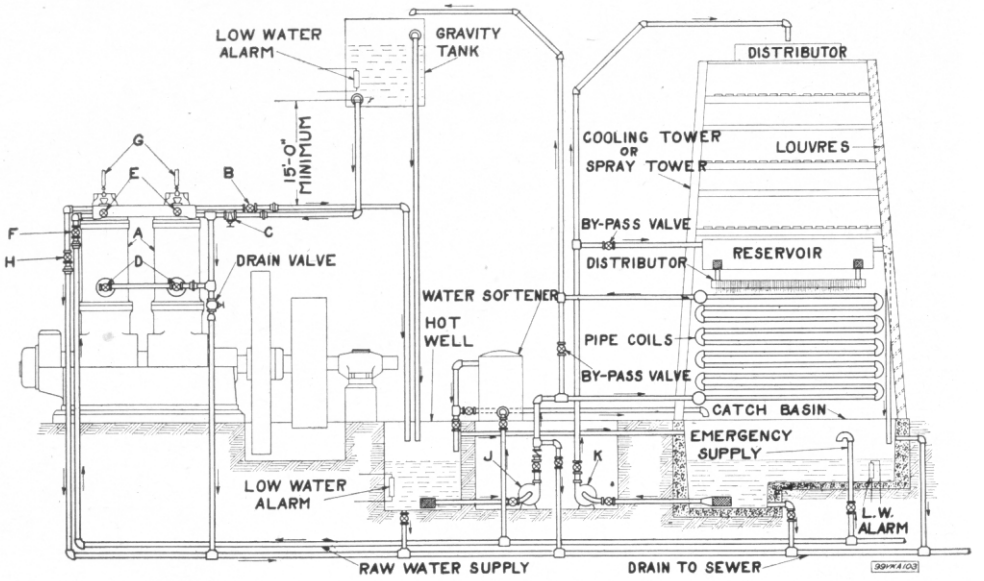
Atmospheric Cooling Systems

117. Should it be impossible to install a closed cooling system, an atmospheric cooling system using a spray tower, cooling tower or spray pond may be used, but is not generally recommended. In these systems the engine cooling water is recooled both by exposure to the open air and by evaporation, and losses will average approximately two and one-half per cent of the water being circulated, and must be made up with raw water treated to "zero" hardness. Weekly samples of the water in the system must be submitted to the manufacturer of the softening system to make sure that concentration is not taking place with resultant increase in hardness.

A. Closed Cooling Systems

Closed Cooling System Using Pipe Coils and Cooling Tower

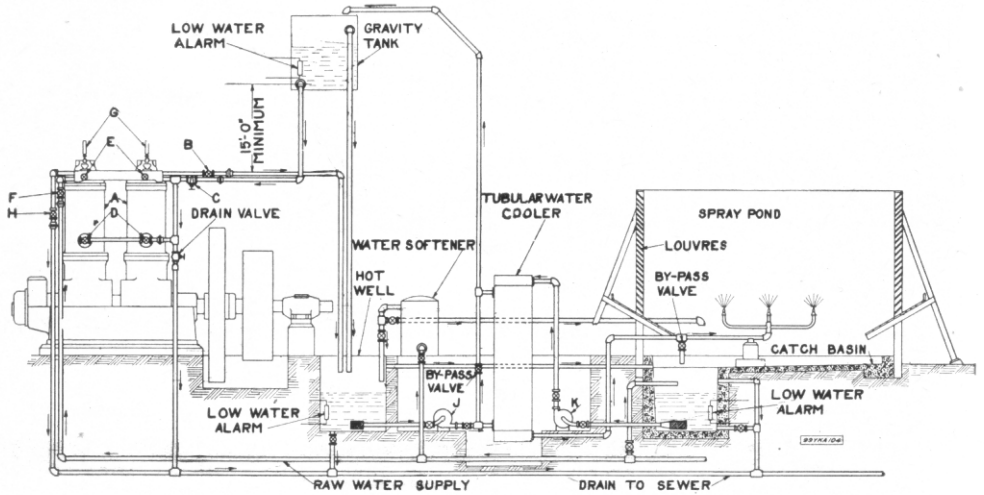
118. Diagram 99YKA103 on page 24 shows a schematic piping layout of a closed cooling water system using pipe coils and a cooling tower. With slight modifications, a commercial tubular cooler and spray tower may be adapted to this system.



CLOSED COOLING WATER SYSTEM USING PIPE COILS AND COOLING TOWER (99YKA103)

Closed Cooling System Using Commercial Cooler and Spray Pond

119. Diagram 99YKA104 below shows a layout of a closed cooling system using a commercial cooler and a spray pond. Pipe coils may be substituted for the commercial cooler if desired.



CLOSED COOLING WATER SYSTEM USING SOFT WATER COOLER AND SPRAY POND (99YKA104)

Circuits Discussed Separately

120. Due to the many possible combinations, the primary and secondary circuits will be discussed separately.

(a) Primary or Engine Cooling Water Circuit:

General

121. The main parts in the primary circuit are (1) Water Softener, (2) Pipe Coils or Commercial Tubular Cooler, (3) Circulating Pump, (4) Gravity Tank, and (5) Hot Well. Other parts making up the complete circuit are the engine water jackets, piping, strainers, valves, low water alarms, etc.

Water Softener

122. When the water is not suitable for cooling without being treated, some method of treating the water, as specified in paragraphs 84 to 86, inclusive, must be used. The size of the softener to be used will depend upon installation conditions. Where only water in the primary circuit is to be treated, a small softener will suffice, but where the water in the secondary circuit or the engine cooling water in an atmospheric system must be softened, a much larger softening plant must be provided. Connect the softener so that the treated water may be discharged into the Hot Well, and place it at such a level that it may be drained easily.

Commercial Tubular Cooler

123. If a commercial tubular cooler is to be used, it should be of a reliable make. Connect it as shown in diagram 99YKA104 on page 24 with a by-pass pipe from the inlet to the outlet of the cooler and a valve between.

Pipe Coils

124. If a pipe coil cooler is to be installed, a minimum of 5 feet of 2-inch pipe must be used per rated engine horsepower. Arrange the coils in stands, 10 to 20 feet long, and not more than 12 pipes high. Wide pattern return bends should be used in connecting the pipes. If more than 240 feet of pipe is required, use two or more stands set 12 to 18 inches apart, and connected at the inlet and outlet by pipe headers. A by-pass should be connected across the inlet and outlet of the coil.

Gravity Tank

125. The gravity tank should have a capacity of from 2 to 5 gallons per rated horsepower and should be placed at a minimum distance of 15′-0″ above the discharge level in the water manifold. This tank should be equipped with a low water alarm. The outlet from the tank should be connected to the lower opening in the water manifold on the engine. The outlet from the cooling coils or cooler should be connected into the top of the tank, and the overflow should run back to the Hot Well.

Hot Well

126. The hot well in the primary circuit should have a minimum capacity of 6 gallons per rated engine horsepower, and preferably should have a capacity sufficient to allow draining the engine water jackets and overhead gravity tank. A strainer should be placed on the suction pipe. A low water alarm should also be installed in this well.

Piping

127. The table on page 22 gives sizes of pipes recommended for the various engines.

(b) Secondary Circuit

General

128. The main parts of the secondary circuit are (1) Spray Tower, Cooling Tower or Spray Pond, (2) Water Softener, (3) Distributor, (4) Circulating Pump and (5) Catch Basin.

Cooling Water

129. It is highly desirable that the cooling water for the secondary circuit be free from scale forming ingredients, for scale on the pipes or in the cooler will cause a marked reduction in their efficiency. If an unlimited supply of reasonably soft water is available for this purpose, the water may be run to waste after passing over the cooling coils, but when the supply is limited or the water must be softened, some form of an atmospheric recooler will be desirable.

Spray Tower

130. The spray tower, owing to its compactness and cooling efficiency will be found most suitable for a majority of installations. These towers can be installed on the roof, which not only utilizes otherwise useless space, but provides a free circulation of air which is essential for rapid cooling.

Spray Tower Specifications

131. The following tabulation shows recommendations for a commercial line of spray towers. These recommendations are based on a capacity of 30 gallons of raw water per rated engine horsepower per hour.

SPECIFICATIONS OF SPRAY COOLING TOWERS FOR COOLING WATER IN SECONDARY CIRCUIT

Size of Engine Inches	No. of Cylinders	SPRAY TOWER		
		Number Required	Pressure At Spray Head	Overall Dimensions Feet Width-Length-Height
12x15	1	1	10	3′-5″x 3′-5″x 9′-0″
14x17	1	1	10	6′-0″x 6′-0″x12′-0″
12x15	2	1	10	6′-0″x 6′-0″x12′-0″
14x17	2	1	10	6′-0″x 6′-0″x12′-0″
14x17	3	1	10	6′-0″x 6′-0″x12′-0″
14x17	4	2	10	6′-0″x20′-0″x12′-0″
14x17	6	2	10	6′-0″x20′-0″x12′-0″

Free Air Circulation

132. When installing spray towers, they should be so located that free circulation of air will be unhindered by proximity to surrounding walls or when several towers are installed in a group, a minimum distance between towers must be maintained. Minimum recommendations are 8 feet clear distance between towers and 20 feet clear distance between any tower and the nearest wall.

Cooling Towers

133. Should a cooling tower arrangement for recooling the water in the secondary circuit be preferred to the spray tower arrangement, the piping layout as shown in diagram 99YKA103 on page 24 should be followed.

Cooling Tower Drawing

134. The manufacturing Division is prepared to furnish working drawings for an efficient type of cooling tower for single engine installations in particular, but it is recommended that a reputable manufacturer of cooling towers be consulted so that the most efficient and modern design may be obtained.

Spray Pond

135. A spray pond for recooling the water in the secondary circuit can be installed where sufficient space is available for the pond, and a cooling tower or spray tower is not desirable. The general piping layout for such an arrangement is shown in diagram 99YKA104 on page 24.

Spray Pond & Pipe Coils

136. From the diagram it will be noted that pump K is used to force the water in the secondary circuit through the soft water cooler and spray nozzles. If pipe coils are to be used in place of the soft water cooler, the spray pond must be placed above the pipe coils or another pump must be used to elevate the cool raw water above the pipe coils.

Spray Pond Specifications

137. General data and dimensions of the spray pond and spray nozzles are given in the following table.

SPECIFICATIONS OF SPRAY POND FOR COOLING WATER IN SECONDARY CIRCUIT

Size of Engine Inches	No. of Cylinders	Spray Nozzles			Spray Pond		Height of Louvres Feet
		Number	Size In.	Pressure	Width Ft.	Length Ft.	
12x15	1	1	1½	7	12	12	11
14x17	1	2	1½	7	12	12	11
12x15	2	4	1¼	7	25	25	11
14x17	2	7	1¼	7	25	25	11
14x17	3	5	1½	7	25	25	11
14x17	4	6	1½	7	25	25	11
14x17	6	5	2	7	30	30	11

(c) Operations of Closed Cooling Systems:

I. When pipe coils and cooling tower, spray tower, or elevated spray pond are used, refer to diagram 99YKA103 on page 24.

Primary Circuit

138. In operation, the pump J in the primary circuit draws water from the Hot Well, and forces it through the Pipe Coil Cooler to the Gravity Tank. From this tank the water flows by gravity through the engine water jackets and back to the hot well, where the cycle is again commenced.

Secondary Circuit

139. The pump K in the secondary circuit draws water from the catch basin and delivers it to the distributor in the cooling tower, or to the spray nozzles in the spray tower or spray pond. The cool water is then collected in a reservoir from which it is distributed over the pipe coils. The warm water is caught in the basin where it is again ready for circulation.

Temperature Control

140. The valves on the pump J should be regulated so that approximately 20 gallons of water are being circulated per rated horsepower per hour. Two methods of controlling the jacket water temperature are provided. First, by adjusting the by-pass valve on the pipe coils the desired amount of water may be discharged from the pump J directly to the gravity tank without going through the pipe coils, and secondly, by adjusting a by-pass valve in the secondary circuit, warm water may be diverted into the reservoir without going through the cooling tower, spray tower or spray pond. With these two controls, the proper temperature may be easily obtained, without varying the pump capacity.

II. When a commercial tubular cooler and cooling tower, spray tower or spray pond are used, refer to diagram 99YKA104 on page 24.

Primary Circuit

141. In operation, the pump J in the primary circuit draws water from the Hot Well, and forces it through the soft water cooler to the Gravity tank. From this tank the water flows by gravity through the engine water jackets and back to the Hot Well, where the cycle is again commenced.

Secondary Circuit

142. The pump K in the secondary circuit draws water from the catch basin, forces it through the soft water cooler and to the distributor in the cooling tower or to the spray nozzles in the spray tower or spray pond. The cool water is then collected in the catch basin where it is again ready for circulation.

Temperature Control

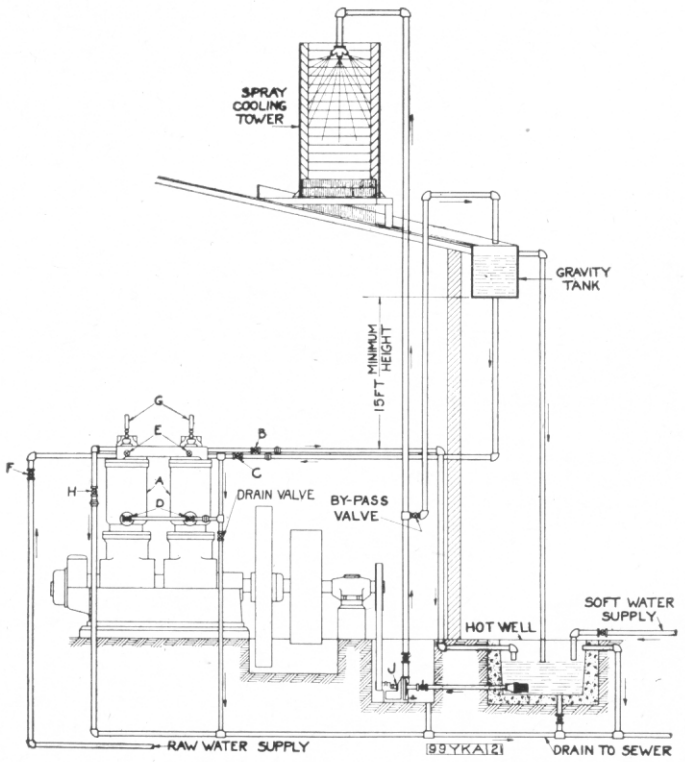
143. The valves on the pump J should be regulated so that approximately 30 gallons of water are being circulated per rated horsepower per hour. The same methods of temperature control are used as specified in paragraph 140.

III. When pipe coils and a low spray pond are used, it will be necessary to install a third pump to raise the raw water to the distributor above the coils.

B. ATMOSPHERIC COOLING SYSTEMS

144. As explained before, atmospheric cooling systems are not generally desirable for direct cooling of the engine circulating water, due to the danger of concentration of scale forming salts through evaporation. By very careful treatment of make-up water, satisfactory results can be obtained, but generally speaking the closed system will, in a majority of cases, prove to be the most desirable.

145. The atmospheric systems to be discussed are (a) Spray Tower System, (b) Cooling Tower System, (c) Spray Pond System, and (d) Cooling Screen System.



ATMOSPHERIC COOLING SYSTEM USING SPRAY TOWER (99YKA121)

(a) Spray Tower System

Where Suitable

146. Owing to the compact construction of the Spray Tower, it is especially suitable for installation in congested districts where ground space is at a premium. It can be installed on the roof, which not only utilizes otherwise useless space, but also gives a free circulation of air, which is essential to rapid and efficient cooling.

Piping Layout

147. Diagram 99YKA121, page 27, shows a general piping layout of an atmospheric system using a spray tower. Follow this layout and use the pipe sizes specified in the table on page 22.

Spray Tower Specifications

148. The following tabulation shows recommendations for a commercial line of approved spray towers. These recommendations are based on a capacity of 20 gallons of circulating water per rated engine horsepower per hour.

SPECIFICATIONS—SPRAY TOWERS FOR DIRECT COOLING:

Size of Engine Inches	No. of Cylinders	Number Required	Pressure at Spray Head, Lbs.	Overall Dimensions Feet
12x15	1	1	10	3′-5″x 3′-5″x 9′-0″
14x17	1	1	10	3′-5″x 3′-5′x 9′-0″
12x15	2	1	10	6′-0″x 6′-0″x12′-0″
14x17	2	1	10	6′-0″x 6′-0″x12′-0″
14x17	3	1	10	6′-0″x 6′-0″x12′-0″
14x17	4	1	10	6′-0″x 6′-0″x12′-0″
14x17	6	2	10	6′-0″x20′-0″x12′-0″

Clearance Between Spray Towers and Buildings

149. When installing Spray Towers, they should be so located that free circulation of air will be unhindered by proximity to surrounding walls or when several towers are installed in a group, a minimum distance between towers must be maintained. Minimum recommendations are 8 feet clear distance between towers and 20 feet clear distance between any tower and the nearest wall.

Gravity Tank

150. The gravity tank should have a capacity of from 2 to 5 gallons per rated engine horsepower. This tank must be at an elevation of at least 15′-0″ above the discharge level in the water manifold.

Hot Well

151. The hot well should have a minimum capacity of 6 gallons per rated engine horsepower and preferably should have sufficient capacity to allow draining the entire system should this be necessary.

Operation

152. The pump J draws water from the Hot Well and forces it through the spray nozzles in the tower. The water, after being atomized, passes downward over the louvres, is cooled by evaporation, and radiation to the atmosphere, and is finally collected in the gravity tank. The water then flows by gravity through the engine water jackets and into the Hot Well where it is again ready for circulation.

Temperature Control

153. The valves on pump J should be regulated so that approximately 20 gallons of water per horsepower per hour are being circulated. The by-pass valve permits adjustment so that the desired amount of water may be by-passed into the gravity tank without being forced through the spray nozzles to be recooled. Thus, temperature control may be obtained without varying the pump capacity.

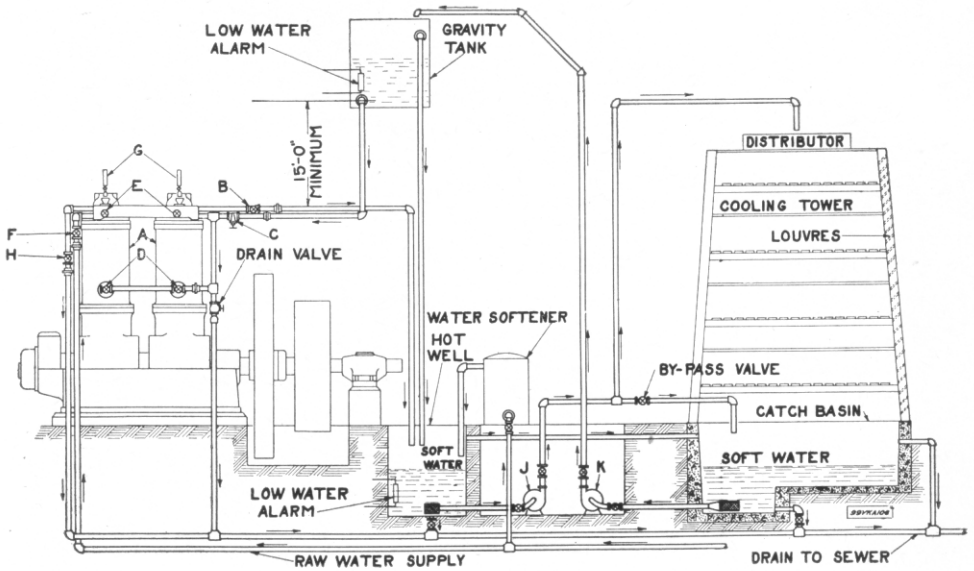
(b) Cooling Tower System

Piping Layout

154. Diagram 99YKA106 shows a general piping layout of an atmospheric cooling system using a cooling tower. Follow this layout and use the pipe sizes specified in the table on page 22.

Cooling Tower Recommendations

155. It is strongly recommended that a reputable manufacturer of cooling towers be consulted, so that the very best type of tower for any specific installation will be obtained. The Manufacturing Division is prepared to furnish working drawings for an efficient type of cooling tower particularly for single unit installations which is free from all patent interference, but which is necessarily not of the most efficient and modern design.



ATMOSPHERIC COOLING SYSTEM USING COOLING TOWER (99YKA106)

156. See Paragraph 150. **Gravity Tank**

157. See Paragraph 151. **Hot Well**

158. The pump J draws water from the Hot Well and discharges it to the distributor at the top of the cooling tower. The water then drips down the tower, and collects in the catch basin from whence pump K discharges it to the gravity tank. From this tank the water flows through the engine water jackets and is discharged into the Hot Well where it is again ready for circulation. **Operation**

159. The valves on both pumps should be regulated so that the pumps are delivering approximately 20 gallons per rated horsepower per hour. Then by means of the by-pass valve warm water from the hot well may be diverted into the catch basin without going through the cooling tower. Thus regulation may easily be obtained without varying the pump capacity. **Temperature Control**

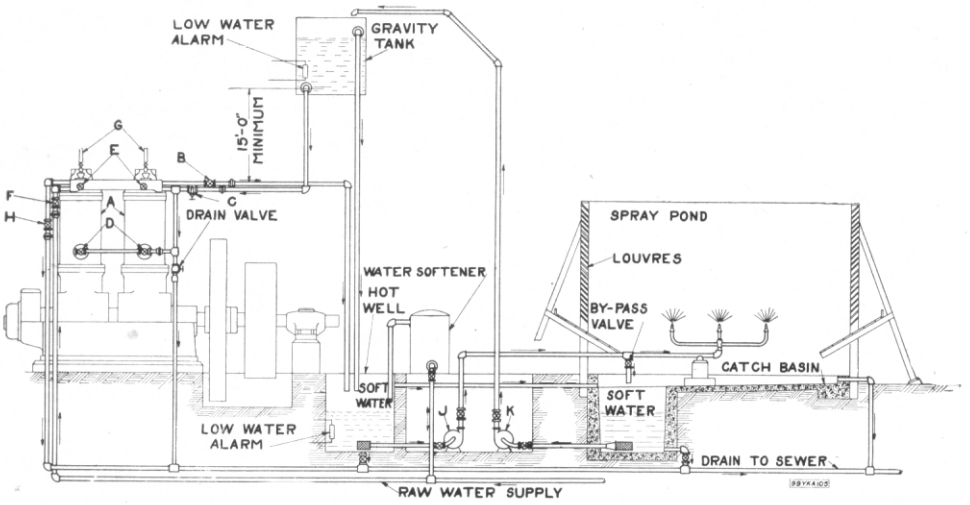
(c) Spray Pond System

160. Diagram 99YKA105 shows a general piping layout of an atmospheric cooling system using a spray pond. Follow the layout and use the pipe sizes specified in the table on page 22. **Piping Layout**

160. General data and dimensions of the spray pond and nozzles are given in the following tabulation. **Spray Pond Specifications**

SPECIFICATIONS—SPRAY POND COOLING SYSTEM:

Size of Engine Inches	No. of Cylinders	Spray Nozzles			Spray Pond		Height of Louvres Feet
		Number	Size Inches	Pressure Pounds	Width Feet	Length Feet	
12x15	1	1	1¼	7	12	12	11
14x17	1	1	1½	7	12	12	11
12x15	2	1	1½	7	12	12	11
14x17	2	4	1¼	7	25	25	11
14x17	3	7	1¼	7	25	25	11
14x17	4	4	1½	7	25	25	11
14x17	6	6	1½	7	25	25	11



ATMOSPHERIC COOLING SYSTEM USING SPRAY POND (99YKA105)

Gravity Tank

162. See Paragraph 150.

Hot Well

163. See Paragraph 151.

Operation

164. The pump J draws water from the Hot Well, and forces it through the spray nozzles into the spray pond. Pump K then draws it from the spray pond catch basin and discharges it into the gravity tank. From this tank the water flows by gravity through the engine water jackets and back into the hot well where it is again ready for circulation.

Temperature Control

165. The valves on both pumps should be regulated so that the pumps are delivering approximately 20 gallons per rated horsepower per hour. Then by means of the by-pass valve, warm water from the hot well may be by-passed directly into the catch basin without going through the spray nozzles.

(d) Cooling Screen System

Piping Layout

166. Diagram 99YKA122 on page 31 shows a general piping layout of an atmospheric cooling system using a cooling screen. This system is recommended only for use in conjunction with small engine installations. Follow this layout and use the pipe sizes specified in the table on page 22.

Screen Construction

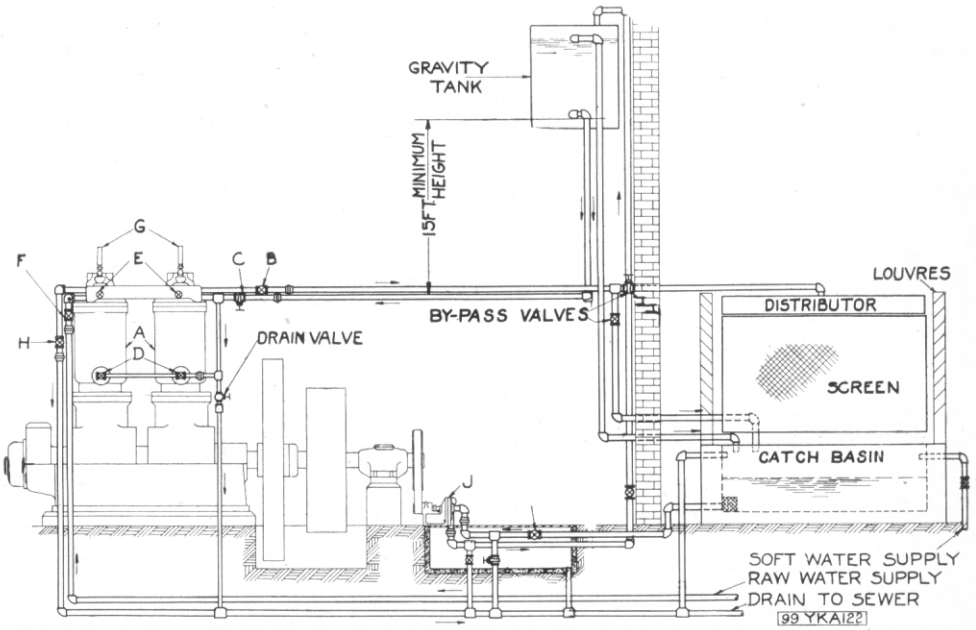
167. Cooling screens are not furnished by the Manufacturing Division but can be readily constructed in the field. Use 1½ square feet of ½-inch mesh galvanized screen per rated engine horsepower. Support the screens on structural steel frames over a suitable catch basin.

Arrangement of Screens

168. The screen stands can be arranged in parallel rows with from 12 to 18 inches separation to allow free circulation of air. The stands should be located well away from surrounding buildings or other obstructions, and should be protected by wooden louvres to prevent the water from being blown from the screens. If the screens can be located a sufficient distance below the engine. the hot water can flow by gravity to the distributor pipes, otherwise, either the engine must be fitted with closed overflow pipes, or a hot well and an additional pump of the same capacity as pump J must be installed.

Distributor

169. The distributor pipes should preferably be slotted along the top, to allow the water to overflow and spread over the screens, or small holes can be drilled about an inch apart if facilities for slotting the pipe are not available. In systems where the screens are arranged in parallel rows, a header pipe feeds the individual distributors. Drawings of the system may be obtained from the Manufacturing Division.



ATMOSPHERIC COOLING SYSTEM USING COOLING SCREEN (99YKA122)

Gravity Tank

170. See Paragraph 150.

Catch Basin

171. The catch basin should have a minimum capacity of 6 gallons per rated engine horsepower and preferably should have sufficient capacity to allow draining the entire system.

Operation

172. The pump J draws water from the catch basin and discharges it into the gravity tank. From this tank, the water flows by gravity through the engine water jackets to the distributor pipes over the cooling screen. The water cools as it passes over the screen and collects in the catch basin where it is again ready for circulation.

Temperature Control

173. The valves on pump J should be adjusted so that the pump will deliver approximately 20 gallons per rated horsepower per hour. By means of the two by-pass valves, warm water may be discharged to the distributor pipe or by-passed directly into the catch basin. With such an arrangement, the temperatures may be controlled without varying the pump capacity.

C. RUNNING WATER COOLING SYSTEM

174. In a running water cooling system, a reservoir should be provided, and the piping should be arranged so that part of the water may be by-passed back into this reservoir. With such an arrangement, temperature control can be obtained by regulating the by-pass rather than by varying the pump capacity.

SCAVENGING AIR

175. The piston and crankcase act as a pump to supply the engine with scavenging air. On the upstroke of the piston, air enters the engine base and is drawn into the crankcase through an automatic air valve. This air may be drawn either from the engine room through a screen located on top of the engine base at the flywheel end or from outside the engine room through an underground conduit connecting with the engine base. Where the air is supplied to the engine through the conduit, the intake opening on top of the base is shut off with a blind flange.

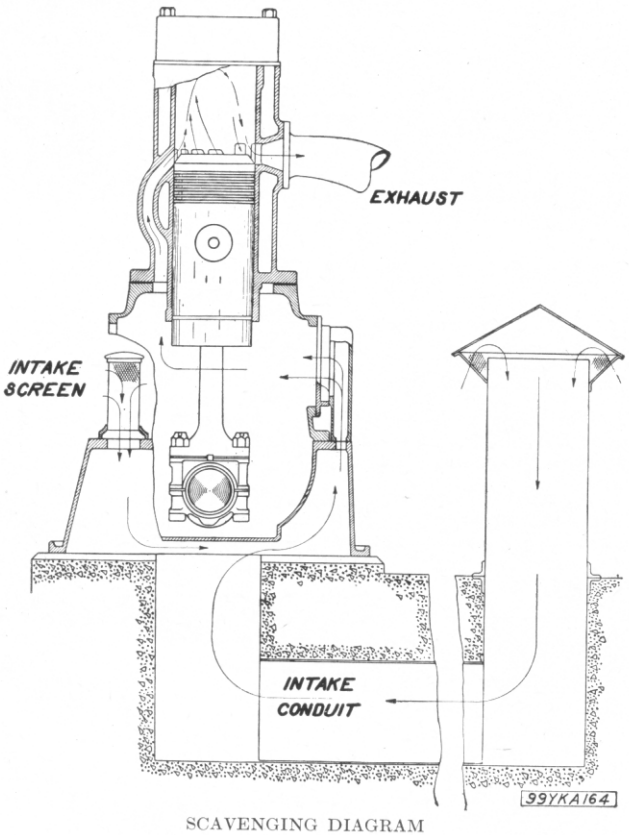
1. Air Inlet

Air Inlet Conduit

176. When the scavenge air is to be taken from outside the engine room, which we recommend in every case, put the conduit in at the time the foundation is built. See diagram 35YKA on page 6. This conduit should be as short as possible, at least 18 inches in diameter, and with as few bends as possible. Line the conduit walls with vitrified tile or galvanized iron culvert pipe to keep particles from being drawn in with the suction. Provide a suitable covering and screen at the outer end to keep dirt from being drawn into the pipe. Extend the pipe above the ground level to keep the water out.

Optional Air Inlets

177. On installations where both extremely cold and warm temperatures are encountered, it may be advisable to provide an optional scavenge air inlet; that is, one from the outside and one from the engine room. This will provide ventilation in warm weather and conserve the heat in the engine room in the winter.



SCAVENGING DIAGRAM

2. Air Filters

Necessity For Filter

178. Many installations are made under conditions which require that the air supply be filtered before it enters the engine. Cement mill, flour mill and rock-crusher installations are examples.

Construction of Filter

179. The assembled filter usually consists of a steel box skeleton containing 2, 3, or 4 filter cells bolted to the vertical sides. When less than four cells are necessary the remaining sides are closed with blank, steel covers which make an air tight joint.

The filter cell is a shallow steel box. The interior is made up of obstructing walls and passages. All surfaces exposed to the passing air are coated with a thin film of non-evaporating, non-inflammable, non-freezing, viscous fluid

Principle of Operation

180. Air is drawn into the filter through the cells and passes out through the top, bottom, or any one of the sides, depending upon the conditions of the particular installation. The air is filtered by impinging against viscous coated baffle surfaces which bind and hold the dust particles. After a short period of operation, the numerous air passages throughout the cells become covered with a viscous-moist dust which materially increases the efficiency of the filter.

Installation of Filter

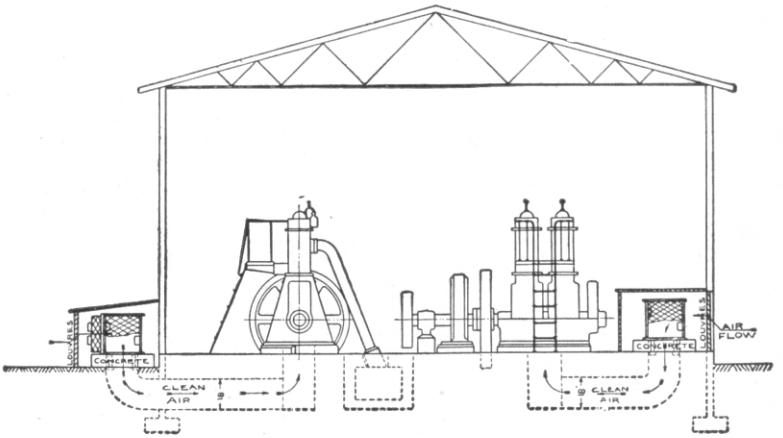
181. The filter may be located at any convenient point in the air suction line; inside the engine room, on the roof, or outside the engine room wall, in a suitable shed that will protect the filter from rain and snow. The connection between the filter and the air conduit must be kept air tight, especially on the engine side of the filter. Detailed instructions for mounting and operating these filters are furnished with each outfit by the filter manufacturer.

Putting Filter Into Operation

182. Before the filter is put into operation, the cells should be thoroughly immersed in the viscous fluid for several seconds, and allowed to drain for 24 hours. The cells should then be installed in the frames so that the air strikes the plates with large openings first. When the corner clips have been adjusted and tightened, the filter is ready for operation.

Cleaning Filter

183. The cells should be cleaned every 4 to 8 weeks, depending upon conditions. To clean, remove the cells from the frames, and thoroughly flush out with cleaning solution, hot water or steam. Use a hose and flush from the back of the cell first. When the cell is dry, dip in the viscous fluid, drain, and install in the frame. If the cleaning fluid, hot water or steam is not available, use a washing tank three-fourths full of kerosene. Hold the cell horizontally, and move vigorously up and down.



TYPICAL INSTALLATION OF AIR FILTER UNIT (CMD54)

AIR STARTING SYSTEM

1. Description And Operation

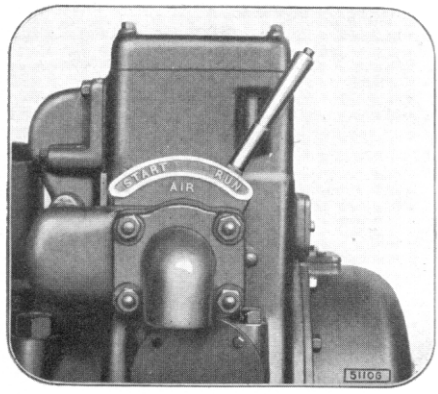
184. Compressed air is used to start these engines. The air starting system consists of an air start mechanism on the engine for distributing and admitting the compressed air to the cylinders, an auxiliary air compressor, steel tanks for storing the compressed air, and the necessary piping and fittings.

Air Start Mechanism

185. Fastened to the left side of the pump case housing is the air lever which controls the air start mechanism. See illustration 5110G, page 34. This lever is attached to a control shaft which has cams for raising or lowering the air valves and to which is fastened the disc shut off valve. The air lever has two positions, "Start" and "Run." These are plainly marked on the quadrant.

Air Lever In "Start" Position

186. When the lever is moved to the "Start" position, the disc shut off valve is opened admitting compressed air to the distributor. At the same time the cams under the air starting valves are moved out of position, and the valves are lowered to their respective seats and brought into contact with the air starting cam. as the engine revolves, the air starting cam lifts the valves in the proper order, and air is admitted to the corresponding power cylinder during a portion of the downward stroke of the piston.



AIR CONTROL MECHANISM (5110G)

Air Starting Check Valve

187. Each cylinder head on those cylinders which receive starting air is provided with an air starting check valve. This valve is so arranged that it is opened by the compressed air during its admission to the cylinder, but is closed at all other times.

Air Lever In "RUN" Position

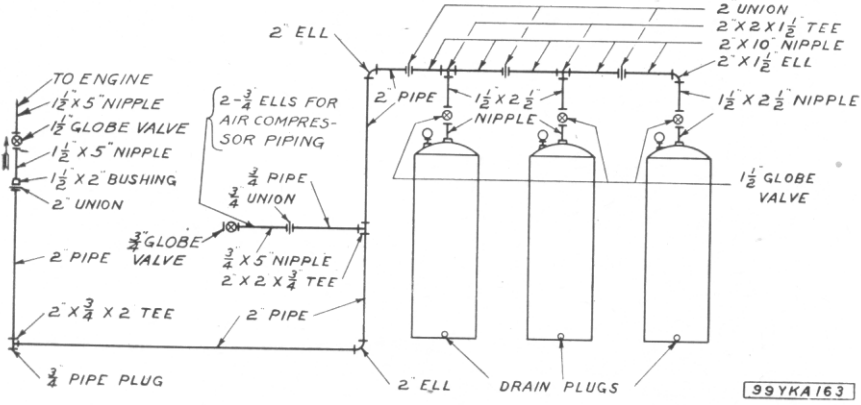
188. When the engine has started, the air lever is moved to the "Run" position. In this position, the disc valve is closed, thus stopping the admission of air from the starting tanks, and the air starting valves are lifted off their seats. With this arrangement, the cam rollers do not come in contact with the cam while the engine is in operation. The disc valve and the lifting cams are interlocked in such a manner that air cannot be admitted to the distributor while the starting valves are off their seats.

2. Installation of Air Starting System

189. Since the air starting mechanism is attached to the engine, installation work on the air starting system will consist of installing the auxiliary air compressor, starting air tanks, and the piping from the tanks to the engine.

Air Starting Equipment

190. Each engine requires an air starting outfit consisting of an auxiliary air compressor, two air tanks (except the six cylinder engine which requires three tanks), piping and fittings. This auxiliary air compressor may be an engine driven direct connected air compressor, or it may be driven by motor, an auxiliary engine or the engine for which it supplies the air. In the last arrangement the drive pulley is fitted to the shaft extension. This last arrangement is not recommended, unless a small independently driven air compressor is included; for otherwise, there would be no provision for supplying air for the initial start or in case of loss of air.



AIR STARTING DIAGRAM

Arrangement of Equipment

191. The usual arrangement of equipment is shown on diagram 99Y6KA163 on page 34. Provide drain valves for each tank and for the main line to the engine. Avoid all unnecessary joints and make each connection carefully, using thick shellac, or a mixture of litharge and glycerine.

Air Tanks And Fittings

192. Air tanks furnished by Fairbanks, Morse & Co., are subjected to a hydrostatic pressure test considerably in excess of the maximum working pressure. Fittings used in the air line should be of the extra heavy pattern.

Pipe Size

193. The following table gives pipe sizes for the air line depending upon the distance from the tanks to the engine.

Pipe Size Inches	Distance from Tanks to Engine—Feet
1½	0-12
2	12-20
2½	20-30
3	30-40

It is recommended that the air line be no longer than 20 feet, and special approval will have to be obtained for an installation which has an air line longer than 40 feet.

Air Pressure

194. The maximum working pressure for the starting air is 250 pounds per square inch. In direct connected installations where the starting air must turn both the engine and the driven unit, and also where the engine is started in low temperatures, it is advantagous to maintain the starting air at the higher pressure level Under normal starting conditions, however, the engine will start satisfactorily at an air pressure of 225 pounds and lower.

LUBRICATING OIL SYSTEM

1. Description And Operation

Automatic System

195. Each engine is equipped with an automatic lubrication and circulation system which requires no attention other than to keep an adequate supply of oil in the storage tank.

Main Parts of System

196. The main parts of the system are the force feed lubricator, pressure type oil filter mounted on the clean oil storage tank, clean oil and used oil sumps each fitted with a reciprocating pump and strainer, and oil rings and wells for each main bearing, oil reservoir in the governor case, and the connecting tubes and piping.

Lubrication of Pistons, Piston Pins and Crankpins

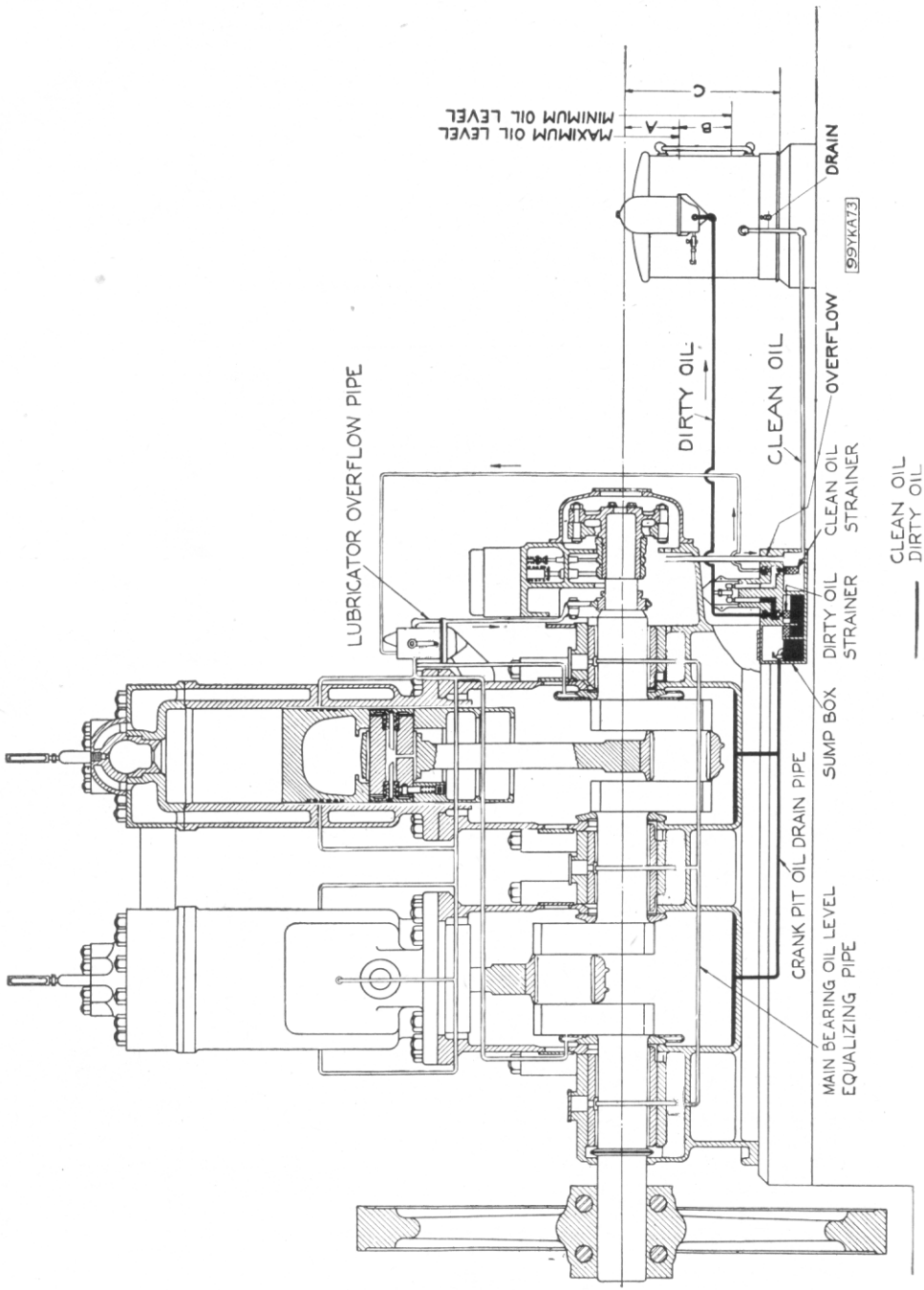
197. In operation, the clean oil pump draws filtered oil through a strainer and delivers it to the force feed lubricator which supplies lubrication to the pistons, piston pins, and crankpins. Referring to diagram 99YKA73 on page 36, it will be noted that two of the lubricator feeds deliver to oil collectors located in the piston at each end of the piston pin. These collectors furnish lubrication to the piston pin. A third lubricator feed leads into the front or scavenge air transfer side of each cylinder for the lubrication of the piston and the fourth feed supplies lubrication to the crank pin bearing by means of a ring oil collector bolted to the crank web. This collector is connected to a drilled passage in the crank web and pin which leads to the bearing.

Used Oil Returned to Filter

198. The used oil from the pistons, piston pins and crankpin bearings drains to the bottom of the respective crankcases and is drained through pipes and bibb cocks to the used oil sump at the governor end of the engine. The used oil pump transfers this oil to the oil filter where it is thoroughly cleansed, and then delivers it to the clean oil storage tank where it is ready for circulation again. **Under no circumstances must oil be allowed to accumulate in the crankcases.**

Description of Filter

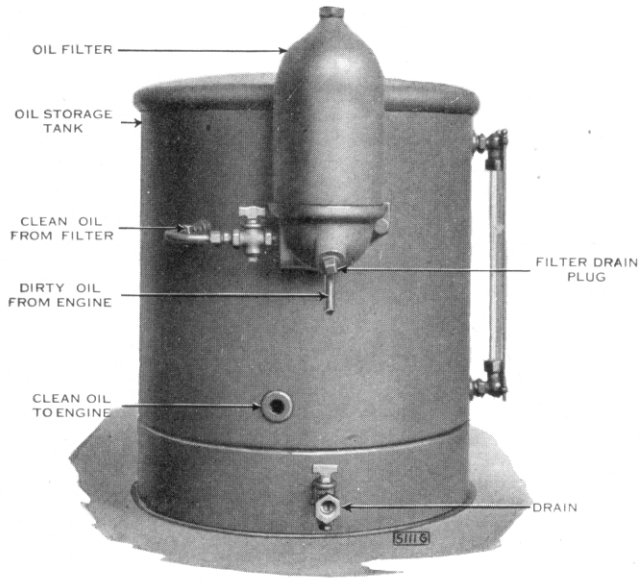
199. The oil filter is mounted on the clean oil storage tank and contains a cloth filter bag stretched over a coiled spring. This bag may be removed for cleaning after removing the upper part of the filter case. A drain plug, located in the bottom of the filter permits draining of accumulated impurities or water without taking the filter out of service. A relief valve is located in the bottom of the filter and by-passes the oil in case the filter becomes so clogged with impurities that the normal flow is impeded. A shut off cock is placed in the line between the filter and the storage tank to stop any leakage while changing filters if the oil level in the tank is so high that the filter will be flooded. This cock must be open during the normal operation of the engine.



LUBRICATION DIAGRAM

Lubrication of Governor Mechanism

200. The clean oil pump delivers more oil than is required by the force feed lubricator, so the excess oil overflows to the governor case, lubricating the lubricator drive eccentric and rocker bearings. The oil level in the governor case is maintained at such a height that the splash created by the dipping of the governor spider thoroughly lubricates the governor mechanism, injection cam, push rods, etc. An overflow pipe permits any excess oil to flow back to the clean oil sump.



OIL FILTER AND STORAGE TANK (5111G)

Lubrication of Main Bearings

201. The oil level in each of the crankshaft main bearing oil wells is automatically maintained by means of a cored passage between the governor case and the governor-end main bearing oil well and an equalizing pipe connecting this oil well to each of the other wells. Lubrication is supplied to the main bearings by means of oil rings which dip into the oil wells beneath. Operation of these rings can be observed and checked by opening the cover provided in the top of each bearing cap.

Oil Level Sight Gauges

202. All engines are equipped with a glass sight gauge at the governor end of the oil equalizer pipe for checking the oil level in the governor case and oil wells. The 4, 5 and 6 cylinder engines are provided with an additional gauge at the flywheel end of the equalizer pipe.

2. Installation of Lubricating System

Installation of Lubricating System

203. The pressure type oil filter and clean oil storage tank are mounted near the engine and connected to the clean and used oil sumps as shown in diagram 99YKA73 on page 36. All other parts are either attached to or incorporated in the engine itself; so installation work on the lubricating system requires only the proper setting and connecting of the filter and storage tank.

Necessity For Proper Oil Levels

204. In the discussion on the operation of the lubricating system it was shown that the oil in the governor case and each of the main bearing oil wells is maintained at a common level by means of equalizing connections. This level is maintained by the clean oil circulating pump and is determined by the vertical overflow pipe leading to the clean oil sump. For best operation, the oil level in the governor case should coincide with the upper end of the overflow pipe. If the level in the engine is allowed to drop because of an insufficient supply to the clean oil pump, the governor spider and main bearing oil rings will swing clear of the oil and lubrication will cease. Also, if the level is too high, oil will overflow from the bearing oil wells and flood the crankcases.

Proper Elevation of Storage Tank

205. In order to maintain the correct level the clean oil storage tank must be so located that the maximum level is slightly lower than the upper end of the governor case overflow pipe and the minimum level is high enough to flood the clean oil pump. By installing the tank so that the bottom is 22 inches below the center line of the engine crankshaft, shown by C on diagram 99YKA73 page 36, the maximum oil level (8 inches below the crankshaft center line) shown by A on the diagram and the minimum oil level (6 inches below the maximum level) shown by B on the diagram will be within the range of the glass sight gauge. These two points should be marked for reference.

FUEL SYSTEM

1. Description and Operation

Fuel System

206. The fuel system may be divided into the auxiliary and injection systems. The auxiliary system includes the fuel tank, suction and overflow pipes with the necessary valves and fittings, auxiliary fuel suction strainer, auxiliary fuel pump, auxiliary fuel discharge strainer, and fuel reservoir. When the fuel tank must be located above the level of the injection pump, a gravity feed fuel regulator must also be installed in this system. The injection system includes the individual injection pumps, tubes, and nozzles for each cylinder.

Auxiliary System

207. In the auxiliary system, the auxiliary fuel pump draws fuel from the fuel tank or gravity feed fuel regulator through the auxiliary fuel suction strainer and delivers it through the discharge strainer to the fuel reservoir. Any excess fuel in this reservoir drains back to the fuel tank or to the gravity feed fuel regulator through the overflow pipe.

Injection System

208. In the injection system, the injection pumps draw the fuel from the fuel reservoir and delivers it through the injection tubes and nozzles to their respective cylinders. Further details regarding the description and operation of this system will be found under Fuel Injection and Governing Systems.

2. Installation of Fuel System

209. Since the fuel tank and the suction and overflow pipes (and the gravity feed fuel regulator, when used) are the only parts of the fuel system that are not incorporated in the engine, only the installation of these parts need be considered under the installation of the fuel system.

A. LOCATION OF FUEL TANK

Fuel Tank Location

210. A galvanized steel fuel supply tank is required for each engine. Connect it to the engine with the suction pipe 3 and overflow pipe 4, as shown on diagram 99YKA83. Locate the fuel tank outside of the building in a covered pit accessible for filling, and place it in a horizontal position so that the suction lift can never be greater than 10 feet. This applies when light fuels are used; for heavy fuels, use heaters, larger pipes, or less suction lift.

Piping

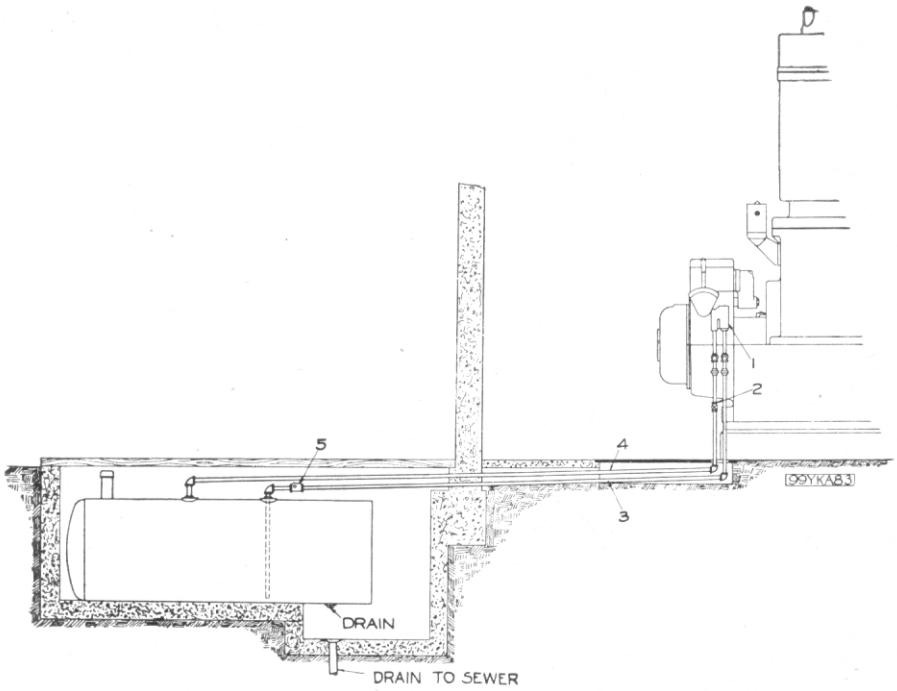
211. When this tank is furnished by Fairbanks, Morse & Co., the proper connections for suction and overflow pipes are included. Use the size of pipe to fit these connections. In connecting the fuel tank with the engine, wash out every piece of pipe or joint with gasoline or kerosene to remove all scale and loose matter, which, if left in the pipes, would interfere with the proper working of the valves.

Joints

212. Make all fuel pipe connections carefully and use shellac to insure tight joints. Thoroughly clean the pipe threads with gasoline to remove all trace of oil before applying the shellac. Shellac will not stick to an oily surface, consequently an oil tight joint cannot be made unless the shellac is applied to clean threads.

Overflow Pipe

213. The engine is shipped with a union attached to the lower end of the overflow pipe from the fuel reservoir. To this union connect the return pipe and carry it down to the floor or through the floor as required, and back to the fuel tank with a gradual descent for the free return of surplus fuel.



LOCATION OF FUEL TANK (99YKA83)

214. The auxiliary fuel section strainer is indicated by 1, diagram 99YKA83. Clean it thoroughly before starting. Reassemble the parts exactly as before. The purpose of the cock 2 in the fuel suction line is to restrict the supply of fuel slightly if the pump should deliver too freely to the reservoir on the engine. The check valve 5 must be provided to prevent the fuel from draining back into the fuel tank when the engine is stopped. It is very necessary that all fuel be strained when filling the fuel tank. For this purpose use a 12-inch funnel fitted with 40-mesh brass wire screen. **Fuel Strainer**

215. A vent is provided in the side of the filler pipe. Care should be taken that the cap is not screwed down so far that this hole will be covered. **Vent**

216. It is advisable to install a storage tank, having the capacity of a tank car, in such a location that the fuel will flow by gravity into the smaller supply tank. **Storage Tanks**

B. GRAVITY FEED FUEL REGULATOR

217. The gravity feed fuel regulator is special equipment and is necessary in installations where the fuel storage tank is located above the level of the injection pump. The function of the regulator is (1) to control the amount of fuel supplied to the auxiliary fuel pump, (2) to provide for the overflow from the auxiliary fuel reservoir, (3) to provide for the overflow from the fuel pumps, and (4) to provide for the preheating of the fuel by means of the outlet water from the engine water jacket. Preheating is necessary only when the fuel is a very heavy oil or when it is exposed to low temperatures. **When Required** **Function of The Regulator** **Preheating Necessary**

218. The regulator consists of a water jacketed reservoir containing a float mechanism, see diagram 99YKA120 on page 40. This float operates a valve which controls the supply of fuel admitted to the regulator reservoir. The regulator is provided with an air vent in the cover which maintains atmospheric pressure on the fuel and indicates, by fuel leakage, if the float is inoperative. This air vent is arranged so that any fuel leakage flows into an open funnel and then into a vented tank outside of the building. With the open funnel, the operator can readily detect any leakage, and with the tank placed outside of the building, the fire hazard is greatly reduced. If fuel leaks from the vent in **Description of Regulator**

Air Vent and Drains

the reservoir cover, shut off the fuel supply to the regulator, drain and clean the reservoir by flushing with gasoline or kerosene. It may be necessary to regrind the valve. There are also provided two drains—the lower drain for the water jacket and the upper for the fuel regulator reservoir. Drain the fuel regulator reservoir frequently to remove any accumulated water or sediment which might interfere with the operation of the engine.

Clean Pipes and Connections

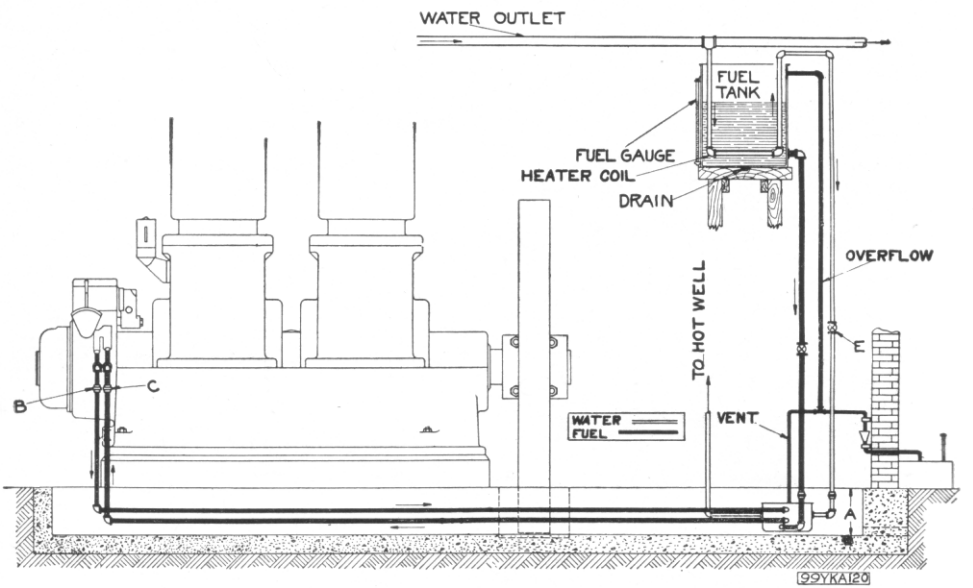
219. In connecting the regulator to the engine, carefully wash, with gasoline or kerosene, each pipe and fitting used in order to remove all dirt or scale, which, if left in the piping, would seriously interfere with the operating of the valves.

Pipe Connections

220. All water and fuel pipe connections must be absolutely tight. Use shellac on fuel pipe joints and white lead on water pipe joints.

Arrangement of Equipment

221. Diagram 99YKA120 below, shows a typical arrangement of the regulator and piping. The regulator may be placed on a low bracket on the wall, on the floor, or in a pit below the floor level. Make dimension A about nine inches deep. In any case, the regulator must be placed below the unions B and C. Connect the overhead fuel tank to the regulator reservoir through the lower hole, tapped for ¾ inch pipe. Place a shut-off valve in this line and keep it closed when the engine is not operating. Connect the fuel overflow pipe on the engine to the upper hole, tapped for ¾ inch pipe in the regulator reservoir. Connect the fuel suction pipe on the engine to the middle hole, tapped for ½ inch pipe, in the regulator reservoir. Place a check valve in the suction line in order to keep the auxiliary fuel pump primed and a shut-off valve D to prevent the loss of oil when disconnecting the fuel pipe at the union C. When valve E in the engine water outlet pipe is open, the water enters the regulator water jacket and heats the fuel but when the valve is closed, the water passes out through the engine water outlet pipe without circulating through the reservoir water jacket. Place unions close to the regulator, in all pipe lines entering it. Extend the pipe, connecting the overhead tank, with the regulator reservoir, about six inches into the tank to permit any sediment in the fuel to settle in the bottom of the tank so as to prevent any foreign matter from entering the fuel regulator. It is advisable to provide a gauge glass on the overhead tank to indicate the amount of oil in the tank and also to show any water that may accumulate in the bottom of the tank. This water should be drained off before it reaches the level of the top of the fuel outlet pipe.



GRAVITY FEED FUEL REGULATOR DIAGRAM (99YKA120)

FUEL INJECTION AND GOVERNING SYSTEMS

Index to Diagrams

222. The following parts are indicated on diagrams 99YKA80 and 99YKA81, on page 43, to illustrate the discussion of the fuel injection and governing system.

(A) Fuel pipe leading to the injection nozzle.
(B) Injection pump plunger.
(C) Discharge valve.
(D) Injection pump roller.
(E) High point of injection cam.
(F) Injection cam (in fixed relation to the crankshaft).
(G) Crankshaft (shown in two sections).
(H) Governor cam (loose on the crankshaft).
(J) An increase in load will turn the governor cam H in the direction J closing the suction valve P earlier, thus causing a greater amount of fuel to be injected into the cylinder.
(K) A decrease in load will turn the governor cam H in the direction K, closing the suction valve P later, thus causing a lesser amount of fuel to be injected into the cylinder.
(L) Leading high point of governor cam for reverse rotation.
(M) Leading high point of governor cam for standard rotation.
(N) Suction valve adjusting screw.
(O) Suction valve adjusting screw nut.
(P) Suction valve.
(Q) Injection pump suction lower push rod.
(R) Injection pump suction upper push rod stem.
(S) Relief valve (used on multi-cylinder engines only).
(T) Governor cam roller.
(U) Governor weight; centrifugal force throws the weight out.
(V) Pivot of the governor weight.
(W) Governor spring adjusting screw; tighten to increase the speed and loosen to decrease the speed.
(X) & (Y) Governor weight to governor cam pull rods.
(Z) Governor spider, with governor weights, clamped in fixed relation to the crankshaft.

1. Description of Governing System

Description

223. The governing system includes the governor, injection cam F, and governor cam H. The governor is of the flyball type and has two spring regulated weights U which pivot about point V. The injection cam F is keyed to the governor spider Z. The governor cam H is mounted on the governor spider too, but is free to rotate. It is held in position by two links X and Y which are connected to the free ends of the governor weights.

224. The entire governor mechanism is clamped on the end of the crankshaft by means of three clamp nuts through the governor spider Z. Slotted holes in the spider allow the shifting of the governor mechanism in relation to the crankshaft.

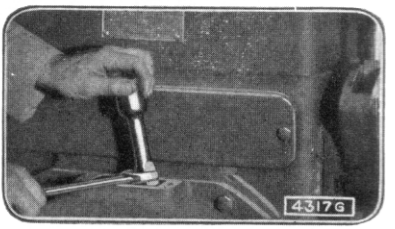
2. Operation of Governing System

Operation

225. Centrifugal force acts on the governor weights U. With a decrease in load, the speed increases and the governor weights are forced out. Through links X and Y, movement is transmitted to the governor cam H, which is retarded in relation to the injection cam F. This causes the suction valve P to close later and less fuel is delivered to the cylinders. With an increase in load the opposite is true; thus, the governor automatically controls the amount of fuel delivered between certain limits.

Speed

226. The rated speeds of these engines when pulling full load are stamped on the nameplate.



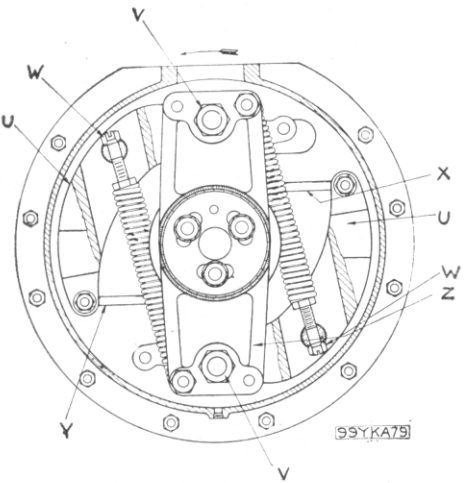
CHANGING SPEED (4317G)

To Change Speed

227. To increase the engine speed, tighten the governor springs by means of the adjusting screws W; to decrease the speed, reverse the operation. See illustration 4317G. Adjust the two springs so that they have equal tension.

Changing Rotation

228. Changing the rotation of the engine must be done by a competent mechanic, and to such a man it will be self-evident how to take the governor apart and reassemble it to the opposite hand. It is necessary to obtain from the factory a new governor spider with injection and governor cams, and also a new air starter cam. Reassemble the governor with the weights as shown in the diagram 99YKA79 for reverse rotation.



REVERSE ROTATION GOVERNOR DIAGRAM (99YKA79)

3. Description of Injection System

(Two Stage Engines Only)

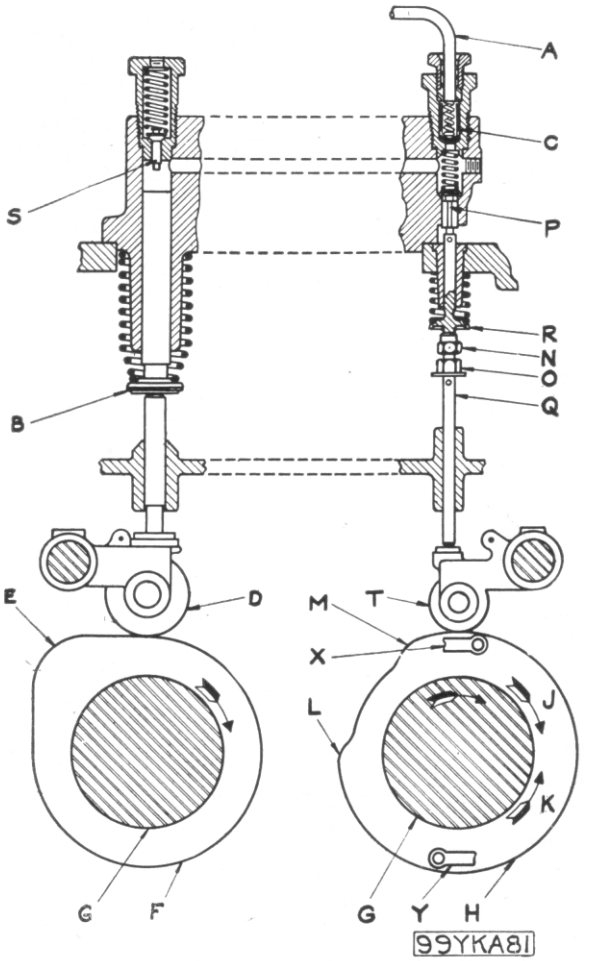
Description of Pump

229. The injection system includes the injection pumps, nozzles, and connecting tubing. Diagram 99YKA81 shows the essential parts of a single injection pump with the injection and governor cams. The pumps are of the plunger type. Each pump is equipped with suction valves P and discharge valves C, and in addition, on multi-cylinder engines, with a relief valve S. The suction valves are controlled by governor cam H, and are closed only when the cam roller T is in contact with the depressed portion of the cam. The discharge valve is opened by pressure in pump, and the relief valve S is moved off its seat by plunger B near the upper end of its stroke. The time at which the relief valve is opened may be varied by raising or lowering the valve seat. The relief valves provide a quick fuel cut-off which stops any fuel dribbling, and also provide a means for making slight variations in injection timing.

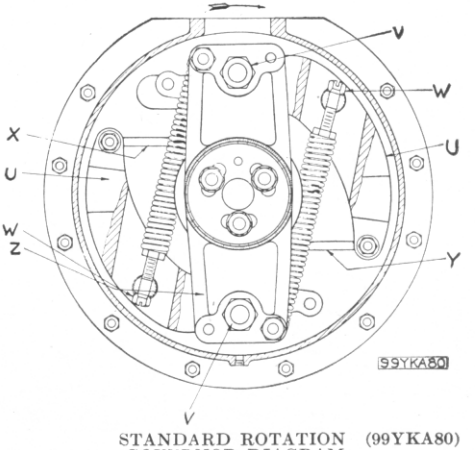
Injection Nozzle

230. The injection nozzle 201B is screwed into the top of the combustion chamber, and is connected to the discharge of the pump with steel tubing. It is of the conical valve type with the valve held against its seat by means of a spring. At each stroke of the pump, the valve is forced open, admitting fuel which passes on through the nozzle tip into the combustion chamber. The valve should lift not more than $\frac{1}{32}$ inch.

231. The nozzle tip has one central hole, and has a spiral pressed into it to secure good distribution of the fuel. The spiral has a portion of an annealed drill pressed into it in such a manner that the end of the drill extends past the point of the spiral and fills the center portion of the hole in the tip. Thus, only the outer portion of the hole is used for spraying the fuel.



INJECTION PUMP AND GOVERNOR CAM DIAGRAM (99YKA81)



STANDARD ROTATION (99YKA80)
GOVERNOR DIAGRAM

Ball Check Valve

232. A ball check valve 2718 is used in conjunction with the regular nozzle. This check valve screws into the top of the nozzle.

Grinding the Valves

233. Under normal conditions, it is necessary to inspect and regrind the injection pump and nozzle valves from time to time depending upon the conditions of service and the fuel used. When the valves become leaky, grind them to their seats using a fine grade of carborundum paste, flour of glass, or pumice stone, but do not use emery, as even the finest grades are too coarse for this purpose. Some of the valves are provided with screw driver slots; for cup shaped valves a round stick may be fitted and used for rotating. After grinding the valves wash the pumps and valves with gasoline or kerosene, making sure that absolutely no grit is left on the valve or valve seat, as the smallest particle might ruin the valve in operation.

4. Operation of Injection System

All Pumps Operated By One Cam

234. The injection pumps are located on the floor of the auxiliary fuel reservoir, and are so arranged that the injection cam F operates all of the pump plungers in turn through rockers spaced equally around it. In similar manner, all of the suction valves are controlled by governor cam H.

Firing Order

235. The firing order of the cylinders on the different engines follows:
3 cylinder 1-3-2.
4 cylinder 1-3-2-4.
5 cylinder 1-4-3-2-5.
6 cylinder 1-3-5-2-4-6 on all engines built prior to engine No. 643338.
6 cylinder 1-4-5-2-3-6 on engine No. 643338 and all built thereafter.

Operation of Injection Pump

236. As the plunger B descends, fuel is drawn into the pump through suction valve P which is held open by the governor cam H. When the injection cam F begins to move the plunger on the injection stroke, fuel is discharged back into the suction until the suction valve P is closed. Injection cam F and governor cam H are placed in such relation to each other that the plunger B always starts its movement before the suction valve is closed; thus, the beginning of injection is controlled by the position of the governor weights.

237. With the suction valve P closed, and with the plunger B rising, a pressure is built up in the pump which forces the discharge valve C off its seat. Fuel is then discharged through the injection tube A to the injection nozzle where it is thoroughly atomized and forced into the combustion chamber.

238. On single cylinder engines, injection is completed when the plunger B is at high point. On multi-cylinder engines, injection is completed when the plunger B pushes the relief valve S off its seat, or slightly before the plunger is at high point. The opening of the suction valve P has no effect on the completion of injection, for the valve always opens after the plunger has reached high point.

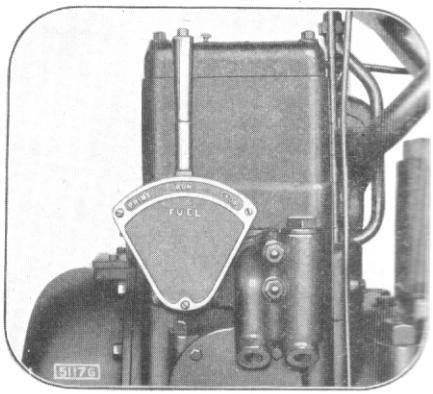
5. Control of Injection System

Control

239. Control of the injection system is centered in the hand lever at the right of the fuel pump housing. It has three positions, "Prime," "Run" and "Stop," which are plainly marked on the quadrant. The hand lever is attached to a control shaft which has cams for lifting the pump plungers B and the suction valves P. See illustration 5117G below.

Lever In "Prime" Position

240. With the lever in "Prime" position, the plunger is being lifted by the control shaft cams; thus, the plunger can be worked up and down by moving the lever from "Run" to "Prime" positions which is the operation performed in priming. When priming a cylinder, the piston must be in such a position that the corresponding suction valve is closed. Also, the control lever should not be pulled too far back, as the relief valve is then opened, and the fuel returns to the suction instead of to the injection nozzle. The point at which the relief valve starts to open can be felt readily due to the marked increase in resistance.



FUEL CONTROL MECHANISM (5117G)

241. When the lever is in "Stop" position, the lifting cam has been moved away from the pump plunger and another has raised the suction valve off its seat. In this position, no fuel can be delivered to the cylinder for the suction valve is open continuously. **Lever in "Stop" Position**

242. With the lever in "Run" position, both the plunger and the suction valves are free and the fuel injection is controlled by the governor mechanism. **Lever in "RUN" Position**

6. Injection Timing

(Two Stage Engines Only)

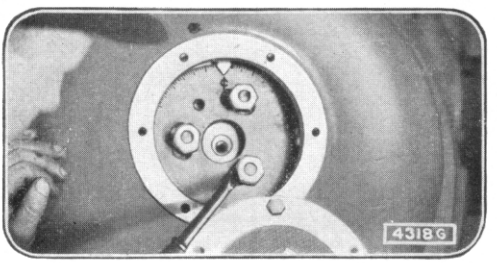
243. In order that the fuel may enter the combustion chamber at the proper time, injection must occur in a certain relation to the position of the power piston. In other words, the injection cam must be set in a certain relation to the crankshaft. **Method of Timing**

244. The method of timing the injection is to clamp the governor mechanism to the crankshaft in such a position that the injection pump plunger B is at high point a certain number of degrees after the corresponding piston has passed upper dead center. The following table gives the settings for the different engines. **Injection Settings**

Size of Engine	Single Cylinder	Multi.-Cylinder
12x15	3°-5° After Top Center	8°-12° After Top Center
14x17	3°-5° After Top Center	10°-14° After Top Center

The later setting on multi-cylinder engines is due to the use of the relief valve, by which injection is completed before the plunger is at high point. Injection is completed on all engines at approximately the same time.

245. To check the time of injection, set the No. 1 piston on the upper dead center as follows: Set the piston approximately on the upper dead center as indicated by the flywheel keyway. Read paragraph 288. Remove the injection nozzle and lower a rod through the opening thus exposed, until it rests on the end of the piston. Mark the rod about 6 inches above the top of the combustion chamber. Turn the flywheel in the direction of rotation until the mark comes down flush with the top of the combustion chamber. Now mark the flywheel rim approximately on its horizontal center line and measure the distance from this mark to the floor. Next turn the flywheel backward, moving the piston up to upper dead center and down again, until the mark on the rod is once more flush with the top of the combustion chamber. Make a new mark on the flywheel rim, the same distance up from the floor as the first mark was made. Make a third mark half way between marks 1 and 2, then turn the flywheel so as to bring this mark the same height above the floor as marks 1 and 2 were made. Be sure to measure all marks from the same point on the floor to insure accuracy. This last setting gives the accurate upper dead center of the piston. With the engine in this position, the long mark designated by the letter "C" on the governor spider 501B, should be directly under the governor case timing pointer 2344. If the cam has moved from this position, the engine will be correctly re-timed when the spider is turned until the long mark "C" coincides with the pointer. The letter "O" on the spider indicates the high point of the cam. (See illustration 4318G.) **Checking Injection Setting**



ADJUSTING INJECTION SETTING (4318G)

246. Changing the injection cam setting will seldom be necessary, as the Factory setting covers a wide range of approved fuels. Very heavy fuels may require a slight change which can readily be made as follows: Remove the governor case end plate 2342 and note the position of the governor spider 501B indicated by the graduated dial and pointer 2344, then loosen the three nuts on the dial and move the spider not more than one degree in the direction of the engine rotation to secure earlier injection. Note the effect of the change in the performance of the engine before making further adjustment. **Injection Setting for Heavy Fuels**

7. Balancing Load on Cylinders

Method of Balancing Load

247. Uniform exhaust temperatures indicate that approximately the same amount of fuel is being injected to all cylinders; therefore, if the temperatures are not uniform, more fuel should be injected to cylinders with low temperatures, and less to those with high temperatures. Before changing the adjustment be sure that all thermocouples are clean and that injection system is operating properly. It has been shown that the amount of fuel injected is greater when suction valve P is closed earlier, and that the time of closing is dependent upon the position of the governor weights.

Clearance Affects Closing of Suction Valve

248. In addition, the time of closing is affected by the amount of clearance between the upper push rod stem R and the suction valve P measured with the cam in low position. With a small clearance, the suction valve will be farther off its seat, and will close later. With a large clearance, the opposite is true. Thus, if less fuel is to be injected to the cylinder, the clearance must be decreased, and if more fuel is to be injected to the cylinders, the clearance must be increased.

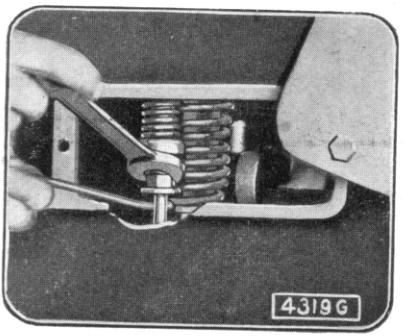
Suction Valve Clearance

249. The clearance between the suction valve and push rod should be from .010″ to .025″ with the governor cam in low position. To measure the clearance, remove the pump case housing cover, the fuel reservoir cover, and the injection pump discharge valve C with its spring. With the governor cam H in low position, hold the suction valve P down on its seat and lift the upper push rod stem R against the valve. Then insert the thickness gauge (feelers) between the push rod stem R and the adjusting screw N.

Sealed Push Rods

250. This clearance is adjusted correctly at the factory, and the adjusting screw for No. 1 cylinder is sealed. On single cylinder engines no further adjustment should be made, but on the multi-cylinder engines, occasional adjustment is required to keep the load balanced on all cylinders. Adjustment should always be made on the unsealed push rods. In this way, No. 1 cylinder is used as the key cylinder, and all other cylinders must be adjusted to it.

Suction Valve Push Rod Adjustment



ADJUSTING PUSH RODS (4319G)

251. The adjustment is made by either lengthening or shortening the push rod. Lengthening the push rod results in decreased clearance; the suction valve closes later, and the amount of fuel injected is decreased. To make the adjustment, loosen the adjusting screw nut O, and then, while holding the push rod Q with a stiff wire or nail inserted through the hole in the push rod, turn the adjusting screw in the desired direction. See illustration 4319G. Be sure to tighten the lock nut after the adjustment has been made. Start the engine and observe the exhaust temperatures under full load. If one of the cylinders has more load than the others, its pyrometer reading will be higher. To balance the load, adjust as above, until the pyrometer indicates exhaust temperatures all within a limit of 30° F. at full load. (See paragraph 82.)

8. Compression and Firing Pressures

(Two Stage Engines Only)

Taking Compression And Firing Pressures

252. The compression pressure is dependent upon the clearance volume, while the firing pressure is dependent on the load and on the time of injection. These pressures should be checked periodically in order to take care of slow changes in adjustment due to wear. An indicator should be used to take the pressures, an opening being provided in the combustion chamber for attaching it. This opening is closed with a pipe plug when the indicator is not in use. It is not necessary to connect up an indicator drive to obtain exact indicator cards, for pulling the indicator by hand will give the desired results. The firing pressures should be taken at full load, and the compression pressure should be taken immediately after, while the engine is hot. The pressures should be as follows:

Engine	Compression (Hot)	Firing
Single cylinder	520-540 lbs. per sq. in.	600 lbs. per sq. in. Max.
Multi-Cylinder	510-530 lbs. per sq. in.	600 lbs. per sq. in. Max.

Adjusting Compression Pressure

253. If the compression pressure does not check according to the values given above, adjustment should be made by adding or removing shims from between the foot of the connecting rod and the crankpin bearing. Add shims to raise the pressure, and remove them to lower the pressure. Three thicknesses of shims may be ordered under repair Nos. 1193D, E and F for use in making this adjustment. Under normal conditions, the cylinder head clearance varies from 3/32" to 1/8".

Firing Pressure Depends on Injection Setting

254. As already mentioned, firing pressures are dependent upon the load and the time of injection. However, by always taking the pressure readings under full load conditions, there will be a direct relation between the firing pressures and injection.

Adjusting Firing Pressure By Setting Injection

255. If the firing pressures are higher than the values given in paragraph 252 on a single cylinder engine, or are uniformly higher on a multi-cylinder engine, it would indicate that injection is too early. Retarding the injection would lower the firing pressures. Before doing this however, check the injection setting as given in paragraph 245.

Adjusting Firing Pressures by Setting Relief Valves

256. If the injection timing on a multi-cylinder engine checks according to paragraph 244, and the exhaust temperatures are balanced, but the firing pressures are not uniform, it would indicate that there is a slight variation in injection timing between the cylinders. Due to the difference in length of the injection tubes, there is a slight lag in the injection period from cylinder to cylinder which increases with the length of the tube. To compensate for this lag, the relief valves may be set to open earlier; and the suction valve clearance may be adjusted so that the valve P will close earlier; thus the actual period of injection may be made the same on all cylinders.

When to Adjust Relief Valves

257. **The relief valves are properly adjusted at the factory and should not be readjusted unless there is a marked deviation from the pressures given in paragraph 252.**

Approximate Lifts of Valves

258. The approximate lifts for these valves are as follows: 2, 3 and 4 cylinder engines, 5/64"; on 6 cylinder engines; No. 1 and 2 cylinders, 1/16"; No. 3 and 4 cylinders, 3/64", No. 5 and 6 cylinders, 1/32". It should be understood that these values are approximate, and that the actual lifts may vary slightly from these figures.

Setting Relief Valves

259. To lower the firing pressure on an individual cylinder, injection must be retarded. Do this by adding shims to the gasket underneath the relief valve seat, and then balance the load by readjusting the suction valve. To raise the firing pressure, remove shims and readjust the suction valve. Each lamination of the shim is .003" thick.

SYNCHRONIZER MECHANISM

Purpose of the Synchronizer

260. The purpose of the synchronizer is to produce, temporarily, a slight variation from the standard engine speed. If a permanent variation from the standard speed is necessary, adjust the regular governor springs. Read paragraph 227. The synchronizer permits a reduction in speed of approximately 25 R. P. M.

Operation of Synchronizer

261. To change the speed of the engine by means of the synchronizer, pull out the hand wheel stop pin knob, turn it 1/4 turn in either direction and release it until it rests on the hand wheel stop pin guide; this will disengage the stop pin, thereby allowing the hand wheel to turn in either direction.

Turning the hand wheel in a clockwise direction will cause a decrease in the engine speed as shown on the indicator dial, which is marked with a letter "S", indicating slower, at the left extremity of the dial, and with a letter "F", indicating faster, at the right or zero extremity. When the indicator hand is on zero, the engine should run at its maximum no load speed.

When the engine has been regulated to the desired speed, turn the hand wheel stop pin knob until it slips into the slot in the end of the hand wheel stop pin guide, then turn the hand wheel to the left or right (not exceeding 1/4 turn) until the stop pin slips into one of the holes in the hand wheel retaining ring thereby locking the hand wheel.

Occasionally remove the knurled plug on top of the synchronizer and lubricate with an oil can.

Installation of the Synchronizers

262. When ordered with the engine, the synchronizer is attached to the engine and tested before shipment from the factory. For equipping engines which have been shipped without synchronizers, the following instructions for fitting synchronizers to engines in the field will apply.

To fit a synchronizer to an engine in the field, first remove the governor case, governor case dowels, and the studs holding the governor spider to the crankshaft. Longer studs and new dowels are furnished with the synchronizer to replace those removed.

Remove the governor case and, before touching the governor assembly, set the No. 1 piston on its upper dead center. With a scratch awl or prick punch mark the position of the governor spider in its relation to the crankshaft. This will make it possible to replace the governor spider exactly in its original position.

After marking the position of the governor spider on the crankshaft, remove the governor assembly and slip the synchronizer governor case centering arbor on to the crankshaft and up to the shoulder near the end of the crankshaft. The purpose of this arbor is to center the outer end of the synchronizer governor case while new dowel holes are being drilled and reamed in the lower base.

Detach the synchronizer governor case from the synchronizer and place it over the studs that originally held the governor case; then tighten all nuts securely.

If the synchronizer governor case is correctly aligned, the centering arbor can now be turned easily; if the arbor cannot be turned easily, the governor case is binding from misalignment and should be adjusted until perfect alignment is obtained. This centering operation is very essential to the successful operation of the synchronizer and should be done accurately.

When the synchronizer governor case has been centered correctly and while the stud nuts still are tight, drill new dowel holes in the synchronizer governor case and lower base with a $^{27}/_{64}$" drill, ream $^{7}/_{16}$" and drive in the dowels.

The synchronizer governor case may now be removed to permit the assembling of the governor and synchronizer.

Screw the large studs in the end of the crankshaft and drive the $^{1}/_{2}$"x1$^{3}/_{8}$" dowel furnished with the synchronizer into the dowel hole in the governor spider, then replace the governor assembly on the crankshaft in exactly the same position it occupied originally, as shown by the prick punch marks made prior to its removal. Now place the governor spider hub on the governor spider, centering it on the governor spider dowel and clamp in place with the three studs in the end of the crankshaft, being careful not to disturb the position of the governor spider on the crankshaft until secured in place.

Insert the spring post in the governor weight and assemble the regulating spring in place.

Next assemble the speed regulator yoke in position with the speed regulator adjusting screw, nut, ball bearing and spider hub bearing retainer and tighten the stud nuts securely.

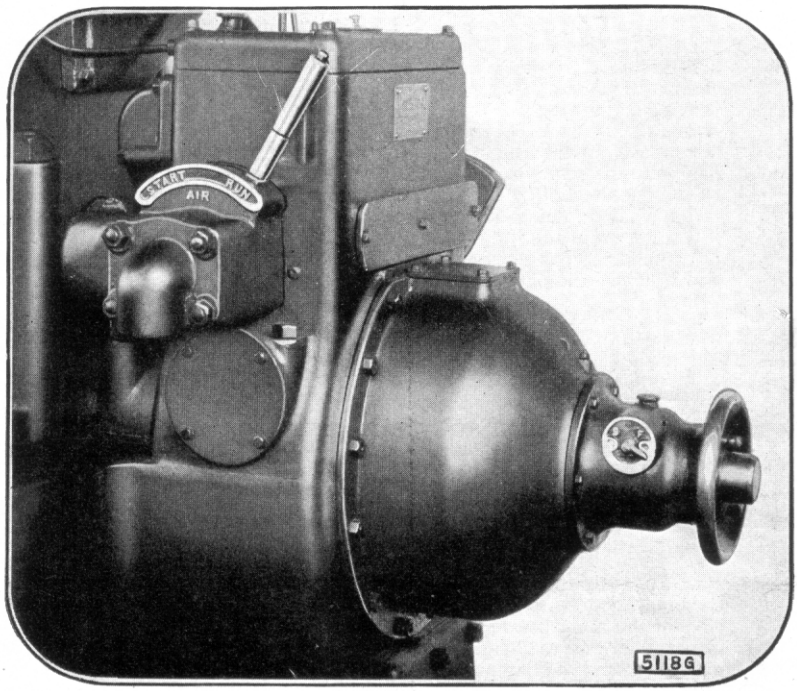
The synchronizer governor case should now be bolted in place. With the No. 1 piston at its upper dead center, mark a zero or other distinguishing mark on the governor spider hub dial, under the governor case timing pointer.

Now take out the flat head machine screws on the speed regulator dial and remove the pinion. Assemble the adjusting screw housing ,complete with the hand wheel, on the synchronizer governor case, then tighten the cap acrews.

Turn the hand wheel in a clockwise direction until the regulating spring has only a slight initial tension, then insert the indicator pinion with the hand pointing to zero on the dial. Fasten the dial screws.

Operating in Electrical Parallel

263. Two or more engines, driving generators, operating in electrical parallel, should each be equipped with a synchronizer. However, if all engines are not so equipped, the device should be attached to the engine or engines used to carry the peak load. It is the usual practice to synchronize the idle engine with the loaded engine, then, by means of the synchronizer, to adjust the speed of the incoming engine sufficiently to allow it to interlock electrically with the loaded engine. After the engines are once adjusted, only a slight change will be necessary when an engine is "thrown in." This change is necessary because of the different characteristics of the hot and cold generators.



SYNCHRONIZER WITH HAND WHEEL AND INDICATING DIAL (5118G)

ADJUSTMENT OF BEARINGS AND OTHER PARTS

Main Bearing Adjustment

264. **Main Bearings:** Adjustment of the main bearings is necessary when excessive play of the crank shaft can be detected. Vibration of the flywheel, when the engine is in operation, also may indicate a necessity for main bearing adjustment. To determine the actual bearing clearance and make the proper adjustment, proceed as follows: Loosen the bearing cap and insert a piece of soft lead wire between the journal and upper half of the bearing liner. Tighten the bearing cap in place, then remove it, and, with a micrometer, measure the thickness of the lead wire which will be the actual bearing clearance. Then add or remove sufficient shims from each side of the bearing to give .004″ to .006″ clearance. Finally replace the top half of the bearing and securely clamp it down again. After the adjustment is made and the engine is in operation, note from time to time whether the running temperature grows excessive.

Main Bearing Renewal

265. When the bearing cap and upper half of the bearing shell have been removed, the lower half may be rolled out after first relieving it of the pressure of the crankshaft by means of a jack under the flywheel or crankshaft. If the bearings do not roll out readily, drive them out by light hammer blows, using a wood driver to protect the bearings from being marred by the hammer. New liners, which will interchange with those on the engine, can be furnished from the factory. Allow from four one-thousandths (.004″) to six one-thousandths (.006″) of an inch clearance at the top of the bearings, when fitting new liners.

Crank Pin Bearing Adjustment

266. The crankpin bearing and box are separate from the connecting rod but are held securely to it by two large connecting rod bolts. The box and cap are lined with babbitt and may be replaced if necessary. It is not necessary to dismantle the connecting rod. Loosen the nuts on the connecting rod bolts about three-quarters of an inch, so that the shims can be slipped off their dowels. Remove from each side of the bearing one or more shims as may be necessary, allowing a clearance of from four one-thousandths to six one-thousandths of an inch. Then tighten the nuts, and be sure to replace the cotters in the ends of the bolts. See that the ends of the cotters are not cracked, so that they can be bent over without breaking.

Removing Crank Pin Bearing

267. With each engine, there are furnished two piston clamps 2600 for supporting the piston and connecting rod in the cylinder while the crank pin bearing is removed. When a crank pin bearing is to be removed, fasten these clamps to the holes in the bottom end of the cylinder wall, with the cap screws provided, allowing the end of the clamp to project upwards into the cylinder bore. As the engine is barred over, the piston will come into contact with these clamps which will support the piston and connecting rod. With the connecting rod bolt nuts removed, the crank pin bearing will slip off the connecting rod bolts as the engine continues to turn over. This manner of supporting the connecting rod and piston makes it unnecessary to remove the cylinder head and connecting rod when renewing the crank pin bearing. **Do not fail to remove the piston clamps** as soon as the crank pin bearing is reassembled, otherwise serious damage will result to the piston and the cylinder.

Piston Clamps

Removal of Cylinder Head Unnecessary

Fitting a Crank Pin Bearing Renewal

268. Always try a repair box and cap on the crank pin by hand to note whether they have sufficient end play (about 1/64 inch) and whether they spot up evenly on the surface. In any case, after new crank pin liners have been fitted to an engine, inspect them after running the engine for five or ten minutes with no load, and again after about a thirty minutes' run with full load. When the nuts are again drawn up, set them as tightly as possible. Always insert the cotter pins in the holes in the ends of the connecting rod bolts and spread the ends of the pins well apart. There are two holes in the bolts, for the cotter pins, either of which may be used, thus allowing a closer adjustment.

Wick Oiler

269. The crank pin bearing cap is fitted with a felt oil retainer which acts as an oil reservoir to furnish lubrication when the engine is started.

Air Stop Ring

270. **Air Stop Ring:** The air stop rings prevent the escape of air from the crank case, through the bearings. They are surfaced very carefully with the ends of the main bearings to secure tight joints. All of the rings are of the split type and may be removed without dismantling the engine. In case a ring becomes worn and tends to be noisy, this noise may be eliminated by adjusting the spring attached to the counterweight U-Bolt on 1, 2 and 3 cylinder engines or by tightening the driving set screw on 4 and 6 cylinder engines.

Crank Pin Oil Ring

271. **Crank Pin Oil Ring:** These rings collect lubricating oil from the force feed lubricator tube and deliver it to the crank pin bearings. They are of the split type and can be removed without dismantling the engine.

Piston Pin Removal

272. **Piston Pin:** The piston pin 7A is of hardened steel, ground to exact size. To remove it, take out the headless screw 4 and the spring from the piston pin boss and drive or pry out the dowel pin 6 which can be seen by looking into the hollow piston pin. Then drive the piston pin out of the piston toward the dowel end, which is slightly larger than the opposite end.

Assembling Connecting Rod and Piston

273. Carefully clean all the oil grooves and oil the bearing thoroughly before re-assembling. When replacing the parts, see that they are put in their original places, and particularly that the connecting rod has not been turned over in its relation to the piston. Mark each connecting rod with respect to its piston, so that they can be reassembled in their correct relation. The dowel pin end of the piston pin is always toward the flywheel.

Renewal of Piston Pin Bushing

274. If it becomes necessary, after long service, to replace the piston pin bearing liner, drill out the two dowels that hold it in position, remove the old bushing, and drive the new one into place. Two new holes then must be drilled for the dowels. To insure a good bearing for the piston pin, the bushing should be scraped, allowing clearances of not less than .016″ and preferably .020″ at the top of the pin and .008″ on each side. The bearing should extend over two-thirds of the lower part of the liner. Also, the bearing must be scraped so that

the piston will be properly aligned with the foot of the connecting rod. To facilitate checking the alignment, the skirt or lower surface of the piston is machined square with the cylindrical part. By placing a straight edge across the foot of the connecting rod parallel to the piston pin, the distance from the straight edge to the piston skirt may be measured on opposite sides of the piston. Equal distances indicate that the piston is properly aligned with the foot of the connecting rod. If the piston pin and bushing have been damaged by overheating, both should be renewed.

Piston Rings

275. Remove the pistons at regular intervals for inspection. The piston rings should work freely in their grooves. Wash out, with kerosene, any accumulation of carbon from the lubricating oil which tends to stick to the rings. If the rings are allowed to stick fast, the compression and explosion will blow past them, and the combustion will be poor, due to the weak compression. If the rings are gummed fast in the grooves, a hot solution, composed of one pound of lye to three gallons of boiling water, will assist in freeing them. Use this treatment only after the piston has been removed from the cylinder. Wash off the solution after the parts are loosened. Lubricate all parts thoroughly before replacing in the engine.

Crankshaft End Play

276. The end play of the crankshaft is adjusted at the factory by fixing the location of one of the cranks. A further adjustment, after long service, can be made by means of thin shims placed between the air stop ring and the shoulder of the crankshaft.

Removal of Air Check Valve

277. The air check valve may be removed from the cylinder without taking the head from the cylinder. Remove the combustion chamber and neck and the two cap screws holding the valve cage in place. Then through the hole in the head introduce a piece of ½ inch pipe or ¾ inch steel bar, placing one end against the air check valve while the engine is barred over to force the valve cage out.

CHECKING EXISTING INSTALLATIONS

Importance of Perfect Alignment

278. Sometimes a foundation settles or the bearings are replaced unevenly. **The importance of knowing that the crankshaft and the shaft extension are in perfect alignment cannot be over-estimated. If an imperfect alignment is neglected, serious damage to the engine may result.** In checking over an existing installation, go over very carefully the points referred to in paragraphs 27 and 33 to 43, inclusive, in so far as they apply.

Crankshaft Alignment

279. After taking off the end main bearing caps and upper shells, place the level on the journals thus exposed. Be sure that the level is parallel with the shaft and not crosswise, or rocking in the slightest degree. Note the location of the ends of the bubble, with respect to the graduations on the bubble tube. If the two end bearing journals do not level exactly alike, check the base as described in paragraph 34 to see if the base needs re-leveling. If such is the case, reset and re-align the whole engine in accordance with the instructions for new installations. Read paragraphs 43 and 44. Also see diagram 99YKA1 on page 7.

Base Alignment

Shaft Extension Alignment

280. If the crankshaft journals on the two end bearings level alike, adjust the shims under the outboard bearing, so that the level, when placed on the shaft extension, will indicate the same as it did on the crankshaft. This will fix the correct elevation of the outboard bearing. Its correct horizontal position can be determined best at the coupling 3 where the shaft extension bolts to the flywheel hub. Read paragraphs 41 and 42.

Crank Pin Alignment

281. The upper half of the crank pin bearing should have contact with the crank pin on two-thirds or more of its surface. It is important that the bearing shows an even distribution of the wear. A heavier contact on one end of the bearing may be due to imperfect alignment, and must be corrected by scraping the bearing on the high side.

OPERATING INSTRUCTIONS

1. Before Starting The Engine

The following instructions refer particularly to a first start, or to a start after a long period of shut-down. Subsequent starts will not require such detailed preparation.

Check the Alignment

282. Check the alignment of the engine. Read paragraphs 43 and 46.

Lubrication

283. Check the installation of the lubrication system. Read paragraphs 203 to 205 inclusive. Lubricate the engine as follows:

(a) Fill the lubricator. Use only a lubricating oil that falls within the specifications approved by Fairbanks, Morse & Co. Specifications may be obtained from the nearest branch house. Disconnect the longest lubricator tube at its connection to the engine, and crank the lubricator until oil is discharged. Reconnect the tube.

(b) Fill the governor case and main bearing oil wells to the level of the overflow pipe

(c) Fill the oil filter storage tank to the maximum level.

(d) Remove the crank case covers. Spread the air seal rings; distribute lubricating oil over their bearing surfaces; then release the rings. Turn each crank down and squirt oil into the crankpin oiler ring to insure lubrication to the crankpin bearing. Then replace the crankcase covers.

(e) Turn engine over a few times to distribute the oil.

(f) **Do not pour oil into the crankcases, they must be drained.**

Cooling Water

284. Check the installation of the cooling water system. Fill the water jackets and the reservoirs, tanks, etc., in the cooling system.

Compressed Air Supply

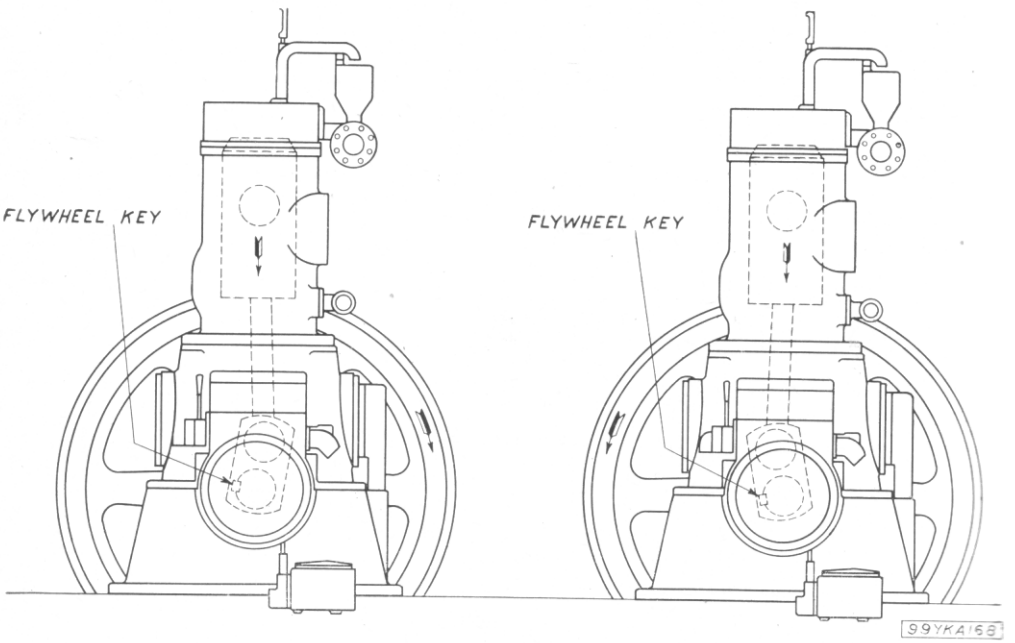
285. Check the installation of the air starting system. Charge air tanks to 225 pounds per square inch.

Fuel Supply

286. Check the installation of the fuel system. Fill the fuel supply tank. Remove the auxiliary fuel pump suction valve plug 2112 and suction valve 519A and fill the auxiliary fuel pump and suction pipe. Replace the valve and plug. Fill the fuel reservoir.

Priming

287. See paragraph 240 on priming. Then prime each cylinder in the following manner. Disconnect the injection tube at the pump, and prime until all air is expelled. Reconnect the tube, and disconnect at the nozzle, priming again until fuel is discharged. Remove the nozzle and connect to the injection tube;



STANDARD ROTATION — REVERSE ROTATION

DIRECTION OF ROTATION AND POSITION OF PISTON AND FLYWHEEL KEY FOR STARTING

then prime until fuel is discharged from the nozzle. Disconnect tube, screw nozzle into combustion chamber, and reconnect tube. With air control lever in "Run" position, prime several times into the cylinder.

Refer to supplementary instructions at end of book for priming Open Head engines.

In general no priming of the cylinders will be necessary for subsequent starts, except in extremely cold weather or when using a heavy grade of fuel oil.

Turn Flywheel to Starting Position

288. Refer to diagram 99YKA168 on page 52. The standard direction of rotation is clockwise, when looking at the engine from the governor end. See left half of diagram on page 52. With the relief valves in the cylinder heads open, turn the flywheel until the crank, nearest the governor, is about 10 degrees past the upper dead center. Determine the location of the crank in question by noting the location of the flywheel key.

Close Relief Valves

289. After the crank is properly set, close the relief valves.

2. Starting The Engine

Open the Air Supply Line

290. See that the air control lever is in the "Run" position. Then open the valves located directly over each air tank and also the shut off valve in the air supply line at the engine. See diagram 99Y6KA163 on page 34.

Starting Multi-Cylinder Engines

291. Before admitting air to the cylinders, set the **fuel** control lever in the "Run" position, then quickly throw the **air** control lever forward to the "Start" position. This permits the starting air supply to rush into the cylinders and turn the engine over. Ignition should occur as soon as the engine attains a good rotative speed. Return the **air** control lever to the "Run" position as soon as ignition occurs. Failure to fire is sometimes due to the insufficient priming of the injection tubes. To correct this condition, prime the tubes as directed in paragraph 287. After connecting the tubes again, it is well to prime each cylinder before starting. Read paragraph 240.

Starting Single Cylinder Engines

292. Single cylinder engines, especially in cold weather or when heavy oil is used for fuel, are more likely to require priming than multi-cylinder engines; also they start more promptly if the starting air supply is shut off as soon as the engine attains a good rotative speed. Therefore, after priming the cylinder as outlined in paragraph 240, and applying the starting air as described in paragraph 291, bring the **air** control lever back to the "Run" position and allow the engine to coast; i.e., to continue its rotation on the impulse of air just received. If ignition fails while the engine is coasting, repeat the operation above, always giving the cylinder a new impulse of air just before the engine stops.

Cold Weather Starting

293. When the engine has been exposed to very cold temperatures and the cylinders are below freezing point the cooling water must be circulated through the water jackets before attempting to start the engine. This will raise the temperature of the cylinder walls so that combustion can take place. The lubricating oil will be thick and heavy after exposure to severely cold temperatures, making the engines hard to start, but this condition can be considerably improved by turning the engine over several times by hand to break the thickened surface of the oil and to separate the metal surfaces that tend to stick, due to the thickening of the lubricant. The lubricator should also be operated by hand until the oil flows freely.

3. Running The Engine

Burn Excess Fuel

294. As soon as one or more ignitions have occurred, and the engine has come up to speed, bring the air control lever to the "RUN" position and close the shut-off valve in the air supply line. It may be necessary to move the fuel control lever slightly toward the "STOP" position until the excess fuel, which has been injected for starting, has been burned; then bring the fuel control lever back to the "RUN" position.

Fuel Supply

295. After the engine is running, see that the auxiliary fuel pump is working properly by observing the level of the fuel in the gauge glass on the fuel reservoir.

Lubrication

296. Lift the cover of each of the main bearing caps, and see that all of the main bearing oil rings are running properly. See that the lubricating pump is maintaining the oil in the lubricator to the level of the overflow. Check the

lubricator operation by observing the sight feeds. No set rules can be given regarding the required number of drops per minute, as conditions vary and different oils have different lubricating values. The following quantities will however usually suffice:

Engine Speed, R.P.M.	257	300	360
All Feeds, Drops per Min.	30	35	40

Checking Lubricator Feeds

296a. To check the lubricator feeds, first determine the number of impulses per minute made by the lubricator with the engine running at normal speed. Then divide the drops per minute by the impulses per minute to find the drops per impulse. With engine stopped, and while hand cranking lubricator, count the drops per impulse. If necessary, adjust feeds as explained in lubricator instruction book.

NOTE: The engines are shipped with a higher setting than given above, but no change should be made until the engine has been operated for 200 hours, when the feeds may be cut down gradually to the amount specified in the table.

Cooling System

297. Regulate the cooling water temperature as explained for the particular system being used.

Starting Air

298. Pump up the air pressure in the air tanks. In installations where the starting air compressor is driven from the main engine, pump the compressed air tanks up to the maximum pressure immediately after starting the engine. As soon as the tanks are up to this pressure, close all the valves in the air line and at the tanks, in order to prevent leakage. Before stopping the engine, see that the air tanks are up to the maximum pressure ready for the next start.

4. Stopping The Engine

Fuel Control Lever

299. To stop the engine, bring the fuel control lever to the "STOP" position.

Lubricate

300. While the engine is coming to a stop, turn the crank handle of the lubricator 25 or 30 revolutions, so that the pistons and the cylinders will be properly lubricated for the period of the shut-down, as well as for the next start.

5. After Stopping Engine

Open Compression Relief Valves

301. Open the compression relief valves.

Cool Cylinder

302. Continue the flow of the cooling water for five or ten minutes in order to cool the hot cylinders and pistons gradually.

Drain Jacket and Pipes

303. If there is the slightest danger of freezing, drain the water jackets, the water manifolds and the piping, otherwise a cracked cylinder or cylinder head will result.

Care of Engine When Not in Use

304. In case the engine is to remain idle **for very long periods,** it is advisable to lubricate the pistons and piston pins occasionally, by hand cranking the lubricator. Turn the engine over a few times following this lubricating; also drain the entire fuel system of all fuel and fill it with lubricating oil.

MAINTENANCE INSTRUCTIONS

Cleanliness

305. Cleanliness is a big asset in your business. A clean, well kept engine room is the best advertisement that your business can have, and it is our observation that clean, well kept plants have but little trouble with their machinery.

Inspection

306. Inspect the plant regularly. It is an excellent plan to have a regular inspection and maintenance routine. To assist operators in making up a suitable routine, the following suggestions are made.

1. Daily Routine:—

307. Under "Running the Engine," page 53 will be found certain duties which should be performed immediately after every start.

308. Inspect fuel level in storage tank.

309. Where gravity feed fuel regulator is used, inspect for leakage through air vent.

310. Inspect water levels in tanks, hot wells, etc., in cooling system.

311. Inspect levels in lubricating oil storage tank, lubricator, and main bearing oil wells.

312. Check the feeds of the lubricator. See paragraph 296.

313. **Watch bibb cocks at the governor end of crankcase. Be sure that they are kept slightly open, and that the pipes are not clogged. Under no circumstances should oil be allowed to accumulate in the crankcase.** Open the cocks wide for inspection, but do not leave them wide open as this will cause splashing in the sump.

314. When a Water Washed Exhaust Stack or Yankee Silencer is used, blow out the overflow line several times daily.

2. Weekly Routine:—

315. Clean injection nozzles. Boil the tips in lye to remove the carbon from the center hole and from the grooves in the spiral. Keep the spare, clean nozzles wrapped in an oily cloth, and they will be ready for use at any time.

316. Inspect and clean exhaust ports, points of thermocouples, and exhaust nozzles of accumulated carbon deposit.

317. Remove upper base hand hole covers immediately after engine is shut down. Check bearing temperatures by hand to determine if they are normal. Inspect pistons, cylinders, etc., for proper lubrication. Inspect crank pin oiler lubricator tubes. Examine connecting rod bearing bolts and cotter keys. Try connecting rod bearings with crowbar for looseness or weardown. Replace hand hole covers.

318. Clean the lubricating oil sump, strainers, etc., at the governor end of the engine. To drain this sump, raise the cover and unscrew the overflow pipe

319. Remove plugs from the bottom of the lubricator and test for water. Drain if any is found.

320. Drain air storage tank of water accumulation.

321. Clean the lubricating oil filter. See instruction card attached to filter

3. Monthly Routine:—

322. Clean fuel reservoir and all crank pits with kerosene. Reach well up into the scavenging air passages in the cylinders.

323. Clean air suction valves.

324. Drain water and sludge from lubricating oil and fuel oil tanks, using the drains provided for this purpose.

325. Drain the lubricator and wash out with kerosene.

4. Quarter Annual Routine:—

326. Remove cylinder inspection plates, and examine for scale. If any deposit is found, consult a reliable manufacturer of water softening systems for suitable treatment. Read paragraphs 84, 85, and 86.

327. Inspect all valves in the injection and auxiliary fuel pumps.

328. Drain entire lubricating system, and thoroughly wash out with kerosene all parts in which sediment might collect. This applies to the main bearing oil reservoirs, governor housing, oil storage tank, force feed lubricator, oil pumps and piping.

329. Wash out auxiliary fuel reservoir with kerosene.

330. Clean the exhaust system including conduit and stack.

331. Inspect the flywheel bolts for tightness.

5. Semi-Annual Routine:—

332. Pull pistons for inspection and cleaning. Remove rings and clean out carbon from grooves. Wash off with kerosene. Examine crank pin bearings and piston pin bearings.

333. Examine cylinder walls. When cleaning cylinders, place a large piece of canvas over the particular crank and main bearings to keep carbon from dropping on them. Clean exhaust ports at this time, too.

333a. Inspect the inner surface of the exhaust port bridges and of the cylinder wall adjacent to the ports. There is a tendency for the cast iron around the exhaust ports to grow due to the heat of the exhaust gases, and this surface must be relieved several thousandths of an inch below the general bore of the cylinder. See "Cylinder Exhaust Port Relief" below.

334. Inspect and clean all water piping, circulating pumps and cooling equipment.

6. Annual Routine:—

335. Check the crankshaft and engine for alignment; also driven apparatus.

336. Clean the main fuel tank with boiling water and washing soda.

7. Routine Dependent Upon Installation:—

337. Clean air filter every 4 to 8 weeks depending upon conditions. See paragraph 183.

338. If any water shows in main bearing oil gauge, lubricator or lubricating oil storage tank gauge glass, drain it off.

339. When recirculated raw water is used in the secondary circuit of a closed cooling system, the secondary circuit should be entirely drained and refilled with fresh water at frequent intervals. The condition of the cooling coils or tubular cooler should also be observed from time to time to see that no scale is forming.

Cylinder Exhaust Port Relief

The inner surface of the exhaust port bridges and of the cylinder wall adjacent to these ports is relieved several thousandths of an inch below the general bore of the cylinder. This is done to offset the growth of cast iron around these ports due to the heat of the exhaust gases.

When the pistons are pulled for the semi-annual inspection and cleaning, or at any other time when the pistons are removed, the cylinder walls should also be examined to see that this relief is being maintained. Use a straight edge and feelers to measure the relief. If the cast iron has grown so that there is very little or no relief, carefully scrape or grind the surface until the relief is from .0045″ to .0055″ on 12″x15″ engines and from .0075″ to .009″ below the general bore of the cylinder. This relief should exist over the surface of the bridges and for approximately ¾″ above and at the side edges of the ports and 1½″ below, from where it should taper gradually to the general surface of the cylinder wall, the taper to extend from 1″ to 1¼″.

Since the relief is provided to allow for growth of the cast iron, it is not expected that the relief will remain at the same depth, nor is it necessary that it do so, but it is absolutely necessary to keep the relief several thousandths of an inch below the general surface of the cylinder walls to offset further growth.

Instructions for Ordering Repair Parts

To obtain the proper parts without delay, be sure to give the complete description of the part, or parts, wanted as shown in the following example:

1. Quantity of parts wanted, "one"
2. Repair number, "3F."
3. Name of part, "cylinder head."
4. Cylinder number, "No. 2."
5. Size of engine, "360 H.P."
6. Type of engine, "Stationary Diesel."
7. Engine serial number, "576189."

Description of Part

The repair order, in this case, should read: "One 3F, cylinder head, for No. 2 cylinder, 360 H.P. Stationary Diesel engine, serial number "576189."

Repair Order

Important: The most important items of the above information are the repair number and the engine serial number. The latter is stamped on the upper face of the lower base on the exhaust side of the engine at the governor end. The cylinders are numbered, 1, 2, 3, etc., beginning at the governor end.

Engine Serial Number

How to Use the Repair List and the Repair Charts.

The first column at the left on each page shows the repair numbers of all complete groups and all separate parts, arranged in numerical order.

Numerical Arrangement

The repair number, when shown in bold-face type and followed by a dash and the letter "C" (indicating complete), is a group number which covers all the items to the next horizontal line.

Complete Group

The second column from the left contains the repair numbers of all of the parts included in each of these groups.

"Group Part" Column

Parts, which are followed by the words "always with," are **not** furnished separately, but only with the parts included within the brackets.

Bracketed Group

When a part is shown with its repair number in numerical order (in the first column), the "Included in Group" column will indicate whether this part is also included in another group.

"Included in Group" Column

The number of parts used in each group is shown in the "Number Used" column. The **total** number of parts used is shown when the part is arranged in numerical order.

"Number Used" Column

The repair charts show all the parts which have repair numbers. The part wanted can be found by locating its repair number on the repair chart, and the name of the part then found by locating the same repair number, in numerical order, in the repair list.

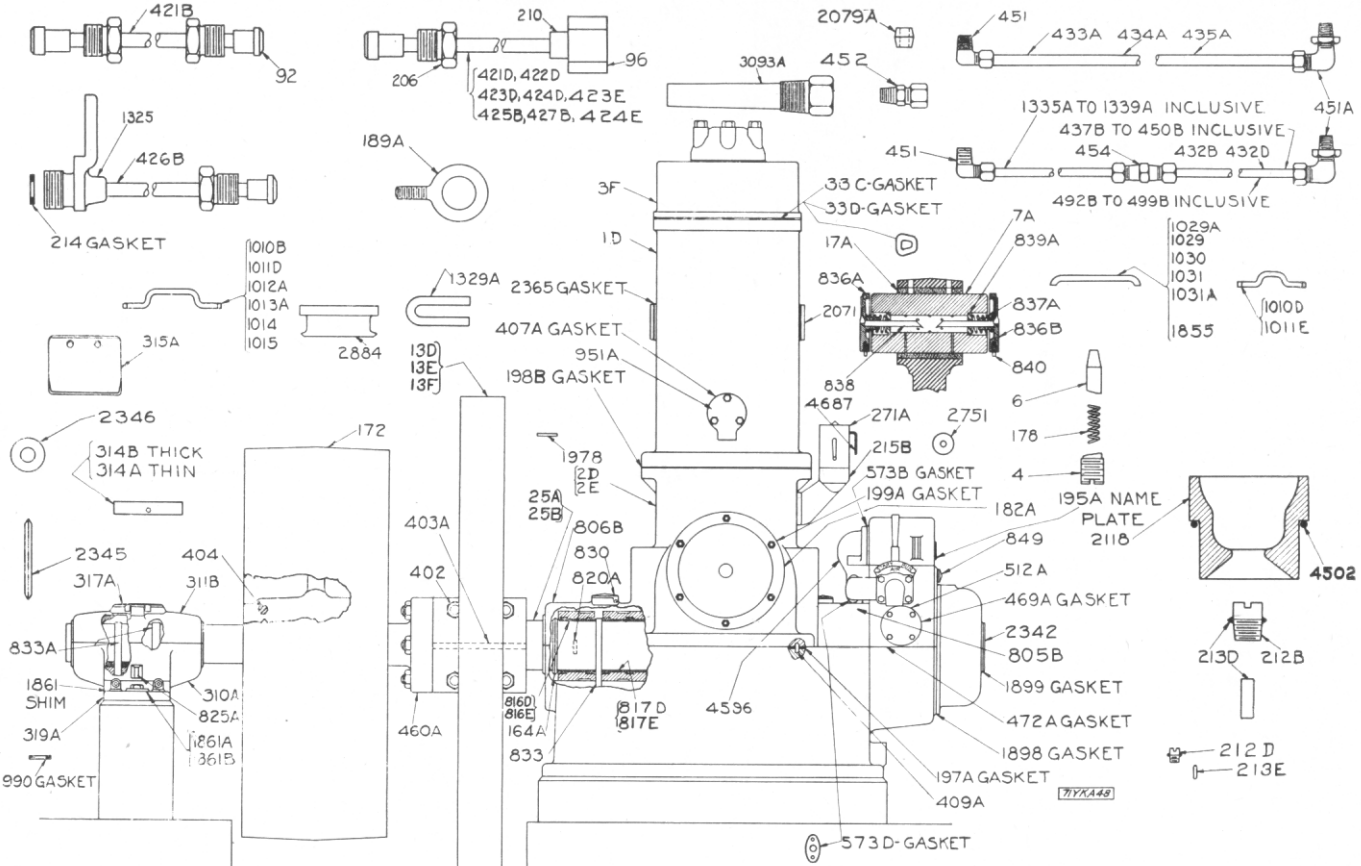
Repair Charts

Always order by group number if possible. Before doing so, carefully check over the group to make sure that all parts included therein are wanted, for they will all be furnished unless otherwise specified. If it is found that in a group all parts but one or two are wanted, order the group and specify "less" the repair numbers not wanted. For example, if in the 5B-C group every part is wanted except the piston rings, the order should read: "5B-C piston less rings 8B."

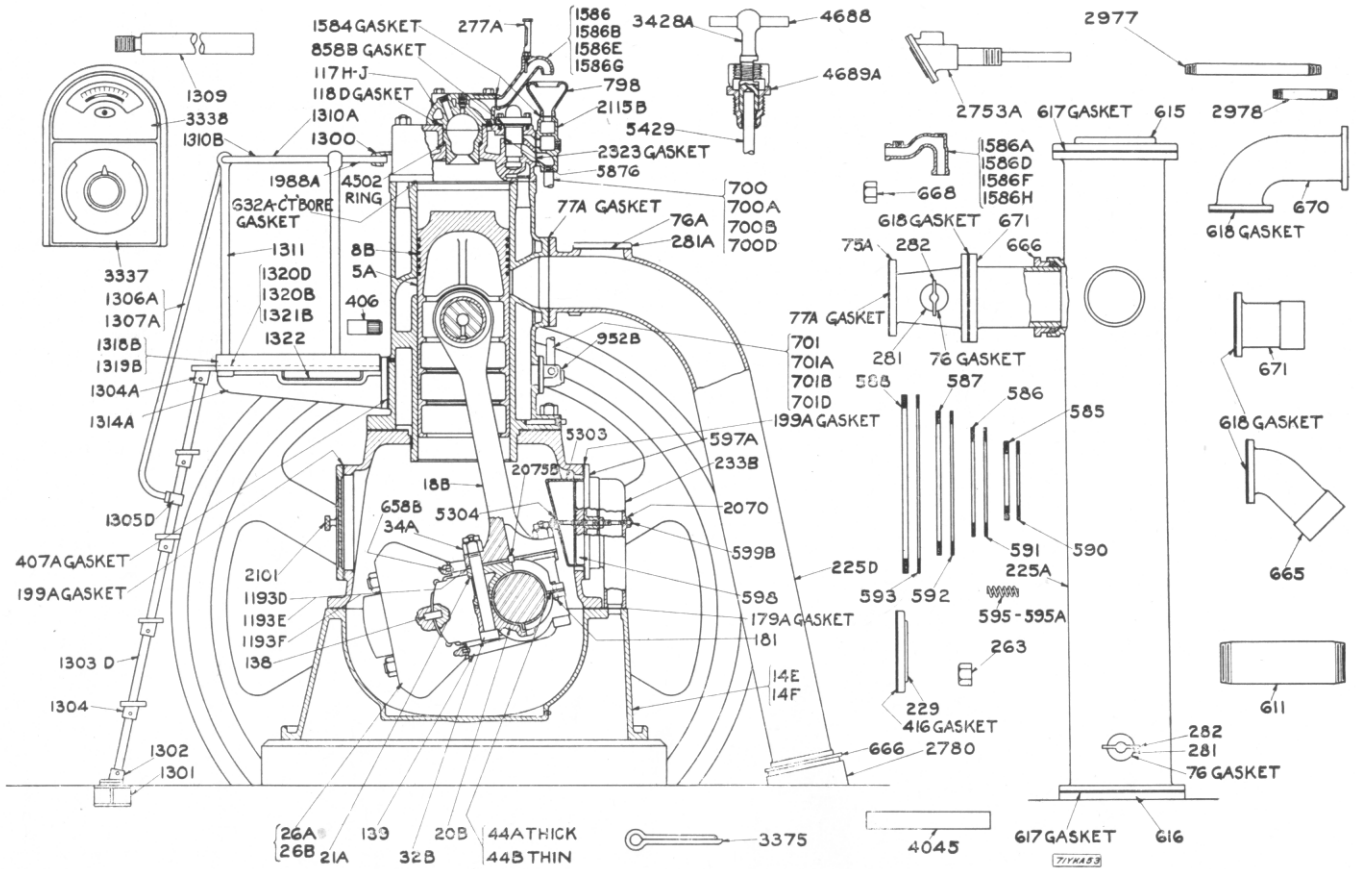
Ordering by Groups

If any part without a repair number is wanted, such as a stud, cap screw, bolt, etc., refer to the repair chart and find the number of the part with which it is used. Then by referring to the repair list, the part without a repair number will be found following the numbered part with which it is used. In some cases, the part without a repair number will be found following the numbered part in the numerical arrangement of the repair numbers. Use the name and the size of the parts, as shown in the repair list, when ordering parts which have no repair numbers. If the size of these parts is the same on all sizes of the product, only one dimension is shown following the part (in the "NAME OF PART" column) when arranged in numerical order. If the sizes of the parts without repair numbers are different, each dimension is listed in the same order as in the "Number Used" column.

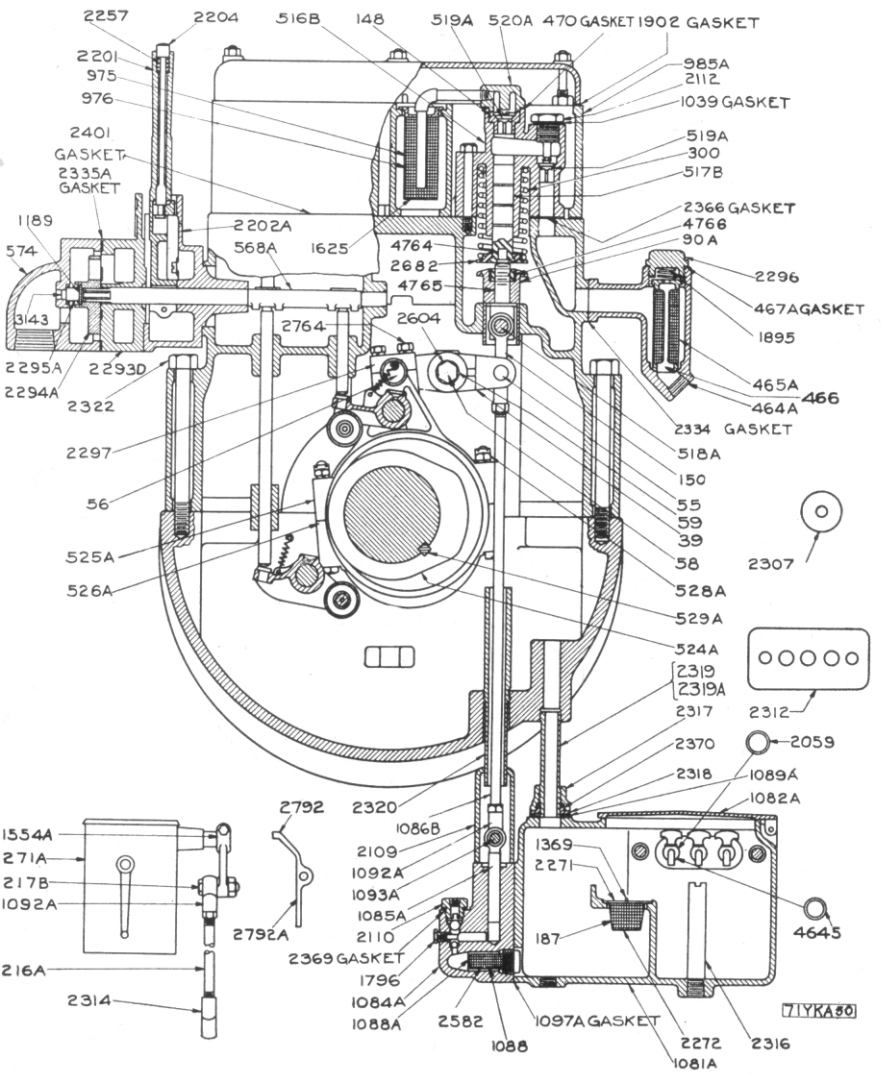
Parts Without Repair Numbers



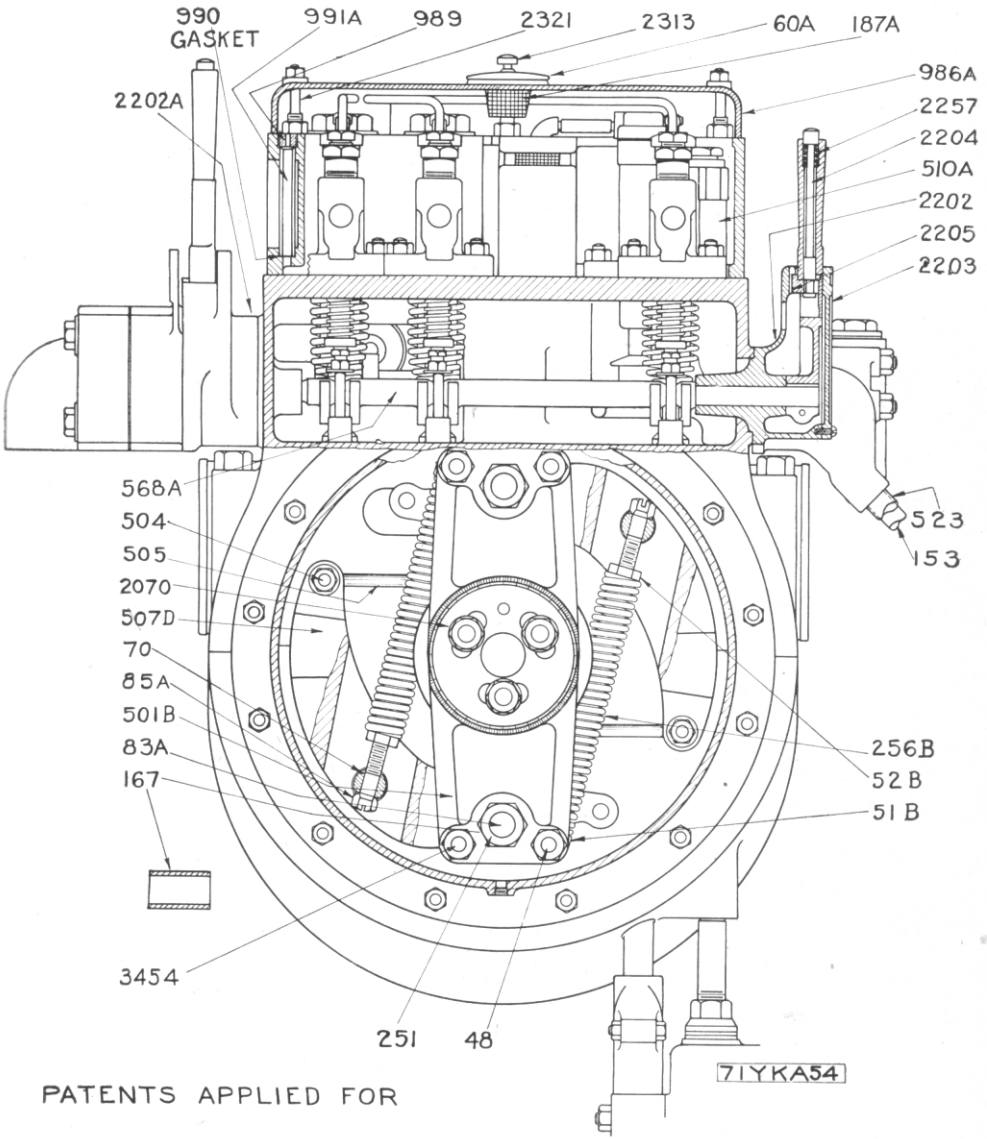
REPAIR CHART (71YKA48)



REPAIR CHART (71YKA53)



REPAIR CHART (71YKA50)



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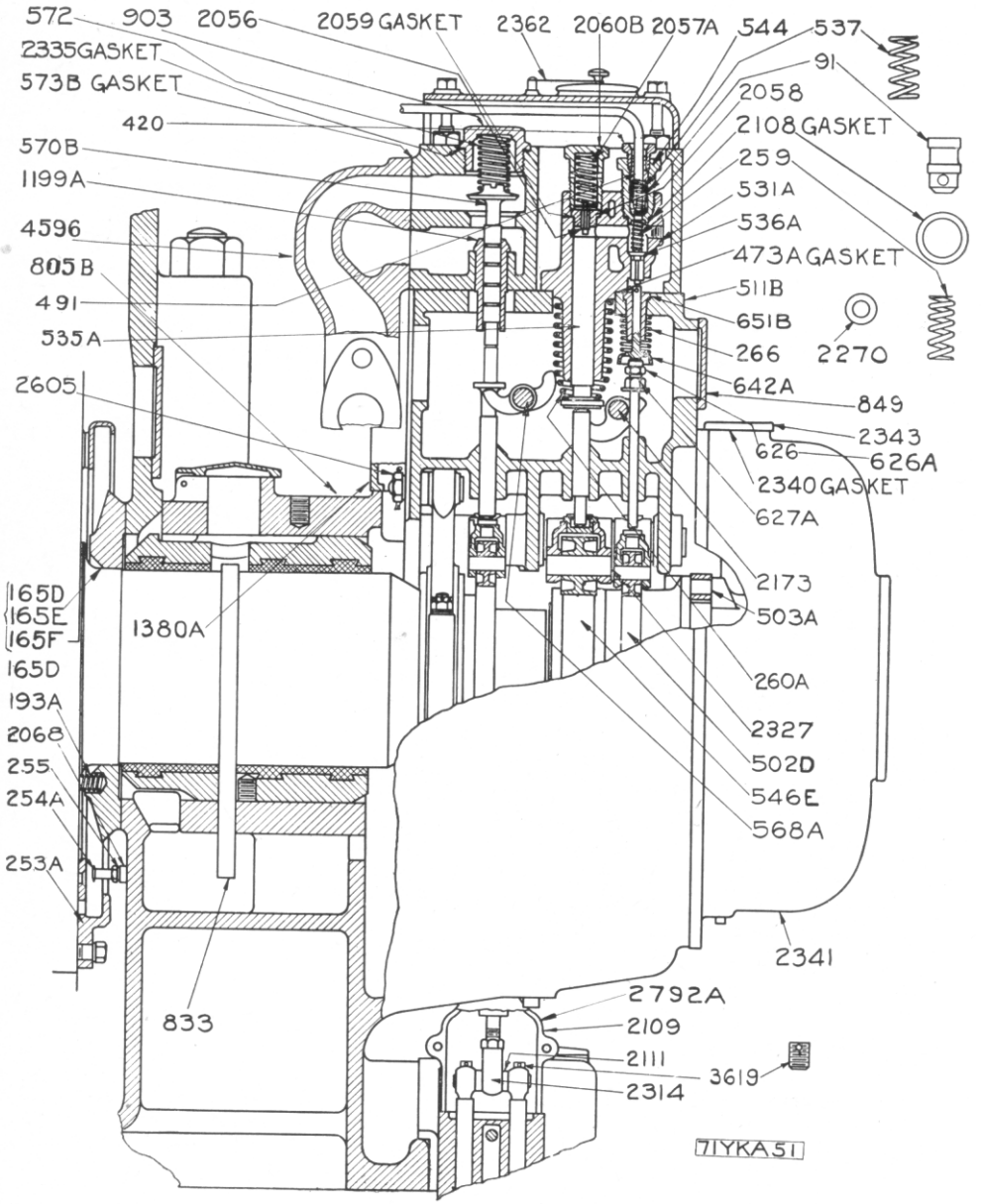
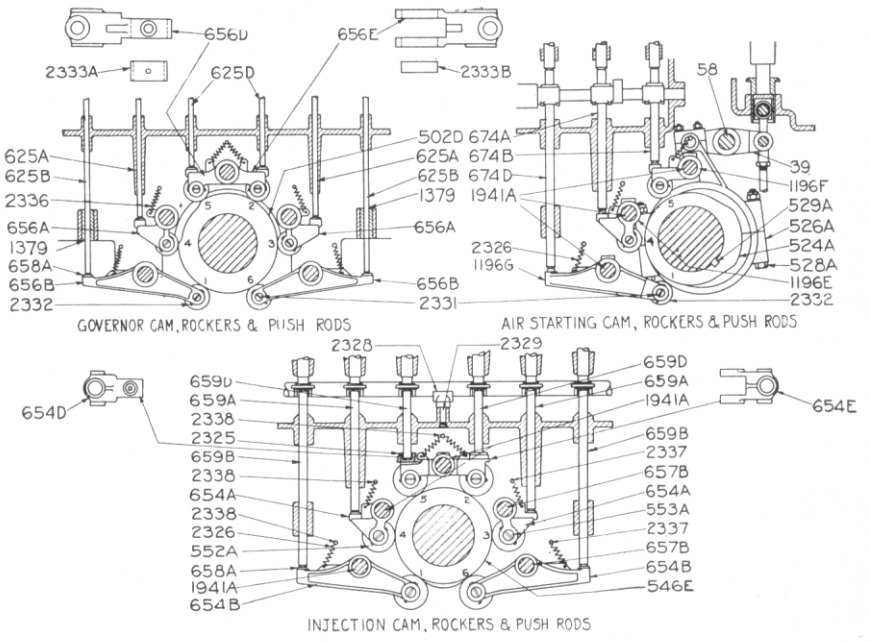
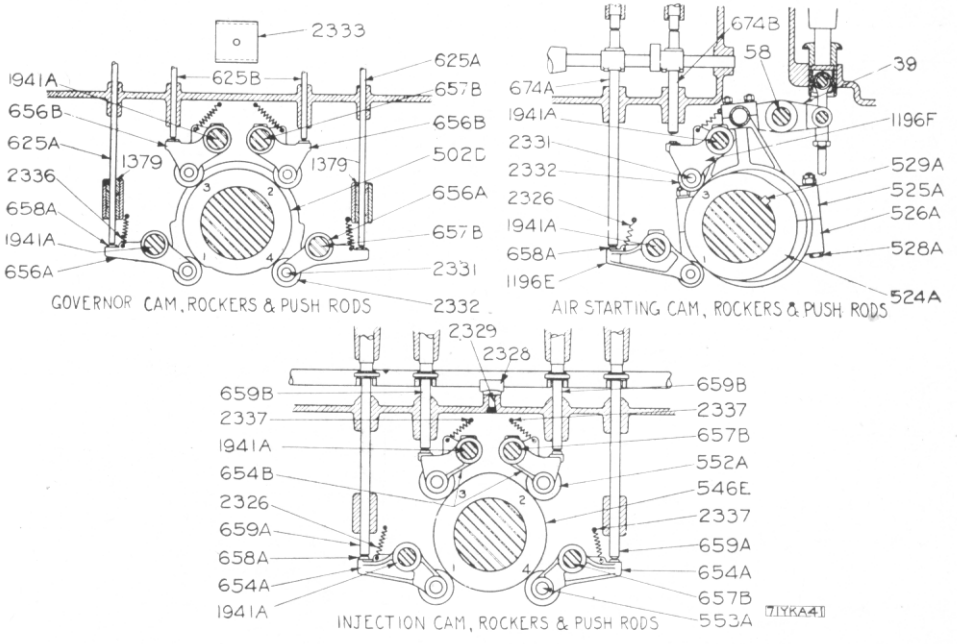


REPAIR CHART (71YKA51)



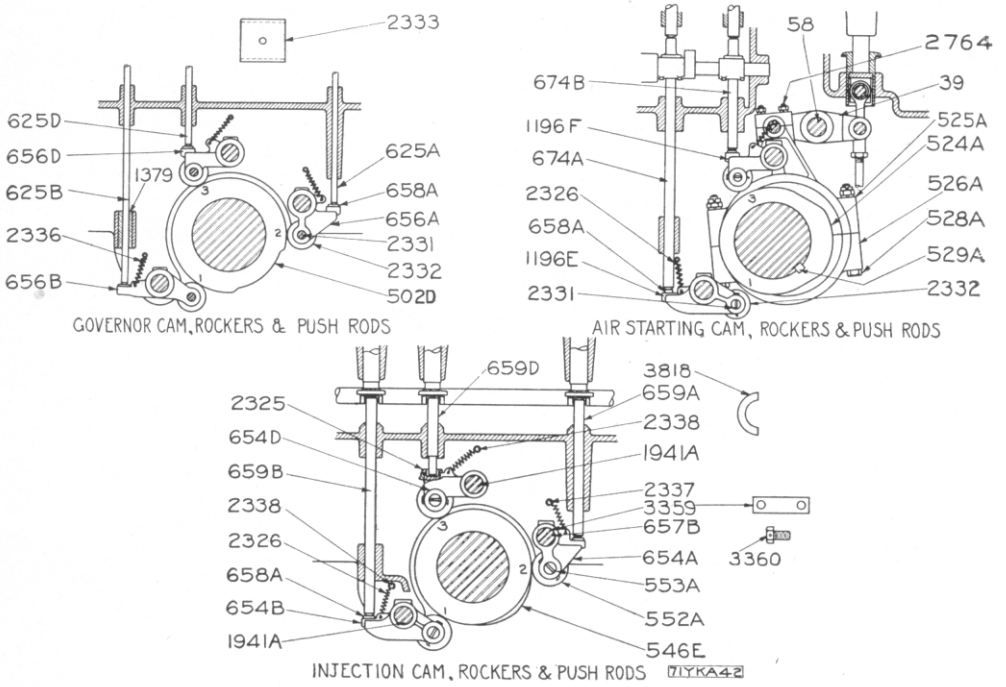
(71YKA40)

SECTIONAL VIEW OF GOVERNOR, AIR AND INJECTION CAMS FOR SIX CYLINDER ENGINES

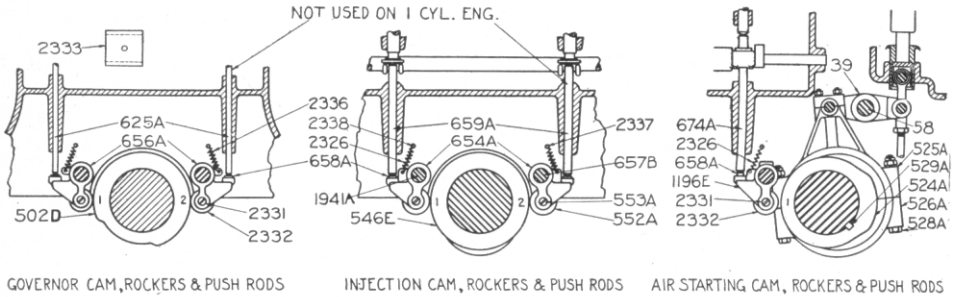


(71YKA41)

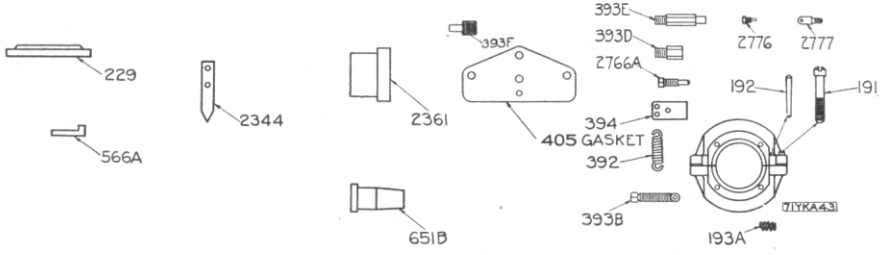
SECTIONAL VIEW OF GOVERNOR, AIR AND INJECTION CAMS FOR FOUR CYLINDER ENGIN



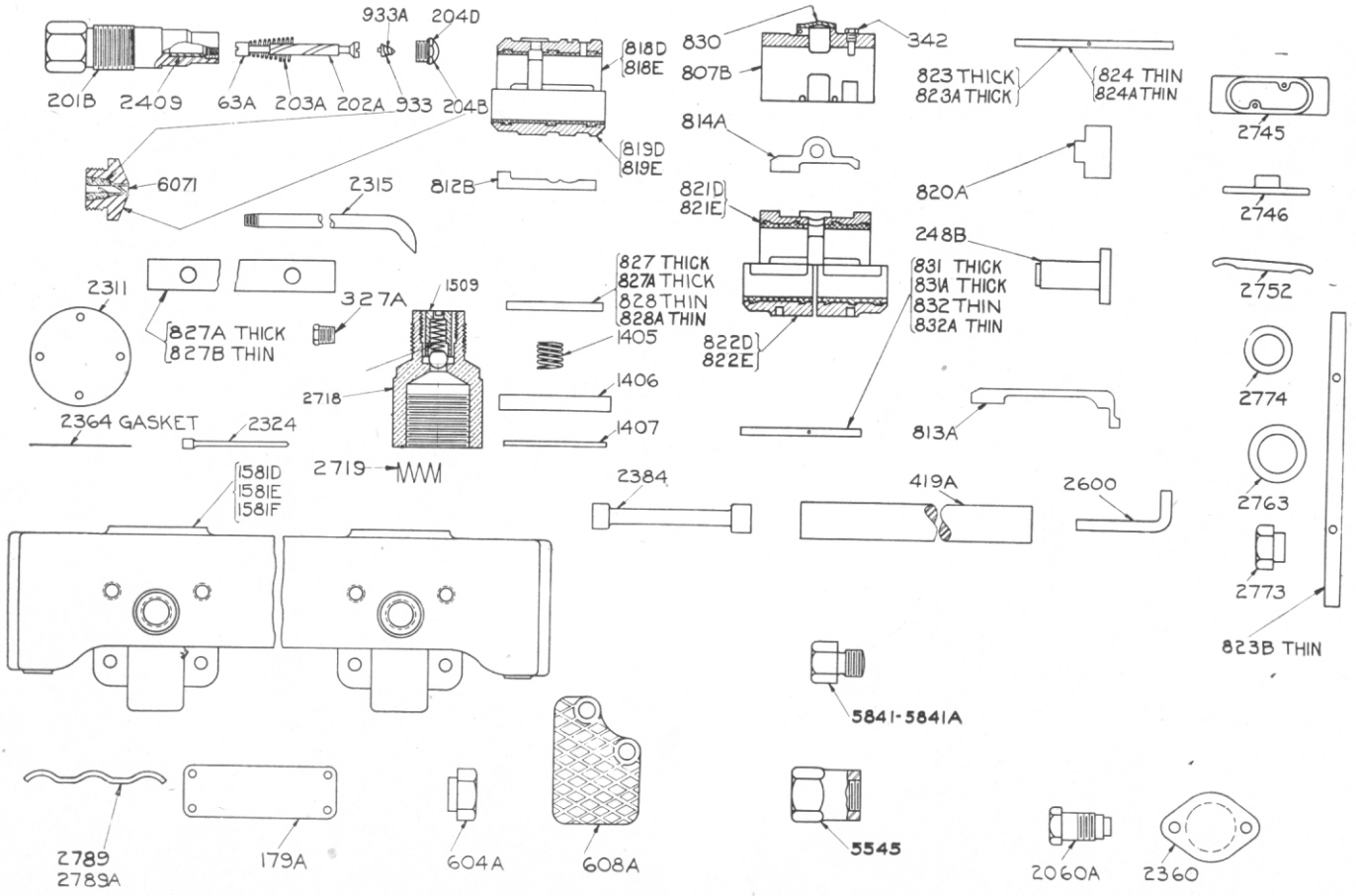
(71YKA42)
SECTIONAL VIEW OF GOVERNOR, AIR AND INJECTION CAMS FOR THREE CYLINDER ENGINES



GOVERNOR, INJECTION & AIR SECTIONS ON 1 & 2 CYLINDER ENGINES

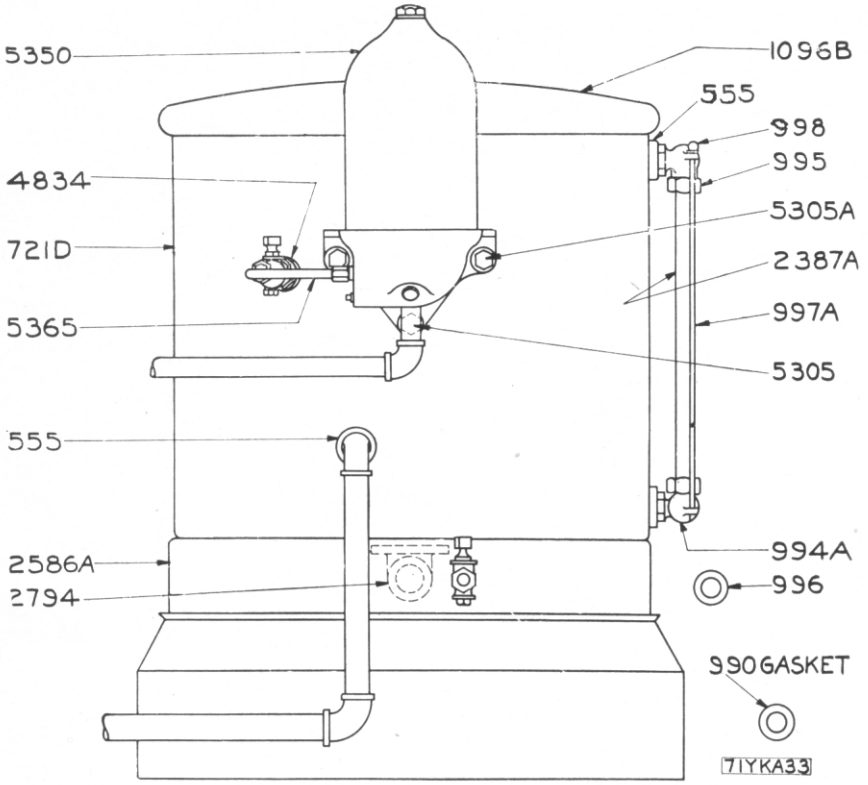


(71YKA43)
SECTIONAL VIEWS OF GOVERNOR, INJECTION AND AIR CAMS FOR ONE AND TWO CYLINDER ENGINES, WITH MISCELLANEOUS PARTS

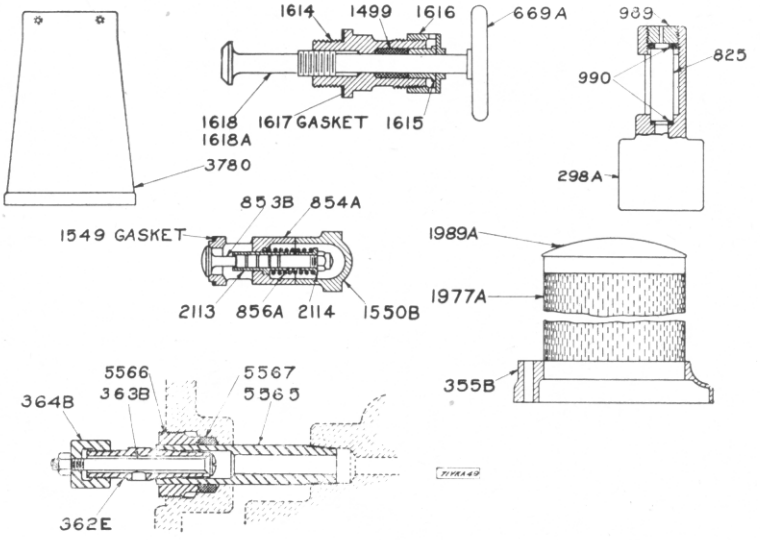


REPAIR CHART

(71YKA52)



REPAIR CHART (71YKA33



REPAIR CHART (71YKA49

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
1D-C		**1D-C Cylinder**		**1**	**2**	**3**	**4**	**6**
	1D	Cylinder, Always with		1	2	3	4	6
		Cylinder Head Stud (12x15)		8	16			
1D		Cylinder Head Stud (14x17)		10	20	30	40	60
		Exhaust Pipe Stud (12x15)		8	16			
		Exhaust Pipe Stud (14x17)		12	24	36	48	72
		Countersunk Pipe Plug (12x15)		4	8			
		Countersunk Pipe Plug (14x17)		4	8	12	16	24
	951A	Core Hole Cover		1				
	407A	Core Hole Cover Gasket		1				
	2071	Exhaust Hand Hole Cover		2	4	6	8	12
	2365	Exhaust Hand Hole Cover Gasket		2	4	6	8	12
	5A-C	Piston		1	2	3	4	6
		Exhaust Hand Hole Cover Cap Screw		8	16	24	32	48
		Core Hole Cover Cap Screw		3				
		Cylinder Head Stud, 1½"x11½" (12x15)	1D-C	8	16			
		Cylinder Head Stud, 1½"x12¼" (14x17)	1D-C	10	20	30	40	60
		Cylinder Head Stud Nut, 1½" (12x15)		6	12			
		Cylinder Head Stud Nut 1½" (14x17)		8	16	24	32	48
		Exhaust Pipe Stud ¾"x2¾" (12x15)	1D-C	8	16			
		Exhaust Pipe Stud ¾"x2¾" (14x17)	1D-C	12	24	36	48	72
		Countersunk Pipe Plug 1½" (12x15)		2	4			
		Countersunk Pipe Plug, 2"		2	4	6	8	12
		Countersunk Pipe Plug, 2½" (14x17)		2	4	6	8	12
		Cylinder Drain Pipe, 1"x26⅜" (12x15)			1			
		Cylinder Drain Pipe, 1"x30½" (14x17)			1	2	3	5
		Cylinder Drain Pipe Plug ¾" (12x15)		1	2			
		Cylinder Stud Core Hole Pipe Plug ¾" (12x15)		2	4			
		Drain Pipe Nipple, 1½"x7½"		1				
		Drain Pipe Nipple, 1"x4½"		1				
		Drain Pipe Nipple, 2"x5½"			1		1	
		Drain Pipe Nipple, 1"x5"		1	2	2	2	2
		Drain Pipe Nipple, 1"x2½"		1	1	1	1	1
		Drain Pipe Nipple, 2½"x5½"				1		1
		Drain Pipe Tee, 2"x2"x1"			1		1	
		Drain Pipe Tee, 1"		1	1	1	1	1
		Drain Pipe Tee, 2½"x2½"x1"				1		1
		Drain Pipe R. R. Union, 1"		1	1	1	1	1
		Drain Pipe Tee, 1½"x1½"x1"		1				
		Drain Pipe Globe Valve, 1"		1	1	1	1	1
		Cylinder Jacket Drain Nipple ¾"x2"		1	2	3	4	6
		Cylinder Jacket Drain Tee ¾"			2	3	4	6
		Cylinder Jacket Drain Close Nipple ¾"			2	3	4	6
		Cylinder Jacket Drain R. R. Union ¾"			1	2	3	5
		Cylinder Jacket Drain Pipe ¾"x24½" (12x15)			1			
		Cylinder Jacket Drain Pipe ¾"x28½" (14x17)			1	2	3	5
		Cylinder Jacket Drain Pipe Plug ¾"			1	1	1	1
		Cylinder Jacket Drain Globe Valve ¾"		1	1	1	1	1
2D-C		**2D-C Upper Base—Cylinder No. 1**	**14E-C 14F-C**	**1**	**1**	**1**	**1**	**1**
	2D	Upper Base, Always with		1	1	1	1	1
2D		Upper Base Cylinder Stud		11	11	11	11	11
		Upper Base Hand Hole Cover Stud		6	6	6	6	6
		Upper Base Air Valve Seat Stud		6	6	6	6	6
	327A	Upper Base Crankpin Oiler Pipe Plug		3	3	3	3	3
	255	Upper Base Crank Pin Oiler Washer		1	1	1	1	1
	2311	Upper Base Side Hand Hole Cover		2	2	2	2	2
	2364	Upper Base Side Hand Hole Cover Gasket		2	2	2	2	2
		Upper Base Side Hand Hole Cover Cap Screw		8	8	8	8	8
	409A	Upper Base Lower Base Dowel		4	4	4	4	4
	604A	Upper Base Cylinder Stud Nut		4				
	2763	Upper Base Cylinder Stud Washer		2				
	2773	Lower Step Nut		2				
	2774	Lower Step Washer		2				
2E-C		**2E-C Upper Base—Cylinders No. 2, 3, 4, 5 and 6**	**14E-C 14F-C**	....	**1**	**2**	**3**	**5**
	2E	Upper Base, Always with		....	1	2	3	5
2E		Upper Base Cylinder Stud		....	11	22	33	55
		Upper Base Hand Hole Cover Stud		....	6	12	18	30
		Upper Base Air Valve Seat Stud		....	6	12	18	30
	327A	Upper Base Crankpin Oiler Pipe Plug		....	3	6	9	21
	255	Upper Base Crankpin Oiler Washer		....	1	2	3	5
	2311	Upper Base Side Hand Hole Cover		....	2	4	6	10
	2364	Upper Base Side Hand Hole Cover Gasket		....	2	4	6	10
		Upper Base Side Hand Hole Cover Cap Screw		....	8	16	24	40
	409A	Upper Base Lower Base Dowel		....	4	8	12	20
		Upper Base Cylinder Stud, 1⅜"x5½" (12x15)	2D-C 2E-C	12	24			
		Upper Base Cylinder Stud, 1½"x5¾" (14x17)	2D-C 2E-C	12	24	36	48	72
		Upper Base Cylinder Stud Nut, 1⅜" (12x15)		8	24			

ALWAYS GIVE ENGINE SERIAL NUMBER

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in	Number Used				
Arranged Numerically	Group Part	NAME OF PART	Group	1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
		Upper Base Cylinder Stud Nut, 1½" (14x17)		8	24	36	48	72
		Upper Base Hand Hole Cover Stud, ⅝"x2¼"	2D-C, 2E-C	6	12	18	24	36
		Upper Base Hand Hole Cover Stud Nut, ⅝"		6	12	18	24	36
		Upper Base Air Valve Seat Stud, ⅝"x2¼"	2D-C, 2E-C	6	12	18	24	36
		Upper Base Air Valve Seat Stud Nut, ⅝"		6	12	18	24	36
		Upper Base Lower Base Dowel Nut, ⅞"		4	8	12	16	24
3F-C		**3F-C Cylinder Head**		**1**	**2**	**3**	**4**	**6**
3F	3F	Cylinder Head, Always with		1	2	3	4	6
		Cylinder Head Combustion Chamber Stud		6	12	18	24	36
	5876	Air Start Check Valve Tube		1	2	3	4	6
		Cyl. Hd. Combustion Chamber Stud, 1"x7¼" (12x15)	3F-C	6	12			
		Cyl. Hd. Combustion Chamber Stud, 1⅛"x7½" (14x17)	3F-C	6	12	18	24	36
		Cyl. Hd. Combustion Chamber Stud Nut, 1" (12x15)		6	12			
		Cyl. Hd. Combustion Chamber Stud Nut, 1⅛" (14x17)		6	12	18	24	36
4		Piston Pin Dowel Screw	5B-C	1	2	3	4	6
5B-C		**5B-C Piston**	**1D-C**	**1**	**2**	**3**	**4**	**6**
5B	5B	Piston with Ring Dowel 406		1	2	3	4	6
6	6	Piston Pin Dowel		1	2	3	4	6
	178	Piston Pin Dowel Spring		1	2	3	4	6
	4	Piston Pin Dowel Screw		1	2	3	4	6
	8B	Piston Ring		6	12	18	24	36
	7A-C	Piston Pin		1	2	3	4	6
7A-C		**7A-C Piston Pin**	**5B-C**	**1**	**2**	**3**	**4**	**6**
7A	7A	Piston Pin with Guides 839A		1	2	3	4	6
	836A	Piston Pin Oil Scraper, Always with		1	2	3	4	6
	838	Piston Pin Oil Scraper Pipe (Not furnished separately)		1	2	3	4	6
	840	Piston Pin Oil Scraper Dowel		1	2	3	4	6
	836B	Piston Pin Oil Scraper, Always with		1	2	3	4	6
	838	Piston Pin Oil Scraper Pipe (Not furnished separately)		1	2	3	4	6
	840	Piston Pin Oil Scraper Dowel		1	2	3	4	6
	837A	Piston Pin Oil Scraper Spring		2	4	6	8	12
8B		Piston Ring	5B-C	6	12	18	24	36
13D-C		**13D-C Flywheel**		**1**	**1**	**1**	**1**	**1**
	13D	Flywheel, Always with (Belted Commercial)		1	1	1	1	1
	13E	Flywheel, Always with (Belted Electric)		1	1	1	1	1
	13F	Flywheel, Always with (Direct Con. Electric)		1	1	1	1	1
13B	402	Flywheel Hub Bolt		4	4	4	4	4
		Flywheel Hub Bolt Nut		8	8	8	8	8
		Flywheel Shaft Extension Stud		6	6	6	6	
		Flywheel Flexible Coupling Stud						12
	403A	Flywheel Key		1	1	1	1	1
		Flywheel Shaft Extension Stud, 1¼"x6" (12x15)	13B-C	6	6			
		Flywheel Shaft Extension Stud, 1½"x6¾" (14x17)	13B-C	6	6	6	6	
		Flywheel Flexible Coupling Stud, 1½"x5" (14x17)	13B-C					6
		Flywheel Flexible Coupling Stud Nut, 1½" (14x17)						6
		Flywheel Shaft Extension Stud Nut, 1¼" (12x15)		6	6			
		Flywheel Shaft Extension Stud Nut, 1½" (14x17)		6	6	6	6	
14E-C		**14E-C Lower Base (14x17)**		**1**	**1**	**1**	**1**	**1**
	14E	Lower Base, Always with		1	1	1	1	1
		Lower Base Upper Base Stud		12	24	36	48	72
		Lower Base Upper Base Stud Nut		12	24	36	48	72
		Lower Base Upper Base Stud		4	8	12	16	24
		Lower Base Upper Base Stud Nut		4	8	12	16	24
		Lower Base Main Bearing Cap Stud (Governor end)		2	2	2	2	2
		Lower Base Main Bearing Cap Stud Nut (Gov. end)		2	2	2	2	2
		Lower Base Main Bearing Cap Stud (Center)			2	4	6	10
		Lower Base Main Bearing Cap Stud Nut (Center)			2	4	6	10
		Lower Base Main Bearing Cap Stud (Opp. gov. end)		4	4	4	4	4
		Lower Base Main Bearing Cap Stud Nut (Opp.gov.end)		4	4	4	4	4
		Lower Base Governor Case Stud		6	6	6	6	6
		Lower Base Lubricating Oil Sump Stud		2	2	2	2	2
		Lower Base Governor Drain Pipe Plug		1	1	1	1	1
		Lower Base Oil Catcher Drain Pipe Plug		1	1	1	1	1
	2068	Lower Base Crank Pin Oiler Bracket		1	2	3	4	6
	254A	Lower Base Crank Pin Oiler Spout		1	2	3	4	6
		Lower Base Crank Pin Oiler Fitting		2	4	6	8	12
		Lower Base Crank Pin Oiler Tube		1	2	3	4	6
		Lower Base Crank Pin Oiler Bracket Cap Screw		2	4	6	8	12
		Lower Base Crank Pin Oiler Bracket Lockwasher		2	4	6	8	12
	812B	Main Bearing Shell Oil Stop (Governor end)		2	2	2	2	2
	813A	Main Bearing Shell Oil Stop (Opposite governor end)		2	2	2	2	2
	814A	Main Bearing Shell Oil Stop (Center)			2	4	6	10
	805B-C	Main Bearing Cap (Governor end)		1	1	1	1	1
	806B-C	Main Bearing Cap (Opposite governor end)		1	1	1	1	1
	807B-C	Main Bearing Cap (Center)			1	2	3	5

(Group Continued on Next Page)

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
		Main Bearing Oil Piping (Not furnished separately)		1	1	1	1	1
		Crank Case Oil Drain Piping (Not furn. separately)		1	1	1	1	1
	298A-C	Main Bearing Oil Gauge		1	1	1	2	2
	355B-C	Lower Base Air Inlet Flange		1	1	1	2	2
	2D-C	Upper Base—Cylinder No. 1		1	1	1	1	1
14E	2E-C	Upper Base—Cylinders No. 2, 3, 4, 5 and 6		....	1	2	3	5
	197A	Upper Base Lower Base Gasket		2	4	6	8	12
		Upper Base Cylinder Stud Nut		8	24	36	48	72
		Upper Base Lower Base Dowel Nut		4	8	12	16	24
		Lower Base Countersunk Pipe Plug		1	2	3	3	5
14F-C		**14F-C Lower Base (12x15)**		**1**	**1**			
	14F	Lower Base, Always with		1	1			
		Lower Base Upper Base Stud		10	20			
		Lower Base Upper Base Stud Nut		10	20			
		Lower Base Upper Base Stud		4	8			
		Lower Base Upper Base Stud Nut		4	8			
		Lower Base Main Bearing Cap Stud (Governor end)		2	2			
		Lower Base Main Bearing Cap Stud Nut (Gov. end)		2	2			
		Lower Base Main Bearing Cap Stud (Center)		....	2			
		Lower Base Main Bearing Cap Stud Nut (Center)		....	2			
		Lower Base Main Bearing Cap Stud (Opp. gov. end)		4	4			
		Lower Base Main Bearing Cap Stud Nut (Opp. gov. end)		4	4			
		Lower Base Governor Case Stud		6	6			
		Lower Base Lubricating Oil Sump Stud		2	2			
		Lower Base Governor Drain Pipe Plug		1	1			
		Lower Base Oil Catcher Drain Pipe Plug		1	1			
	2068	Lower Base Crank Pin Oiler Bracket		1	2			
	254A	Lower Base Crank Pin Oiler Spout		1	2			
		Lower Base Crank Pin Oiler Fitting		2	4			
14F		Lower Base Crank Pin Oiler Tube		1	2			
		Lower Base Crank Pin Oiler Bracket Cap Screw		2	4			
		Lower Base Crank Pin Oiler Bracket Lockwasher		2	4			
	812B	Main Bearing Shell Oil Stop (Governor end)		2	2			
	813A	Main Bearing Shell Oil Stop (Opposite governor end)		2	2			
	814A	Main Bearing Shell Oil Stop (Center)		....	2			
	805B-C	Main Bearing Cap (Governor end)		1	1			
	806B-C	Main Bearing Cap (Opposite governor end)		1	1			
	807B-C	Main Bearing Cap (Center)		....	1			
		Main Bearing Oil Piping (Not furnished separately)		1	1			
		Crank Case Oil Drain Piping (Not furn. separately)		1	1			
	298A-C	Main Bearing Oil Gauge		1	1			
	355B-C	Lower Base Air Inlet Flange		1	1			
	2D-C	Upper Base		1	1			
	2E-C	Upper Base—Cylinder No. 2		....	1			
	197A	Upper Base Lower Base Gasket		2	4			
		Upper Base Cylinder Stud Nut		8	24			
		Upper Base Lower Base Dowel Nut		4	8			
		Lower Base Countersunk Pipe Plug		1	2			
		Lower Base Upper Base Stud, 1⅛″x4½″ (12x15)	14F-C	10	20			
		Lower Base Upper Base Stud, 1⅛″x4½″ (14x17)	14E-C	12	24	36	48	72
		Lower Base Upper Base Stud Nut, 1⅛″ (12x15)	14F-C	10	20			
		Lower Base Upper Base Stud Nut, 1⅛″ (14x17)	14E-C	10	24	36	48	72
		Lower Base Upper Base Stud, 1⅜″x16½″ (12x15)	14F-C	4	8			
		Lower Base Upper Base Stud, 1½″x18¾″ (14x17)	14E-C	4	8	12	16	24
		Lower Base Upper Base Stud Nut, 1⅜″ (12x15)	14F-C	4	8			
		Lower Base Upper Base Stud Nut, 1½″ (14x17)	14E-C	4	8	12	16	24
		Lower Base Main Bearing Cap Stud (Governor end) 1⅛″x8½″ (12x15)	14F-C	2	2			
		Lower Base Main Bearing Cap Stud (Governor end) 1¼″x9″ (14x17)	14E-C	2	2	2	2	2
		Lower Base Main Bearing Cap Stud Nut (Governor end) 1⅛″ (12x15)	14F-C	2	2			
		Lower Base Main Bearing Cap Stud Nut (Governor end) 1¼″ (14x17)	14E-C	2	2	2	2	2
		Lower Base Main Bearing Cap Stud (Center) 1⅛″x6″ (12x15)	14F-C	....	2			
		Lower Base Main Bearing Cap Stud (Center) 1¼″x6¼″ (14x17)	14E-C	....	2	4	6	10
		Lower Base Main Bearing Cap Stud Nut (Center) 1⅛″ (12x15)	14F-C	....	2			
		Lower Base Main Bearing Cap Stud Nut (Center) 1¼″ (14x17)	14E-C	....	2	4	6	10
		Lower Base Main Bearing Cap Stud (Opposite governor end) 1⅛″x8½″ (12x15)	14F-C	4	4			
		Lower Base Main Bearing Cap Stud (Opposite governor end) 1¼″x9″ (14x17)	14E-C	4	4	4	4	4
		Lower Base Main Bearing Cap Stud Nut (Opposite governor end) 1⅛″ (12x15)	14F-C	4	4			
		Lower Base Main Bearing Cap Stud Nut (Opposite governor end) 1¼″ (14x17)	14E-C	4	4	4	4	4
		Lower Base Governor Case Stud, ½″x1¾″	14E-C	6	6	6	6	6
		Lower Base Governor Case Stud Nut, ½″		6	6	6	6	6
		Lower Base Lubricating Oil Sump Stud, ⅝″x8¾″	14E-C	2	2	2	2	2
		Lower Base Lubricating Oil Sump Stud Nut, ⅝″ (14x17)		2	2	2	2	2

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
		Lower Base Governor Drain Pipe Plug, ½"	14E-C	1	1	1	1	1
		Lower Base Oil Catcher Drain Pipe Plug, ¾"		1	1	1	1	1
		Lower Base Countersunk Pipe Plug, 1½"		1	2	3	3	5
17A		Connecting Rod Piston Pin Bushing, Always with	18B-C	1	2	3	4	6
		Connecting Rod Piston Pin Bushing Dowel #1217	18B-C	2	4	6	8	12
18B-C		**18B-C Connecting Rod Body**		**1**	**2**	**3**	**4**	**6**
18B	18B	Connecting Rod Body, Always with		1	2	3	4	6
	17A	Connecting Rod Piston Pin Bushing		1	2	3	4	6
		Connecting Rod Piston Pin Bushing Dowel		2	4	6	8	12
	20B-C	Connecting Rod Bearing		1	2	3	4	6
	32B	Connecting Rod Bolt, with		2	4	6	8	12
	34A	Connecting Rod Bolt Nut		2	4	6	8	12
	3375	Connecting Rod Bolt Cotter		2	4	6	8	12
	2075B	Connecting Rod Key		1	2	3	4	6
		Connecting Rod Key Flat Head Screw		2	4	6	8	12
	1193D	Connecting Rod Crank Brg. Shim (When req.) (thick)		1	2	3	4	6
	1193E	Connecting Rod Crank Brg. Shim (When req.) (medium)		1	2	3	4	6
	1193F	Connecting Rod Crank Brg. Shim (When req.) (thin)		3	6	9	12	18
20B-C		**20B-C Connecting Rod Bearing**	**18B-C**	**1**	**2**	**3**	**4**	**6**
	20B	Connecting Rod Cap (Babbitted), Always with		1	2	3	4	6
	181	Connecting Rod Cap to Box Dowel		4	8	12	16	24
20B	44A	Connecting Rod Box Shim (Thick)		16	32	48	64	96
	44B	Connecting Rod Box Shim (Thin)		16	32	48	64	96
21A	21A	Connecting Rod Box (Babbitted)		1	2	3	4	6
	1406	Connecting Rod Cap Wick		1	2	3	4	6
	1407	Connecting Rod Cap Wick Support		1	2	3	4	6
	1405	Connecting Rod Cap Wick Support Spring		2	4	6	8	12
25A-C		**25A-C Crankshaft (12x15, 1 & 2 Cyl.—14x17, 6 Cyl.)**		**1**	**1**	....	....	**1**
	25A	Crankshaft, Always with		1	1	....	....	1
	164A	Crankshaft Oil Throw Ring		1	1	....	....	1
	26A	Crankshaft Counterweight		2	4			
25A	138	Crankshaft Counterweight Dowel		2	4			
	139	Crankshaft Counterweight Bolt		2	4			
		Crankshaft Counterweight Bolt Nut		4	8			
	658B	Crankshaft Counterweight Mushroom		4	8			
		Crankshaft Governor Spider Stud		3	3	....	....	3
		Crankshaft Governor Spider Stud Nut		3	3	....	....	3
		Crankshaft Governor Spider Stud Washer (12x15)		3	3			
	2070	Crankshaft Governor Spider Stud Washer (14x17)		....	....	....	....	3
	253A-C	Crank Pin Oiler Ring		1	2	....	....	6
	405	Crank Pin Oiler Ring to Shaft Gasket		1	2	....	....	6
	165E-C	Air Stop Ring		2	4			
	165F-C	Air Stop Ring		....	....	....	....	12
25B-C		**25B-C Crankshaft (14x17)**		**1**	**1**	**1**	**1**	
	25B	Crankshaft, Always with		1	1	1	1	
	164A	Crankshaft Oil Throw Ring		1	1	1	1	
	26B	Crankshaft Counterweight		2	4	6	8	
25B	138	Crankshaft Counterweight Dowel		2	4	6	8	
	139	Crankshaft Counterweight Bolt		2	4	6	8	
		Crankshaft Counterweight Bolt Nut		4	8	12	16	
	685B	Crankshaft Counterweight		4	8	12	16	
		Crankshaft Governor Spider Stud		3	3	3	3	
		Crankshaft Governor Spider Stud Nut		3	3	3	3	
	2070	Crankshaft Governor Spider Stud Washer		3	3	3	3	
	253A-C	Crank Pin Oiler Ring		1	2	3	4	
	405	Crank Pin Oiler Ring to Shaft Gasket		1	2	3	4	
	165G-C	Air Stop Ring		2	4	6	8	
		Crankshaft to Governor Spider Stud, ⅝"x2¼"	25A-C, 25B-C	3	3	3	3	3
		Crankshaft to Governor Spider Stud Nut, ⅝"		3	3	3	3	3
		Crankshaft to Gov. Spider Stud Washer, ⅝" (12x15)		3	3			
26A		Crankshaft Counterweight (12x15)	25A-C	2	4			
26B		Crankshaft Counterweight (14x17)	25B-C	2	4	6	8	
32B		Connecting Rod Bolt with 34A Nut and Cotter	18B-C	2	4	6	8	12
33C		Cylinder Head Gasket (14x17)		12	24	36	48	72
33D		Cylinder Head Gasket (12x15)		10	20			
34A		Connecting Rod Bolt Nut	18B-C	2	4	6	8	12
39-C		**39-C Auxiliary Fuel Pump Rocker**		**1**	**1**	**1**	**1**	**1**
39	39	Auxiliary Fuel Pump Rocker		1	1	1	1	1
	55	Auxiliary Fuel Pump Rocker Pin with Cotter		1	1	1	1	1
	2307	Auxiliary Fuel Pump Rocker Pin Washer		1	1	1	1	1
		Auxiliary Fuel Pump Rocker Pin Hex. Head Cap Screw		1	1	1	1	1
		Auxiliary Fuel Pump Rocker Pin Set Screw		1	1	1	1	1
		Auxiliary Fuel Pump Rocker Pin Set Screw Jam Nut		1	1	1	1	1
		Auxiliary Fuel Pump Rocker Pin Set Screw Lockwasher		1	1	1	1	1
	56	Auxiliary Fuel Pump Rocker Eccentric Rocker Pin		1	1	1	1	1
	2605	Auxiliary Fuel Pump Rocker Pin Jam Nut		1	1	1	1	1
		Auxiliary Fuel Pump Rocker Pin Lock Washer		1	1	1	1	1
	58	Auxiliary Fuel Pump Rocker Shaft		1	1	1	1	1

(Group Continued on Next Page)

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
	59	Auxiliary Fuel Pump Rocker Shaft Collar		1	1	1	1	1
	2604	Auxiliary Fuel Pump Rocker Shaft Screw		1	1	1	1	1
		Auxiliary Fuel Pump Rocker Shaft Screw Lockwasher		1	1	1	1	1
44A		Connecting Rod Box Shim (Thick)	20B-C	16	32	48	64	96
44B		Connecting Rod Box Shim (Thin)	20B-C	16	32	48	64	96
48A		Governor Weight Spring Pin	501B-C	2	2	2	2	2
		Governor Weight Spring Pin Nut, 5/8"		2	2	2	2	2
51B		Governor Spring Eye Bolt	256B-C	2	2	2	2	2
52B		Governor Spring Plug	256B-C	2	2	2	2	2
55		Auxiliary Fuel Pump Rocker Pin	39-C	1	1	1	1	1
		Rocker Pin Cotter, 1/8"x1 1/4"	39-C	1	1	1	1	1
		Auxiliary Fuel Pump Rocker Pin Cap Screw, 1/4"x1/2"	39-C	1	1	1	1	1
		Auxiliary Fuel Pump Rocker Pin Set Screw, 3/8"x1"	39-C	1	1	1	1	1
		Rocker Pin Set Screw Jam Nut, 3/8"	39-C	1	1	1	1	1
		Rocker Pin Screw Lockwasher, 1/4"	39-C	1	1	1	1	1
		Rocker Pin Lockwasher, 5/8"	39-C	1	1	1	1	1
56		Auxiliary Fuel Pump Rocker Eccentric Rocker Pin	39-C	1	1	1	1	1
58		Auxiliary Fuel Pump Rocker Shaft	39-C	1	1	1	1	1
59		Auxiliary Fuel Pump Rocker Shaft Washer	39-C	1	1	1	1	1
60A		Fuel Reservoir Cover Cap	986B-C	1	1	1	1	1
63A		Injection Nozzle Valve Nut	201B-C, 201D-C	1	2	3	4	6
70A		Governor Spring Adjusting Screw Plate	256B-C	2	2	2	2	2
75A-C		**75A-C Exhaust Nozzle**		**1**	**2**	**3**	**4**	**6**
75A	75A	Exhaust Nozzle		1	2	3	4	6
	281	Exhaust Nozzle Hand Hole Cover		2	4	6	8	12
	282	Exhaust Nozzle Hand Hole Cover Clamp		2	4	6	8	12
		Exhaust Nozzle Hand Hole Cover Clamp Set Screw		2	4	6	8	12
76	76	Exhaust Nozzle Hand Hole Cover Gasket		2	4	6	8	12
		Exhaust Nozzle Pipe Plug		1	2	3	4	6
76		Exhaust Pot Hand Hole Cover Gasket	225A-C	1	1	1	2	3
76A		Exhaust Pipe Hand Hole Cover Gasket	225B-C	1	2	3	4	6
77A		Exhaust Nozzle to Cylinder Gasket		1	2	3	4	6
83A		Governor Weight Pin	501B-C	2	2	2	2	2
		Governor Weight Pin Jam Nut, 1"	501B-C	2	2	2	2	2
85A		Governor Spring Adjusting Screw	256B-C	2	2	2	2	2
		Governor Spring Adjusting Screw Nut, 5/8"		2	2	2	2	2
90A		Auxiliary Fuel Pump Plunger Sleeve	516A-C	1	1	1	1	1
91		Injection Pump Discharge Valve	531A-C	1	2	3	4	6
92		Pump Discharge Tube Gland Connection		1	2	3	4	6
96		Injection Tube Half Union Nut			2	3	4	6
117H-C		**117H-C Combustion Chamber**		**1**				
117H	117H	Combustion Chamber, Always with		1				
	4689A	Starting Plug Seat		1				
	3428A	Starting Plug, with Handle 4688		1				
	2118A	Combustion Chamber Sleeve		1				
	4502	Combustion Chamber Sleeve Gasket		1				
	212B	Combustion Chamber Cooling Water Tube		2				
	212D	Combustion Chamber Cooling Water Tube		1				
	213E	Combustion Chamber Cooling Water Tube Gasket		1				
	213D	Combustion Chamber Cooling W. Tube Gasket		2				
117J-C		**117J-C Combustion Chamber**			**2**	**3**	**4**	**6**
	117H	Combustion Chamber, Always with			2	3	4	6
	3093A	Indicator Hole Plug			2	3	4	6
	2118A	Combustion Chamber Sleeve			2	3	4	6
	4502	Combustion Chamber Sleeve Gasket			2	3	4	6
	212B	Combustion Chamber Cooling Water Tube			4	6	8	12
	212D	Combustion Chamber Cooling Water Tube			2	3	4	6
	213E	Combustion Chamber Cooling Water Tube Gasket			2	3	4	6
	213D	Combustion Chamber Cooling Water Tube Gasket			4	6	8	12
118E		Cylinder Head Combustion Chamber Sleeve Gasket		1	2	3	4	6
138		Crankshaft Counterweight Dowel	25A-C, 25B-C	2	4	6	8	
139		Crankshaft Counterweight Bolt	25A-C, 25B-C	2	4	6	8	
		Crankshaft Counterweight Bolt Nut, 1 1/2"	25A-C, 25B-C	4	8	12	16	
148		Auxiliary Fuel Pump Discharge Valve Seat	516A-C	1	1	1	1	1
150		Auxiliary Fuel Pump Plunger Link	516A-C	1	1	1	1	1
153		Fuel Suction Pipe		1	1	1	1	1
164A		Crankshaft Oil Throw Ring	25A, 25B	1	1	1	1	1
165E-C		**165E-C Air Stop Ring (12x15)**	**25A-C**	**2**	**4**			
	165D	Air Stop Ring (Two pieces), Always with		2	4			
	191	Air Stop Ring Bolt		4	8			
165D	192	Air Stop Ring Dowel		4	8			
		Air Stop Ring Lockwasher		4	8			
		Air Stop Ring Lock Wire		4	8			
	393B	Air Stop Ring Back Lash Spring Set Screw (Long)		2	4			
	393F	Air Stop Ring Back Lash Spring Set Screw (Short)		2	4			
	392	Air Stop Ring Back Lash Spring		2	4			

(Group Continued on Next Page)

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
	394	Air Stop Ring Back Lash Spring Clip		2	4			
	193A	Air Stop Ring Spring		8	16			
		Air Stop Ring Cap Screw		2	4			
		Air Stop Ring Cap Screw Nut		2	4			
		Air Stop Ring Dog Point Set Screw Jam Nut		4	8			
		Air Stop Ring Lockwasher		4	8			
		Air Stop Ring Cap Screw, 5/16"x2"	165E-C, 165G-C	2	4	6	8	
		Air Stop Ring Cap Screw Nut, 5/16"	165E-C, 165G-C	2	4	6	8	
		Ring Dog Point Set Screw Jam Nut, 1/2"	165E-C, 165G-C	4	8	12	16	
		Air Stop Ring Lockwasher, 1/2"	165E-C, 165G-C	4	8	12	16	
		Air Stop Ring Lockwasher, 5/8"	165E-C, 165G-C	4	8	12	16	
		Air Stop Ring Lock Wire, 1/16"x3 1/2"	165E-C, 165G-C	4	8	12	16	
165F-C		**165F-C Air Stop Ring**	**25A-C**					**12**
	165E	Air Stop Ring (Two Pieces), Always with						12
	191	Air Stop Ring Bolt						24
165E	192	Air Stop Ring Dowel						24
		Air Stop Ring Lockwasher						24
		Air Stop Ring Lock Wire						24
	393D	Air Stop Ring Driving Stud						6
	393E	Air Stop Ring and Oil Throw Ring Driving Stud						6
	392	Air Stop Ring Driving Spring						12
	2776	Air Stop Ring Driving Spring Plug						12
	193A	Air Stop Ring Spring						48
	2766A	Air Stop Ring Driving Set Screw						12
		Air Stop Ring Driving Spring Lockwasher						24
		Air Stop Ring Set Screw Nut						12
	2777	Air Stop Ring Driving Clamp						6
		Air Stop Ring Driving Clamp Cap Screw						6
		Air Stop Ring Driving Clamp Cap Screw Nut						6
		Air Stop Ring Driving Clamp Cap Screw Lockwasher						6
		Air Stop Ring Driving Clamp Nut						6
		Air Stop Ring Driving Clamp Lockwasher						6
165G-C		**165G-C Air Stop Ring (14x17)**	**25B-C**	**2**	**4**	**6**	**8**	
	165F	Air Stop Ring (Two Pieces), Always with		2	4	6	8	
	191	Air Stop Ring Bolt		4	8	12	16	
165F	192	Air Stop Ring Dowel		4	8	12	16	
		Air Stop Ring Lockwasher		4	8	12	16	
		Air Stop Ring Lockwire		4	8	12	16	
	393B	Air Stop Ring Backlash Spring Set Screw		4	8	12	16	
	392	Air Stop Ring Backlash Spring		2	4	6	8	
	394	Air Stop Ring Backlash Spring Clip		2	4	6	8	
	193A	Air Stop Ring Spring		8	16	24	32	
		Air Stop Ring Cap Screw		2	4	6	8	
		Air Stop Ring Cap Screw Nut		2	4	6	8	
		Air Stop Ring Dog Point Set Screw Jam Nut		4	8	12	16	
		Air Stop Ring Lockwasher		4	8	12	16	
137		Governor Weight Bushing	507D	2	2	2	2	2
172-C		**172-C Belt Pulley**		1	1	1	1	1
	172	Belt Pulley, Always with		1	1	1	1	1
172	404	Belt Pulley Hub Stud		2	2	2	2	2
		Belt Pulley Hub Stud Nut		4	4	4	4	4
		Belt Pulley Key, 1"x3/4"x9" (12x15)		1				
		Belt Pulley Key, 1"x3/4"x13" (12x15)			1			
		Belt Pulley Key, 1 1/4"x3/4"x12" (14x17)		1				
		Belt Pulley Key, 1 1/4"x3/4"x17" (14x17)			1			
		Belt Pulley Key, 1 1/4"x3/4"x22" (14x17)				1		
		Belt Pulley Key, 1 1/4"x3/4"x24" (14x17)					1	
		Belt Pulley Key, 1 1/2"x1"x12" (14x17)						2
178		Piston Pin Dowel Spring	5B-C	1	2	3	4	6
179A		Air Pipe to Base Gasket		1	2	3	4	6
131		Connecting Rod Cap to Box Dowel	20B-C	4	8	12	16	24
132A		Upper Base Hand Hole Cover		1	2	3	4	6
187-C		**187-C Lubricating Oil Sump Strainer**	**1081A-C**	**1**	**1**	**1**	**1**	**1**
	187	Lubricating Oil Sump Strainer Side, Always with		1	1	1	1	1
187	2271	Lubricating Oil Sump Strainer Flange (Not furn. sep.)		1	1	1	1	1
	2272	Lubricating Oil Sump Strainer Bottom (Not furn. sep.)		1	1	1	1	1
	1369	Lubricating Oil Sump Strainer Handle (Not furn. sep.)		1	1	1	1	1
187A-C		**187A-C Fuel Reservoir Cover Strainer**		**1**	**1**	**1**	**1**	**1**
	187A	Fuel Reservoir Cover Strainer Side, Always with	986B-C	1	1	1	1	1
187A	2271	Fuel Reservoir Cover Strainer Flange (Not furn. sep.)		1	1	1	1	1
	2272	Fuel Reservoir Cover Strainer Bottom (Not furn. sep.)		1	1	1	1	1
	1369	Fuel Reservoir Cover Strainer Wire (Not furn. sep.)		1	1	1	1	1

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
191		Air Stop Ring Bolt	165E-C, 165F-C, 165G-C	4	8	12	16	24
192		Air Stop Ring Dowel	165E-C, 165F-C, 165G-C	4	8	12	16	24
193A		Air Stop Ring Spring	165E-C, 165G-C	8	16	24	32	48
195A		Name Plate		1	1	1	1	1
		Name Plate R. H. M. Screw #10—24x¼"		4	4	4	4	4
		Name Plate Washer, 3/16"		4	4	4	4	4
197A		Upper Base Lower Base Gasket	14E-C	2	4	6	8	12
			14F-C	2	4			
198B		Upper Base Cylinder Gasket		1	2	3	4	6
199A		Upper Base Air Valve Seat Gasket		1	2	3	4	6
199A		Upper Base Front Hand Hole Cover Gasket		1	2	3	4	6
201B-C		**201B-C Injection Nozzle (12x15)**		**1**	**2**			
201B	201B	Injection Nozzle Body with Seat #2409		1	2			
	202A	Injection Nozzle Valve		1	2			
	203A	Injection Nozzle Valve Spring		1	2			
	63A	Injection Nozzle Valve Nut		1	2			
	204B	Injection Nozzle Tip, Always with		1	2			
	933	Injection Nozzle Spiral		1	2			
201D-C		**201D-C Injection Nozzle (14x17)**		**1**	**2**	**3**	**4**	**6**
	201B	Injection Nozzle Body with Seat #2409	201B-C	1	2	3	4	6
202A	202A	Injection Nozzle Valve	201B-C	1	2	3	4	6
	6071	Injection Nozzle Drill		1	2	3	4	6
203A	203A	Injection Nozzle Valve Spring	201B-C	1	2	3	4	6
	63A	Injection Nozzle Valve Nut		1	2	3	4	6
	204D	Injection Nozzle Tip, Always with		1	2	3	4	6
	933A	Injection Nozzle Spiral		1	2	3	4	6
204B	204B	Injection Nozzle Tip, Always with	201B-C	1	2			
	933	Injection Nozzle Spiral		1	2			
204D	204D	Injection Nozzle Tip, Always with	201D-C	1	2	3	4	6
	933A	Injection Nozzle Spiral		1	2	3	4	6
206		Injection Tube Nozzle Gland Nut		1	2	3	4	6
210		Injection Tube Half Union Connection		....	2	3	4	6
212B		Combustion Chamber Cooling Water Tube	117H-C	2	4	6	8	12
212D		Combustion Chamber Water Tube	117H-C, 117J-C	1	2	3	4	6
213D		Combustion Chamber Cooling Water Tube Gasket	117J-C	2	4	6	8	12
213E		Combustion Chamber Water Tube Gasket	117H-C, 117 J-C, 421D-C, 422D-C	1	2	3	4	6
214		Injection Tube Union Gasket	423D-C, 424D-C, 425B-C, 427B-C	....	2	3	4	6
215B		Lubricator Bracket	271A-C	1	1	1	1	1
		Lubricating Bracket Cap Screw, ½"x1"	271A-C	2	2	4	4	4
216A-C		**216A-C Lubricator Drive Mechanism**		**1**	**1**	**1**	**1**	**1**
216A	216A	Lubricator Drive Rod		1	1	1	1	1
	1092A	Lubricator Drive Rod Connection (Lubricator end)		1	1	1	1	1
	2314	Lubricator Drive Rod Connection (Rocker end)		1	1	1	1	1
		Lubricator Drive Rod Nut		1	1	1	1	1
	1554A	Lubricator Ratchet Arm with Cap Screw		1	1	1	1	1
217B	217B	Lubricator Ratchet Arm Link Pin with Nut		1	1	1	1	1
		Lubricator Ratchet Arm Pin Nut, 7/16"	217B	1	1	1	1	1
		Lubricator Drive Rod Nut, ½", S. A. E.	216A-C	1	1	1	1	1
225A-C		**225A-C Exhaust Pot**		**1**	**1**	**1**	**2**	**3**
	225A	Exhaust Pot, Always with		1	1	1	2	3
		Exhaust Pot Stuffing Box Stud		....	8	12	16	24
225A	668	Exhaust Pot Stuffing Box Stud Nut		....	8	12	16	24
		Exhaust Pot Pipe Plug (Drain)		1	1	1	2	3
		Exhaust Pot Pipe Plug (Water inlet)		1	1	1	2	3
	615	Exhaust Pot Cover (Top)		1	1	1	2	3
	616	Exhaust Pot Cover (Bottom)		1	1	1	2	3
		Exhaust Pot Cover Bolt		24	24	24	48	72
	263	Exhaust Pot Cover Bolt Nut		24	24	24	48	72
	281	Exhaust Pot Hand Hole Cover		1	1	1	2	3
	282	Exhaust Pot Hand Hole Cover Clamp with Set Screw		1	1	1	2	3
	76	Exhaust Pot Hand Hole Cover Gasket		1	1	1	2	3
	416	Exhaust Pot Flange Gasket (12x15)		2				
		Asbestos Wicking		....	3	5	6	9
	229	Exhaust Nipple Flange (14x17)		1				
	618	Exhaust Pot Flange Gasket (14x17)		1				
	617	Exhaust Pot Cover Gasket		2	2	2	4	6

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
		Exhaust Nipple Flange Sq. Hd. Mach. Bolt, ¾″x3¼″		8				
		Exhaust Nipple Square Head Machine Bolt, ¾″x3″		8				
	263	Exhaust Nipple Flange Square Head Mach. Bolt Nut		8				
	666	Exhaust Pot Stuffing Box Gland		....	2	3	4	6
		Exhaust Pot Stuffing Box Stud, ⅝″x4½″	225A-C	....	8	12	16	24
		Exhaust Pot Pipe Plug (Drain), 2″	225A-C	1	1	1	2	3
		Exhaust Pot Pipe Plug (Water inlet), 2″	225A-C	1	1	1	2	3
225D-C		**225D-C Exhaust Pipe**		**1**	**2**	**3**	**4**	**6**
225D	225D	Exhaust Pipe, Always with		1	2	3	4	6
225D		Exhaust Pipe Plug		1	2	3	4	6
		Exhaust Pipe Plug		1	2	3	4	6
		Exhaust Pipe Hole Cover Stud		4	8	12	16	24
	281A	Exhaust Pipe Hand Hole Cover		1	2	3	4	6
		Exhaust Pipe Hand Hole Cover Stud Nut		4	8	12	16	24
	76A	Exhaust Pipe Hand Hole Cover Gasket		1	2	3	4	6
	2780	Exhaust Conduit Thimble		1	2	3	4	6
		Exhaust Conduit Thimble to Gland Stud		4	8	12	16	24
	666	Exhaust Conduit Thimble Gland		1	2	3	4	6
		Asbestos Wicking		2	3	5	6	9
	668	Exhaust Conduit Thimble to Gland Stud Nut		4	8	12	16	24
		Exhaust Pipe Plug, ½″ (Pyrometer)	225B-C	1	2	3	4	6
		Exhaust Pipe Plug, 1″ (Water connection)	225B-C	1	2	3	4	6
		Exhaust Pipe Hand Hole Cover Stud, ⅝″x2¼″	225B-C	4	8	12	16	24
		Exhaust Conduit Thimble to Gland Stud, ⅝″x4″	225B-C	4	8	12	16	24
		Asbestos Wicking, ½ Lb. Ball	225B-C	2	3	5	6	9
		Exhaust Pipe Hand Hole Cover Stud Nut, ⅝″	225B-C	4	8	12	16	24
229		Exhaust Pot Flange (14x17)	225A-C 665-C	1 1				
		Exhaust Nipple Flange Bolt, ¾″x3″ (12 x 15)	665-C	8				
		Exhaust Nipple Flange Bolt, ¾″x3¼″ (14x17)	665-C	8				
233B		Air Suction Valve Pipe	597A-C	1	2	3	4	6
248B		Air Starting Check Valve Cage Plug		....	1	2	2	3
251		Governor Weight Pin Nut	501B-C	2	2	2	2	2
253A-C		**253A-C Crank Pin Oiler Ring**	**25A-C 25B-C**	**1**	**2**	**3**	**4**	**6**
253A	253A	Crank Pin Oiler Ring (Two pieces), Always with		1	2	3	4	6
253A		Crank Pin Oiler Ring Hex. Head Cap Screw		2	4	6	8	12
		Crank Pin Oiler Ring Lockwasher		2	4	6	8	12
		Crank Pin Oiler Ring Cap Screw, ½″x4¼″	253A-C	2	4	6	8	12
		Crank Pin Oiler Ring Lockwasher, ½″	253A-C	2	4	6	8	12
		Oil Ring Half F. H. Screw, ⅜″x¾″		1	2	3	4	6
		Crankpin Shaft Counterweight Cap Screw, ½″x1½″		6	12	18	16	24
		Counterweight Cap Screw Lockwasher, ½″		3	6	9	12	
254A		Lower Base Crank Pin Oiler Spout	14E-C 14F-C	1	2	3	4	6
255		Upper Base Crank Pin Oiler Washer	2D-C 2E-C	1	2	3	4	6
256B-C		**256B-C Governor Spring**	**501B-C**	**2**	**2**	**2**	**2**	**2**
256B	256B	Governor Spring with Plug 52B		2	2	2	2	2
	51B	Governor Spring Eye Bolt		2	2	2	2	2
	70	Governor Spring Adjusting Screw Plate		2	2	2	2	2
	85A	Governor Spring Adjusting Screw		2	2	2	2	2
259		Injection Pump Suction Valve Spring	531A-C	1	2	3	4	6
260A		Injection Pump Plunger Spring	531A-C	1	2	3	4	6
263		Exhaust Pot Cover Bolt Nut	225A-C	24	24	24	48	72
263		Exhaust Nipple Flange Sq. Hd. Machine Bolt Nut	665-C	16				
263		Cylinder to Exhaust Pipe Stud Nut (14x17)		24	24	36	48	72
263		Exhaust Elbow Bolt Nut	665-C	....	16	24	32	48
266		Injection Pump Suction Valve Push Rod Spring		1	2	3	4	6
271A-C		**271A-C Lubricator**		**1**	**1**	**1**	**1**	**1**
271A	271A	Lubricator		1	1	1	1	1
	215A	Lubricator Bracket		2	1	1	1	1
		Lubricator Bracket Cap Screw		18	2	4	4	4
	2315	Auxiliary Fuel Pump Eccentric Oil Pipe		2	1	1	1	1
		Auxiliary Fuel Pump Eccentric Oil Pipe		1	1	1	1	1
		Auxiliary Fuel Pump Eccentric Oil Pipe Union		2	1	1	1	1
	2751	Lubricator Bracket Cap Screw Washer		11	2	4	4	4

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in	Number Used				
Arranged Numerically	Group Part	NAME OF PART	Group	1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
		Lubricator Bracket Upper Base Cap Screw, ½"x1¾"		4	4	4	4	4
277A		Cooling Water Thermometer	2115B-C 2115D-C	1	2	3	4	6
281		Exhaust Pot Hand Hole Cover	225A-C	1	1	1	2	3
281		Exhaust Nozzle Hand Hole Cover	75-C	2	4	6	8	12
281A		Exhaust Pipe Hand Hole Cover with Pipe Plug	225B-C	1	2	3	4	6
		Exhaust Pipe Hand Hole Cover Pipe Plug, ½"	75-C	1	2	3	4	6
282		Exhaust Nozzle Hand Hole Cover Clamp	75-C	2	4	6	8	12
		Ex. Noz. Hand Hole Cover Clamp Set Screw, ⅝"x2¼"	75-C	2	4	6	8	12
282		Exhaust Pot Hand Hole Cover Clamp	225A-C	1	1	1	2	3
		Ex. Pot Hand Hole Cover Clamp Set Screw, ⅝"x2¼"	225A-C	2	4	6	8	12
298A-C		**298A-C Main Bearing Oil Gauge**	**14E-C 14F-C**	**1**	**1**	**1**	**2**	**2**
	298A	Main Bearing Oil Gauge, Always with		1	1	1	2	2
298A	990	Main Bearing Oil Gauge Glass Gasket		2	2	2	4	4
	825	Main Bearing Oil Gauge Glass		1	1	1	2	2
	989	Main Bearing Oil Gauge Glass Plug		1	1	1	2	2
		Main Bearing Oil Level Gauge Pipe Plug, 1"		1	1	1	2	2
		Main Bearing Oil Level Gauge Pipe Plug, ⅛"		1	1	1	2	2
		Crankcase Drain Pipe Close Nipple, ¼"			1	1	2	3
		Crankcase Drain Pipe Coupling, ¼"			1	1	2	3
300		Aux. Fuel Pump Plunger Spring		1	1	1	1	1
310A-C		**310A-C Outboard Bearing (Special when ordered)**		**1**	**1**	**1**	**1**	**2**
	310A	Outboard Bearing Body, Always with		1	1	1	1	2
		Outboard Bearing Body Pipe Plug		1	1	1	1	2
		Outboard Bearing Body Drain Pipe Plug		2	2	2	2	4
		Outboard Bearing Body Cap Stud		4	4	4	4	8
		Outboard Bearing Body Cap Stud Nut		4	4	4	4	8
310A	311B	Outboard Bearing Body Cap (Not furn. separately)		1	1	1	1	2
	314A	Outboard Bearing Body Cap Shim (Thin)		12	12	12	12	24
	314B	Outboard Bearing Body Cap Shim (Thick)		8	8	8	8	16
	317A	Outboard Bearing Oil Hole Cover		1	1	1	1	2
		Outboard Bearing Oil Hole Cover Hinge Pin		1	1	1	1	2
		Outboard Bearing Body Cap Shim Dowel		4	4	4	4	8
	833A	Out. Brg. Oil Ring (Furnished in pairs) with Pin 1978		2 Pr	2 Pr	2Pr	2 Pr	4 Pr
		Out. Brg. Body Vertical Adjusting Set Screw, ⅞"x2"		2	2	2	2	4
	825A	Outboard Bearing Oil Gauge Glass		1	1	1	1	2
	989	Outboard Bearing Oil Gauge Glass Plug		1	1	1	1	2
	990	Outboard Bearing Oil Gauge Glass Gasket		2	2	2	2	4
		Outboard Bearing Oil Gauge Glass Pipe Plug		1	1	1	1	2
		Out. Bearing Horizontal Adjusting Set Screw, ⅝"x3"		4	4	4	4	4
	315A	Outboard Bearing Oil Baffle		2	2	2	2	4
		Outboard Bearing Oil Baffle Screw		4	4	4	4	8
	2345	Outboard Bearing Oil Throw Ring		2	2	2	2	4
		Outboard Bearing Oil Throw Ring Felt		2	2	2	2	4
	319A	Outboard Bearing Sole Plate		1	1	1	1	1
	3780	Outboard Bearing Pedestal, Always with		1	1	1	1	1
		Outboard Bearing Horizontal Adjusting Screw		4	4	4	4	4
		Outboard Bearing Horizontal Adj. Screw Jam Nut		4	4	4	4	4
	1861	Outboard Bearing Vertical Adjusting Shim (Thick)		4	4	4	4	8
	1861A	Outboard Bearing Vertical Adjusting Shim (Medium)		2	2	2	2	4
	1861B	Outboard Bearing Vertical Adjusting Shim (Thin)		2	2	2	2	4
		Outboard Bearing Body Sole Plate Cap Screw		4	4	4	4	8
	2346	Outboard Bearing Body Sole Plate Cap Screw Washer		4	4	4	4	8
		Out. Bearing Body Sole Plate Cap Screw Lockwasher		4	4	4	4	8
		Outboard Bearing Body Drain Pipe Plug, ¾"		2	2	2	2	4
		Outboard Bearing Body Pipe Plug, ¾" (12x15)		1	1			
		Outboard Bearing Body Pipe Plug, 1" (14x17)		1	1	1	1	2
		Outboard Bearing Body Cap Stud, ¾"x6" (12x15)		4	4			
		Outboard Bearing Body Cap Stud, 1"x7¾" (14x17)		4	4	4	4	
		Outboard Bearing Body Cap Stud, 1"x8¼" (14x17)						8
		Outboard Bearing Body Cap Stud Nut, ¾" (12x15)		4	4			
		Outboard Bearing Body Cap Stud Nut, 1" (14x17)		4	4	4	4	8
311B		Outboard Bearing Body Cap (Not furn. separately)	310A-C	1	1	1	1	2
314A		Outboard Bearing Body Cap Shim (Thin)	310A-C	12	12	12	12	24
314B		Outboard Bearing Body Cap Shim (Thick)	310A-C	8	8	8	8	16
315A		Outboard Bearing Oil Baffle	310A-C	2	2	2	2	4
		Out. Brg. Oil Baffle Cap Hex. Hd. Cap Screw, ⅜"x¾"	310A-C	4	4	4	4	8
317A		Outboard Bearing Oil Hole Cover	310A-C	1	1	1	1	2
		Outboard Bearing Oil Hole Cover Hinge Pin #457	310A-C	1	1	1	1	2
319A		Outboard Bearing Sole Plate	310A-C	1	1	1	1	
		Outboard Bearing Body Sole Plate Cap Screw, 1"x3½"	310A-C	4	4	4	4	8
		Out. Bearing Sole Plate Cap Screw Lockwasher, 1"	310A-C	4	4	4	4	8
		Out. Brg. Horizontal Adjusting Set Screw, ⅝"x3½"						8
		Out. Brg. Hori. Adjusting Set Screw Jam Nut, ⅝"						8
		Outboard Bearing Body Cap Shim Dowel #413		4	4	4	4	8
327A		Crankpin Oiler Pipe Plug	2D-C 2E-C	3	6	9	12	24
					6	9	12	24
342		Main Bearing Cap Dowel (12x15)	807B-C	2	3			
342		Main Bearing Cap Dowel (14x17)	807B-C	2	3	4	5	7

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
355B-C		**355B-C Lower Base Air Inlet Flange**	**14E-C, 14F-C**	**1**	**1**	**1**	**2**	**2**
355B	355B	Lower Base Air Inlet Flange		1	1	1	2	2
		Lower Base Air Inlet Flange Cap Screw, ½"x3"		3	3	3	6	6
	1977A	Lower Base Air Inlet Screen		1	1	1	2	2
	1989A	Lower Base Air Inlet Screen Plate		1	1	1	2	2
		Lower Base Air Inlet Screen R. H. M. Screw		8	8	8	16	16
	4045	Lower Base Air Inlet Screen Seam Strip		1	1	1	2	2
362E-C		**362E-C Relief Valve**		**1**	**2**	**3**	**4**	**6**
362E	362E	Relief Valve Body		1	2	3	4	6
363B	363B	Relief Valve		1	2	3	4	6
364B	364B	Relief Valve Cap		1	2	3	4	6
	5565	Adapter Tube		1	2	3	4	6
	5566	Adapter Tube Packing Gland		1	2	3	4	6
	5567	Adapter Tube Packing		1	2	3	4	6
		Relief Valve Hexagon Jam Nut, 5/16"		1	2	3	4	6
		Relief Valve Lockwasher, 5/16"		1	2	3	4	6
392		Air Stop Ring Lash Spring	165E-C, 165G-C	2	4	6	8	
392		Air Stop Ring Driving Spring	165F-C					12
393B		Air Stop Ring Back Lash Spring Set Screw (14x17)	165G-C	4	8	12		
393B		Air Stop Ring Back Lash Sp. Set Screw (12x15) (Long)	165E-C	2	4			
393D		Air Stop Ring Driving Stud	165F-C				4	6
		Air Stop Ring Driving Spring Stud Lockwasher, 7/8"	165F-C				16	24
393E		Air Stop Ring and Oil Throw Ring Driving Stud	165F-C				4	6
393F		Air Stop Ring Back Lash Sp. Set Screw (12x15) (Short)	165E-C	2	4			
394		Air Stop Ring Back Lash Spring Clip	165E-C, 165F-C	2	4	6		
402		Flywheel Hub Bolt	13B-C	4	4	4	4	4
		Flywheel Hub Bolt Nut, 1¾" (12x15)	13B-C	8	8			
		Flywheel Hub Bolt Nut, 2¼" (14x17)	13B-C	8	8	8	8	8
403A		Flywheel Key	13B-C	1	1	1	1	1
404		Belt Pulley Hub Stud	172-C	2	2	2	2	2
		Belt Pulley Stud Nut, 1⅛"	172-C	4	4	4	4	4
405		Crank Pin Oiler Ring Shaft Gasket	25A-C, 25B-C	1	2	3	4	6
406		Piston Ring Dowel	5B-C	6	12	18	24	36
407A		Cylinder Core Hole Cover Gasket	1D-C	2	2	3	4	6
407A		Cylinder Platform Bracket Gasket			2	3	4	6
409A		Upper Base Lower Base Dowel	2D-C	4	4	4	4	4
			2E-C		4	8	12	20
416		Exhaust Pot Flange Gasket (12x15)	225A-C	2				
			665-C	1	2			
420		Injection Pump Discharge Tube Gland Nut		1	2	3	4	6
421B		Inj. Tube (Cyl. No. 1), with glands and gland nuts		1				
421D-C		**421D-C Injection Tube (Cylinder No. 1)**			**1**	**1**	**1**	**1**
421D	421D	Inj. Tube, Pump to Union, with glands and gland nuts			1	1	1	1
	426B	Inj. Tube, Nozzle to Union, with half union, glands and gland nuts			1	1	1	1
	214	Injection Tube Union Gasket			1	1	1	1
422D-C		**422D-C Injection Tube (Cylinder No. 2)**			**1**	**1**	**1**	**1**
422D	422D	Inj. Tube Pump to Union, with glands and gland nuts			1	1	1	1
	426B	Inj. Tube, Nozzle to Union, with half union, glands and gland nuts			1	1	1	1
	214	Injection Tube Union Gasket			1	1	1	1
423D-C		**423D-C Injection Tube (Cylinder No. 3)**					1	1
423D	423D	Inj. Tube, Pump to Union, with glands and gland nuts					1	1
	426B	Inj. Tube, Nozzle to Union, with half union, glands and gland nuts					1	1
	214	Injection Tube Union Gasket					1	1
423E-C		**423E-C Injection Tube (Cylinder No. 3)**						1
423E	423E	Inj. Tube, Pump to Union, with glands and gland nuts						1
	426B	Inj. Tube, Nozzle to Union, with half union, glands and gland nuts						1
	214	Injection Tube Union Gasket						1

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
424D-C		**424D-C Injection Tube (Cylinder No. 4)**					1	
424D	424D	Inj. Tube, Pump to Union, with glands and gland nuts					1	
	426B	Inj. Tube, Nozzle to Union, with half union, glands and gland nuts					1	
	214	Injection Tube Union Gasket					1	
424E-C		**424E-C Injection Tube (Cylinder No. 4)**						1
424E	424E	Inj. Tube, Pump to Union, with glands and gland nuts						1
	426B	Inj. Tube, Nozzle to Union, with half union, glands and gland nuts						1
	214	Injection Tube Union Gasket						1
425B-C		**425B-C Injection Tube (Cylinder No. 5)**						1
425B	425B	Inj. Tube, Pump to Union, with glands and gland nuts						1
	426B	Inj. Tube, Nozzle to Union, with half union, glands and gland nuts						1
	214	Injection Tube Union Gasket						1
426B		Inj. Tube, Nozzle to Union, with half union, glands and gland nuts	421D-C		1	1	1	1
			422D-C		1	1	1	1
			423D-C			1	1	1
		Injection Tube Half Union Cap Screw, 3/8"x1"	424D-C				1	
			424E-C					1
		Injection Tube Half Union Cap Screw Nut, 3/8"	425B-C					1
			427B-C					1
427B-C		**427B-C Injection Tube (Cylinder No. 6)**						1
427B	427B	Inj. Tube, Pump to Union, with glands and gland nuts						1
	426B	Inj. Tube, Nozzle to Union, with half union, glands and gland nuts						1
	214	Injection Tube Union Gasket						1
		NOTE:—1/4" O. D. copper lubricating tubes can be had in any desired length. Sleeve 2079A for cinch fittings can be ordered separately.						
432B		Lub. Tube (Cyl. No. 1)(Left) with Elbows 451 & 451A		1				
432D		Lubricating Tube (Cylinder No. 1) (Left) with Lub. Tube 1339A, Union 454, and Elbows 451 and 451A		1	1	1	1	1
433A		Lub. Tube (Cyl. No. 1)(Front) with Elbows 451 & 451A		1	1	1	1	1
434A		Lub. Tube (Cyl. No. 1)(Right) with Elbows 451 & 451A		1	1	1	1	1
435A		Lub. Tube (Cyl. No. 1)(Crank pin) with El. 451 & 451A		1	1	1	1	1
437B		Lubricating Tube (Cylinder No. 2) (Left) with Lub. Tube 1339A, Union 454 and Elbows 451 and 451A			1	1	1	1
438B		Lubricating Tube (Cylinder No. 2) (Front) with Tube 1339A, Union 454 and Elbows 451 and 451A			1	1	1	1
439B		Lubricating Tube (Cylinder No. 2) (Right) with Tube 1337A, Union 454 and Elbows 451 and 451A			1	1	1	1
440B		Lubricating Tube (Cylinder No. 2) (Crank Pin) with Tube 1336A, Union 454 and Elbows 451 and 451A			1	1	1	1
442B		Lubricating Tube (Cylinder No. 3) (Left) with Tube 1339A, Union 454 and Elbows 451 and 451A				1	1	1
443B		Lubricating Tube (Cylinder No. 3) (Front) with Tube 1338A, Union 454 and Elbows 451 and 451A				1	1	1
444B		Lubricating Tube (Cylinder No. 3) (Piston Pin) with Tube 1337A, Union 454 and Elbows 451 and 451A				1	1	1
445B		Lubricating Tube (Cylinder No. 3) (Crank Pin) with Tube 1336A, Union 454 and Elbows 451 and 451A				1	1	1
447B		Lubricating Tube (Cylinder No. 4) (Left) with Tube 1339A, Union 454 and Elbows 451 and 451A					1	1
448B		Lubricating Tube (Cylinder No. 4) (Front) with Tube 1338A, Union 454 and Elbows 451 and 451A					1	1
449B		Lubricating Tube (Cylinder No. 4) (Piston Pin) with Tube 1337A, Union 454 and Elbows 451 and 451A					1	1
450B		Lubricating Tube (Cylinder No. 4) (Crank Pin) with Tube 1336A, Union 454 and Elbows 451 and 451A					1	1
451		Lubricating Tube Cinch Fitting Elbow	(See note)	4	8	12	16	24
451A		Lubricating Tube Cinch Fitting Elbow	(See note)	4	8	12	16	24
452		Lubricator Oil Tube Connector		1	2	3	4	6
		NOTE:—Elbows 451 and 451A are included in 432B, 432D, 433A, 434A, 435A, 437B, 438B, 439B, 440B, 442B, 443B, 444B, 445B, 447B, 448B, 449B, 450D, 492B, 493B, 494B, 494D, 495B, 496B, 498B, 498D and 499B.						
454		Lubricating Tube Cinch Fitting Union	(See note)	4	8	12	20	30
		NOTE:—Union 454 is included in 432D, 437B, 438B, 439B, 440B, 442B, 443B, 444B, 445B, 447D, 448B, 449B, 450B, 492B, 493B, 494B, 494D, 495B, 496B, 497B, 498B, 498D and 499B.						

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
460A-C		**460A-C Shaft Extension**		**1**	**1**	**1**	**1**	**1**
460A	460A	Shaft Extension		1	1	1	1	1
	2345	Shaft Extension Oil Throw Ring		2	2	2	2	4
	2884	Outboard Bearing Extension Shaft Thrust Collar						1
464A-C		**464A-C Aux. Fuel Suc. Str. and Overflow Casing**		**1**	**1**	**1**	**1**	**1**
464A	464A	Auxiliary Fuel Suction Strainer and Overflow Casing		1	1	1	1	1
	2296	Auxiliary Fuel Suction Strainer Plug		1	1	1	1	1
	466	Auxiliary Fuel Suction Strainer Body, Always with		1	1	1	1	1
	465A	Auxiliary Fuel Suction Strainer Screen		1	1	1	1	1
	1895	Auxiliary Fuel Suction Strainer Spring #217		1	1	1	1	1
	467A	Auxiliary Fuel Suction Strainer Plug Gasket		1	1	1	1	1
465A		Auxiliary Fuel Suction Strainer Screen	464A-C	1	1	1	1	1
466		Auxiliary Fuel Suction Str. Body with Screen 465A	464A-C	1	1	1	1	1
467A		Auxiliary Fuel Suction Strainer Plug Gasket	464A-C	1	1	1	1	1
469A		Pump Case Housing Side Cover Gasket		2	2	2	2	2
470		Auxiliary Fuel Pump Discharge Valve Cap Gasket	516A-C	1	1	1	1	1
472A		Pump Case Housing Gasket		2	2	2	2	2
473A		Injection Pump Body to Housing Gasket		1	2	3	4	6
		NOTE:—¼" O. D. copper lubricating tubes can be had in any desired length. Sleeve 2079A for cinch fittings can be ordered separately.						
491		Injection Tube Nozzle Gland Connection		1	2	3	4	6
492B		Lubricating Tube (Cylinder No. 5) (Front) with Tube 1338A, Union 454 and Elbows 451 and 451A						1
493B		Lubricating Tube (Cylinder No. 5) (Piston Pin) with Tube 1337A, Union 454 and Elbows 451 and 451A						1
494B		Lubricating Tube (Cylinder No. 5) (Crank Pin) with Tube 1336A, Union 454 and Elbows 451 and 451A						1
494D		Lubricating Tube (Cylinder No. 5) (Crank Pin)with Tube 1335A, Union 454 and Elbows 451 and 451A						1
495B		Lubricating Tube (Cylinder No. 5) (Left) with Tube 1339A, Union 454 and Elbows 451 and 451A						1
496B		Lubricating Tube (Cylinder No. 6) (Front) with Tube 1338A, Union 454 and Elbows 451 and 451A						1
497B		Lubricating Tube (Cylinder No. 6) (Piston Pin) with Tube 1337A, Union 454 and Elbows 451 and 451A						1
498B		Lubricating Tube (Cylinder No. 6) (Crank Pin) with Tube 1336A, Union 454 and Elbows 451 and 451A						1
498D		Lubricating Tube (Cylinder No. 6) (Crank Pin) with Tube 1335A, Union 454 and Elbows 451 and 451A						1
499B		Lubricating Tube (Cylinder No. 6) (Left) with Tube 1339A, Union 454 and Elbows 451 and 451A						1
501B-C		**501B-C Governor**		**1**	**1**	**1**	**1**	**1**
	501B	Governor Spider, Always with		1	1	1	1	1
	502D	Governor Cam with Link Pin 503A		1	1	1	1	1
501B	546E	Injection Cam		1	1	1	1	1
	566A	Injection Cam Key		1	1	1	1	1
	505	Governor Weight Link		2	2	2	2	2
	507D	Governor Weight with Bushing 167		2	2	2	2	2
	83A	Governor Weight Pin		2	2	2	2	2
	251	Governor Weight Pin Nut Lock		2	2	2	2	2
		Governor Weight Pin Jam Nut		2	2	2	2	2
	3454	Governor Weight Stop Pin		2	2	2	2	2
		Governor Weight Stop Pin Jam Nut		2	2	2	2	2
		Governor Weight Stop Pin Cotter		2	2	2	2	2
	504	Governor Weight Link Pin		2	2	2	2	2
		Governor Weight Link Pin Hex. Nut		2	2	2	2	2
	48A	Governor Weight Spring Pin		2	2	2	2	2
	256B-C	Governor Spring		2	2	2	2	2
502D		Governor Cam with Link Pin 503A	501B-C	1	1	1	1	1
503A		Governor Link Sleeve Pin		2	2	2	2	2
504		Governor Weight Link Pin	501B-C	2	2	2	2	2
		Governor Weight Link Pin Hex. Nut, ½"	501B-C	2	2	2	2	2
505		Governor Weight Link	501B-C	2	2	2	2	2
507D		Governor Weight with Bushing 167	501B-C	2	2	2	2	2
510A		Pump Case Housing Overflow Pipe	511B-C	1	1	1	1	1
511B-C		**511B-C Pump Case Housing**		**1**	**1**	**1**	**1**	**1**
	511B	Pump Case Housing, Always with		1	1	1	1	1
	2361	Pump Case Housing Injection Pump Push Rod Plug		1				
	2360	Pump Case Housing Injection Pump Hole Cover		1				
	510A	Pump Case Housing Overflow Pipe		1	1	1	1	1
	642A	Injection Pump Suction Upper Push Rod Stem, Always with Bushing 651B		1	2	3	4	6
	2321	Pump Case Housing Stud		4	4	4	4	4
511B	1379	Governor Push Rod Guide Bushing				1	2	2
		Pump Case Housing Fuel Reservoir Stud		2	2	2	2	2
		Pump Case Housing Governor Case Stud		6	6	6	6	6
		Pump Case Housing Injection Pump Stud		4	4	6	8	12

(**Group Continued on Next Page**)

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl
		Pump Case Housing Auxiliary Pump Stud		3	3	3	3	3
		Pump Case Housing Air Inlet Stud		4	4	4	4	4
		Pump Case Housing Overflow Casing Stud		2	2	2	2	2
	849	Pump Case Housing Cover (Governor end)		1	1	1	1	1
		Pump Case Hous. Gov. End Cover Cap Screw		3	3	3	3	3
	512A	Pump Case Housing Side Cover		2	2	2	2	2
		Pump Case Hous. Side Cover Cap Screw		8	8	8	8	8
	1380A	Pump Case Housing Lubricator Rod Cover		1	1	1	1	1
		Pump Case Hous. Lub. Rod Cover Cap Screw, 3/8"x2"		1	1	1	1	1
		Pump Case H. Lub. Rod Cover Cap Screw, 3/8"x1 3/4"		2	2	2	2	2
		Pump Case H. L. R., Cover Cap Screw Lockwasher, 3/8"		3	3	3	3	3
		Pump Case Housing Lower Base Dowel #609		2	2	2	2	2
		Pump Case H. Air and Fuel Quadrant Cap Sc. 3/8"x1"		2	2	2	2	2
		Pump Case H. Air and Fuel Quadrant Fil. Hd. Sc., 3/8"x1 3/4"		2	2	2	2	2
		Pump Case H. Air and Fuel Quadrant Lockwasher, 3/8"		4	4	4	4	4
		Pump Case Housing Tee Handle Drain Cock		1	1	1	1	1
		Pump Case Housing Governor Case Stud, 1/2"x1 3/4"	511B-C	6	6	6	6	6
		Pump Case Housing Governor Case Stud Nut, 1/2"		6	6	6	6	6
		Pump Case Housing Injection Pump Stud, 1/2"x2"	511B-C	4	4	6	8	12
		Pump Case Housing Injection Pump Stud Nut, 1/2"		4	4	6	8	12
		Pump Case Housing Auxiliary Pump Stud, 1/2"x4 1/2"	511B-C	3	3	3	3	3
		Pump Case Housing Auxiliary Pump Stud Nut, 1/2"		3	3	3	3	3
		Pump Case Housing Overflow Casing Stud, 1/2"x6"	511B-C	2	2	2	2	2
		Pump Case Housing Overflow Casing Stud Nut, 1/2"		2	2	2	2	2
		Pump Case Housing Fuel Reservoir Stud, 1/2"x6 3/4"	511B-C	2	2	2	2	2
		Pump Case Housing Fuel Reservoir Stud Nut, 1/2"		2	2	2	6	6
		Pump Case Housing Fuel Res. Cover Stud Nut, 3/8"		4	4	4	4	4
		Pump Case Housing Air Inlet Stud, 5/8"x8 1/2"	511B-C	4	4	4	4	4
		Pump Case Housing Air Inlet Stud Nut, 5/8"		4	4	4	4	4
512A		Pump Case Housing Side Cover	511B-C	2	2	2	2	2
		Pump Case Housing Side Cover Cap Screw, 3/8"x 3/4"		8	8	8	8	8
516A-C		**516A-C Auxiliary Fuel Pump Body**		**1**	**1**	**1**	**1**	**1**
516B	516B	Auxiliary Fuel Pump Body with Stud		1	1	1	1	1
517B	517B	Auxiliary Fuel Pump Plunger		1	1	1	1	1
	300	Aux. Fuel Pump Plunger Spring		1	1	1	1	1
	2682	Aux. Fuel Pump Plunger Spring Retainer		1	1	1	1	1
	4764	Aux. Fuel Pump Plunger Tip		1	1	1	1	1
	4765	Aux. Fuel Pump Plunger Push Rod		1	1	1	1	1
	4766	Aux. Fuel Pump Plunger Push Rod Nut		1	1	1	1	1
518A	518A	Auxiliary Fuel Pump Plunger Link Pin		1	1	1	1	1
519A	519A	Auxiliary Fuel Pump Discharge Valve		1	1	1	1	1
519A	519A	Auxiliary Fuel Pump Suction Valve		1	1	1	1	1
520A	520A	Auxiliary Fuel Pump Discharge Valve Cap		1	1	1	1	1
	470	Auxiliary Fuel Pump Discharge Valve Cap Gasket		1	1	1	1	1
	148	Auxiliary Fuel Pump Discharge Valve Seat		1	1	1	1	1
	2112	Auxiliary Fuel Pump Suction Valve Plug		1	1	1	1	1
	1039	Auxiliary Fuel Pump Valve Plug Gasket		1	1	1	1	1
	90A	Auxiliary Fuel Pump Plunger Sleeve		1	1	1	1	1
	150	Auxiliary Fuel Pump Plunger Link		1	1	1	1	1
		Auxiliary Fuel Pump Cap Stud Nut, 3/8"		2	2	2	2	2
		Auxiliary Fuel Pump Body Cap Stud, 3/8"x2"	516A-C	2	2	2	2	2
		Aux. Fuel Pump Discharge Valve Cap Nipple, 1/4"x2 3/4"		1	1	1	1	1
		Auxiliary Fuel Pump Discharge Valve Cap Elbow, 1/4"		1	1	1	1	1
		Auxiliary Fuel Pump Strainer Nipple, 1/4"x4"		1	1	1	1	1
		Auxiliary Fuel Pump Body Pipe Plug, 1/2"		1	1	1	1	1
523		Fuel Overflow Pipe		1	1	1	1	1
524A-C		**524A-C Air Starter and Eccentric**		**1**	**1**	**1**	**1**	**1**
	524A	Air Starter Cam and Eccentric, Always with		1	1	1	1	1
	525A	Air Starter Eccentric Strap (Upper half)		1	1	1	1	1
	2764	Air Starter Eccentric Strap Cap Stud		2	2	2	2	2
		Air Starter Eccentric Strap Stud Lockwire		2	2	2	2	2
	526A	Air Starter Eccentric Strap (Lower half)		1	1	1	1	1
524A	2297	Air Starter Eccentric Strap Cap		1	1	1	1	1
	528A	Air Starter Eccentric Strap Bolt		2	2	2	2	2
		Air Starter Eccentric Strap Castle Nut		2	2	2	2	2
		Air Starter Eccentric Strap Lockwasher		2	2	2	2	2
		Air Starter Eccentric Strap Cotter Pin		2	2	2	2	2
		Air Starter Eccentric Strap Stud Nut		2	2	2	2	2
		Air Starter Eccentric Strap Lockwasher		2	2	2	2	2
	529A	Air Starter Cam and Eccentric Key		1	1	1	1	1
		Air Starter Eccentric Strap Castle Nut, 1/2"—20S.A.E.	524A-C	2	2	2	2	2
		Air Starter Eccentric Strap Lockwasher, 1/2"	524A-C	2	2	2	2	2
		Air Starter Eccentric Strap Cotter Pin, 1/8"x1"	524A-C	2	2	2	2	2
		Air Starter Eccentric Strap Cap Stud Nut, 3/8"		2	2	2	2	2
		Air Starter Ec. Strap Cap Stud Lockwire, 4 1/2"x.0625		2	2	2	2	2
525A		Air Starter Ec. Strap (Upper half), Always with 526A	524A-C	1	1	1	1	1
526A		Air Starter Ec. Strap (Lower half), Always with 525A	524A-C	1	1	1	1	1
528A		Auxiliary Fuel Pump Eccentric Strap Bolt	524A-C	2	2	2	2	2
529A		Air Starter Cam and Eccentric Key	524A-C	1	1	1	1	1

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
531A-C		**531A-C Injection Pump Body**		**1**	**2**	**3**	**4**	**6**
531A	531A	Injection Pump Body, Always with		1	2	3	4	6
	535A	Injection Pump Plunger (Not furnished separately)		1	2	3	4	6
		Injection Pump Body Pipe Plug		1	2	3	4	6
	260A	Injection Pump Plunger Spring		1	2	3	4	6
	2056	Injection Pump Relief Valve		....	2	3	4	6
		Injection Pump Relief Valve Plug		....	2	3	4	6
	2057A	Injection Pump Relief Valve Spring		....	2	3	4	6
	2058	Injection Pump Relief Valve Seat		....	2	3	4	6
	2059	Injection Pump Relief Valve Seat Gasket		2	4	6	8	12
	2060B	Injection Pump Relief Valve Seat Clamping Nut		....	2	3	4	6
	2060A	Injection Pump Relief Valve Seat Plug		1				
	536A	Injection Pump Suction Valve		1	2	3	4	6
	259	Injection Pump Suction Valve Spring		1	2	3	4	6
	91	Injection Pump Discharge Valve		1	2	3	4	6
	537	Injection Pump Discharge Valve Spring		1	2	3	4	6
	544	Injection Pump Discharge Valve Cage		1	2	3	4	6
	2108	Injection Pump Discharge Valve Cage Gasket		1	2	3	4	6
		Injectio Pump Body Pipe Plug, ¼"	531A-C	1	2	3	4	6
535A		Injection Pump Plunger (Not furnished separately)	531A-C	1	2	3	4	6
536A		Injectio Pump Suction Valve	531A-C	1	2	3	4	6
537		Injectio Pump Discharge Valve Spring	531A-C	1	2	3	4	6
544		Injection Pump Discharge Valve Cage	531A-C	1	2	3	4	6
546E		Injection Cam with Key 566A	501B-C	1	1	1	1	1
552A		Injection Cam Roller	654A-C	1	2	1	2	2
			654B-C	....	....	1	2	2
			654D-C	....	....	1	....	1
			654E-C	....	....	....	....	1
553A		Injection Cam Roller Pin	654A-C	1	2	1	2	2
			654B-C	....	....	1	2	2
			654D-C	....	....	1	....	1
			654E-C	....	....	....	....	1
555		Oil Storage Tank Coupling		3	3	3	3	3
566A		Injection Cam Key	501B-C	1	1	1	1	1
568A-C		**568A-C Air Starter Control**		**1**	**1**	**1**	**1**	**1**
568A	568A	Air Start Hand Control Shaft and Cam		1	1	1	1	1
	2202A	Air Start Hand Control Lever Quadrant		1	1	1	1	1
	2201-C	Air Start Hand Control Lever		1	1	1	1	1
570B-C		**570B-C Air Starting Valve**		**1**	**1**	**2**	**2**	**3**
570B	570B	Air Starting Valve		1	1	2	2	3
572	572	Air Starting Valve Spring		1	1	2	2	3
	903	Air Starting Valve Spring Plug		1	1	2	2	3
	2335	Air Starting Valve Spring Plug Gasket		1	1	2	2	3
573B		Air Starter Distrfbutor Body Gasket		1	1	1	1	1
573D		Air Shut Off Valve Cage Gasket		1	1	1	1	1
574		Air Start Inlet Elbow	2293B-C	1	1	1	1	1
585		Air Valve No. 1 (14x17)	588-C	1	2	3	4	6
586		Air Valve No. 2	588-C	1	2	3	4	6
587		Air Valve No. 3	588-C	1	2	3	4	6
588-C		**588-C Air Valve Leathers (Complete set)**	**597A-C**	**1**	**2**	**3**	**4**	**6**
588	588	Air Valve No. 4		1	2	3	4	6
	587	Air Valve No. 3		1	2	3	4	6
	586	Air Valve No. 2		1	2	3	4	6
	585	Air Valve No. 1 (14x17)		1	2	3	4	6
590		Air Valve Ring No. 1	593-C	1	2	3	4	6
591		Air Valve Ring No. 2	593-C	1	2	3	4	6
592		Air Valve Ring No. 3	593-C	1	2	3	4	6
593-C		**593-C Air Valve Rings (Complete set)**	**597-C**	**1**	**2**	**3**	**4**	**6**
593	593	Air Valve Ring No. 4		1	2	3	4	6
	592	Air Valve Ring No. 3		1	2	3	4	6
	591	Air Valve Ring No. 2		1	2	3	4	6
	590	Air Valve Ring No. 1 (14x17)		1	2	3	4	6
595		Air Valve Spring (14x17)	597A-C	24	48	72	96	144
595A		Air Valve Spring (12x15)	597A-C	20	40			

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
597B-C		**597B-C Air Valve**		**1**	**2**	**3**	**4**	**6**
597A	597A	Air Valve Seat		1	2	3	4	6
	588-C	Air Valve Leather		1	2	3	4	6
	593-C	Air Valve Ring		1	2	3	4	6
	595	Air Valve Spring (14x17)		24	48	72	96	144
	595A	Air Valve Spring (12x15)		20	40			
	233B	Air Suction Valve Pipe		1	2	3	4	6
	5303	Air Valve Cover		1	2	3	4	6
	5304	Air Valve Cover Washer		1	2	3	4	6
		Air Valve Cover R. H. M. Screw		1	2	3	4	6
		Air Valve Cover Lockwasher		1	2	3	4	6
		Air Valve Cover Dowel (12x15)		2	4			
598	598	Air Valve Seat Guide with Stud 599B		1	2	3	4	6
		Air Valve Seat Guide Stud Nut		1	2	3	4	6
		Air Valve Seat Guide Stud Nut		1	2	3	4	6
	2070	Air Valve Seat Guide Stud Washer		1	2	3	4	6
		Air Valve Seat Guide Stud Lockwasher		2	4	6	8	12
		Air Valve Seat Guide Stud Jam Nut		1	2	3	4	6
		Air Valve Seat Guide Stud Slotted Nut		1	2	3	4	6
		Air Valve Seat Guide Stud Cotter		1	2	3	4	6
599B		Air Valve Seat Guide Stud	597A-C	1	2	3	4	6
		Air Valve Seat Guide Stud Lockwasher, ¾"	597A-C	2	4	6	8	12
		Air Valve Seat Guide Stud Nut, ¾"	597A-C	1	2	3	4	6
		Air Valve Seat Guide Stud Nut, ⅝"	597A-C	1	2	3	4	6
		Air Valve Seat Guide Stud Jam Nut, ¾"	597A-C	1	2	3	4	6
		Air Valve Seat Guide Stud Slotted Nut, ⅝"	597A-C	1	2	3	4	6
		Air Valve Seat Guide Stud Cotter, ⅛"x½"	597A-C	1	2	3	4	6
604A		Upper Base Cylinder Stud Nut	2D-C	4				
608A		Lower Step		1				
611		Exhaust Nipple (14x17)	665-C	1				
615		Exhaust Pot Cover (Top)	225A-C	1	1	1	2	3
616		Exhaust Pot Cover (Bottom)	225A-C	1	1	1	2	3
		Exhaust Pot Cover Bolt ¾"x3¼"	225A-C	24	24	24	48	72
617		Exhaust Pot to Cover Gasket	225A-C	2	2	2	4	6
618		Exhaust Nipple Flange Gasket	225A-C / 665-C	1				
618		Exhaust Elbow Gasket	665-C	....	2	5	4	6
625A		Inj. Pump Suction Valve Lower Push Rod (Medium)		1	2	1	2	2
625B		Inj. Pump Suction Valve Lower Push Rod (Long)		....	....	1	2	2
625D		Inj. Pump Suction Valve Lower Push Rod (Short)		....	....	1	....	2
626		Injection Pump Suction Valve Adjusting Screw		1	1	2	3	5
626A		Injection Pump Suction Valve Adjusting Screw		....	1	1	1	1
627A		Injection Pump Suction Valve Adjusting Screw Nut		1	2	3	4	6
632A		Cylinder Head Counterbore Gasket		1	2	3	4	6
642A		Injection Pump Suction Upper Push Rod Stem, Always with Bushing 651B	511B-C	1	2	3	4	6
651B		Injection Pump Push Rod Bushing (Not furn. sep.)	624A	1	2	3	4	6
654A-C		**654A-C Injection Pump Rocker** Six Cyl. Engine, Used on Cylinders No. 3 and No. 4. Four Cyl. Engine, Used on Cylinders No. 2 and No. 3. Three Cylinder Engine, Used on Cylinder No. 2. Two Cyl. Engine, Used on Cylinders No. 1 and No. 2. One Cylinder Engine, Used on Cylinder No. 1.		**1**	**2**	**2**	**1**	**2**
654A	654A / 658A	Injection Pump Rocker, Always with / Injection Pump Rocker Mushroom		1	2	1	2	2
	552A	Injection Cam Roller		1	2	1	2	2
	553A	Injection Cam Roller Pin		1	2	1	2	2
	2324	Injection Pump Rocker Dowel		2	4	2	4	4
654B-C		**654B-C Injection Pump Rocker** Six Cyl. Engine, Used on Cylinders No. 1 and No. 6. Four Cyl. Engine, Used on Cylinders No. 2 and No. 3. Three Cylinder Engine, Used on Cylinder No. 1.		....	....	**1**	**2**	**2**
654B	654B / 658A	Injection Pump Rocker, Always with / Injection Pump Rocker Mushroom		....	....	1	2	2
	552A	Injection Cam Roller		....	....	1	2	2
	553A	Injection Cam Roller Pin		....	....	1	2	2
	2324	Injection Pump Rocker Roller Dowel		....	....	2	4	4
654D-C		**654D-C Injection Pump Rocker** Six Cylinder Engine, Used on Cylinder No. 5. Three Cylinder Engine, Used on Cylinder No. 3.		....	....	**1**	....	**1**
654D	654D / 2325	Injection Pump Rocker, Always with / Injection Pump Rocker Mushroom		....	....	1	....	1
	552A	Injection Cam Roller		....	....	1	....	1
	553A	Injection Cam Roller Pin		....	....	1	....	1
	2324	Injection Pump Rocker Roller Dowel		....	....	2	....	2
654E-C		**654E-C Injection Pump Rocker** Six Cylinder Engine, Used on Cylinder No. 2.		....	....	....	....	**1**
654E	654E / 2325	Injection Pump Rocker, Always with / Injection Pump Rocker Mushroom		....	....	....	....	1
	552A	Injection Cam Roller		....	....	....	....	1
	553A	Injection Cam Roller Pin		....	....	....	....	1
	2324	Injection Pump Rocker Roller Dowel		....	....	....	....	2

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
656A-C		**656A-C Governor Cam Rocker**		**1**	**2**	**1**	**2**	**2**
		Six Cyl. Engine, Used on Cylinders No. 3 and No. 4.						
		Four Cyl. Engine, Used on Cylinders No. 1 and No. 4.						
		Three Cylinder Engine, Used on Cylinder No. 2.						
		Two Cyl. Engine, Used on Cylinders No. 1 and No. 2.						
		One Cylinder Engine, Used on Cylinder No. 1.						
	656A	Governor Cam Rocker, Always with		1	2	1	2	2
656A	658A	Governor Cam Rocker Mushroom		1	2	1	2	2
	2333	Governor Cam Rocker Bushing		1	2	1	2	2
	2331	Governor Cam Rocker Roller Pin		1	2	1	2	2
	2976	Governor Cam Rocker Roller Pin Dowel		2	4	2	4	4
	2332	Governor Cam Roller		1	2	1	2	2
656B-C		**656B-C Governor Cam Rocker**				**1**	**2**	**2**
		Six Cyl. Engine, Used on Cylinders No. 1 and No. 6.						
		Four Cyl. Engine, Used on Cylinders No. 2 and No. 3.						
		Three Cylinder Engine, Used on Cylinder No. 1.						
	656B	Governor Cam Rocker, Always with				1	2	2
656B	658A	Governor Cam Rocker Mushroom				1	2	2
	2333	Governor Cam Rocker Bushing				1	2	2
	2331	Governor Cam Rocker Roller Pin				1	2	2
	2976	Governor Cam Rocker Roller Pin Dowel				2	4	4
	2332	Governor Cam Roller				1	2	2
656D-C		**656D-C Governor Cam Rocker**				**1**		
		Three Cylinder Engine, Used on Cylinder No. 3.						
	656D	Governor Cam Rocker, Always with				1		
656D	658A	Governor Cam Rocker Mushroom				1		
	2333	Governor Cam Rocker Bushing				1		
	2331	Governor Cam Rocker Roller Pin				1		
	2976	Governor Cam Rocker Roller Pin Dowel				2		
	2332	Governor Cam Roller				1		
656D-C		**656D-C Governor Cam Rocker**						**1**
		Six Cylinder Engine, Used on Cylinder No. 5.						
	656D	Governor Cam Rocker, Always with						1
656D	658A	Governor Cam Rocker Mushroom						1
	2333A	Governor Cam Rocker Bushing						1
	2331	Governor Cam Rocker Roller Pin						1
	2976	Governor Cam Rocker Roller Pin Dowel						2
	2332	Governor Cam Roller						1
656E-C		**656E-C Governor Cam Rocker**						**1**
		Six Cylinder Engine, Used on Cylinder No. 2.						
	656E	Governor Cam Rocker, Always with						1
656E	658A	Governor Cam Rocker Mushroom						1
	2333B	Governor Cam Rocker Bushing						2
	2331	Governor Cam Rocker Roller Pin						1
	2976	Governor Cam Rocker Roller Pin Dowel						2
	2332	Governor Cam Roller						1
657B		Short Rocker Shaft			1	1	2	3
658A		Injection Pump Rocker Mushroom	654A-C	1	2	1	2	2
			654B-C			1	2	2
658A		Governor Cam Rocker Mushroom		1	2	3	4	6
658A		Air Starter Rocker Mushroom		1	1	2	2	3
658B		Crankshaft Counterweight Mushroom	25A-C	4	8	12	16	
			25B-C					
659A		Injection Pump Plunger Push Rod		1	2	1	2	2
659B		Injection Pump Plunger Push Rod				1	2	2
659D		Injection Pump Plunger Push Rod				1		2
665-C		**665-C Exhaust Piping**		**1**	**1**	**1**	**1**	**1**
665	665	Exhaust Elbow			2		4	6
	416	Exhaust Elbow Gasket (12x15)			2			
	618	Exhaust Elbow Gasket (14x17)			2	5	4	6
	670	Exhaust Elbow				2		
	671	Exhaust Pipe				3		
	611	Exhaust Nipple (14x17)		1				
	416	Exhaust Pot Flange Gasket (12x15)		1				
	229	Exhaust Nipple Flange (14x17)		1				
	618	Exhaust Nipple Flange Gasket		1				
		Exhaust Nipple Thread Protector		2				
		Exhaust Nipple Flange Bolt, (12x15) ¾″x3″		8				
		Exhaust Nipple Flange Bolt, (14x17) ¾″x3¼″		8				
		Exhaust Elbow Bolt, (12x15) ¾″x3″			16			
		Exhaust Elbow Bolt, (14x17) ¾″x3¼″			16	40	32	48
	263	Exhaust Nipple Flange Bolt Nut		8				
	263	Exhaust Elbow Bolt Nut			16	40	32	48

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
666		Exhaust Conduit Thimble Gland	225B-C	1	2	3	4	6
666		Exhaust Pot Stuffing Box Gland	225A-C	....	2	3	4	6
668		Exhaust Pot Stuffing Box Stud Nut	225A-C	....	8	12	16	24
668		Exhaust Conduit Thimble to Gland Stud Nut	225B-C	4	8	12	16	24
669A		Cooling Water Handwheel with Pin #205	1618-C / 1618A-C	1	2	3	4	6
670		Exhaust Elbow	665-C	....	....	2		
		Exhaust Elbow Bolt, ¾″x3¼″ (14x17)		....	16	40	32	48
671		Exhaust Pipe	665-C	....	....	3		
671		Exhaust Pipe (12x15)	665-C	1				
674A		Air Starter Push Rod		1	1	1	1	1
674B		Air Starter Push Rod		....	....	1	1	1
674D		Air Starter Push Rod		....	....	....	....	1
700B-C		**700B-C Air Start Pipe (Upper)**		**1**	**1**	**1**	**1**	**1**
700	700	Air Start Pipe (Upper) Cyl. #1 with Unions & Nipple		1	1	1	1	1
700A	700A	Air Start Pipe (Upper) Cyl. #3 with Unions & Nipple		....	....	1	1	
700B	700B	Air Start Pipe (Upper) Cyl. #4 with Unions & Nipple		....	....	....	....	1
700D	700D	Air Start Pipe (Upper) Cyl. #5 with Unions & Nipple		....	....	....	....	1
	2789	Air Start Pipe Clamp		....	....	....	....	2
	2789A	Air Start Pipe Clamp		....	....	2	2	
		Air Start Pipe Clamp Cap Screw ⅜″x2″		....	....	1	1	2
		Air Start Pipe Clamp Cap Screw Nut, ⅜″		....	....	1	1	2
		Air Start Pipe R. Union, 1¼″		2	2	4	4	6
		Air Start Pipe Close Nipple, 1¼″		1	1	2	2	3
701B-C		**701B-C Air Start Pipe Lower**		**1**	**1**	**1**	**1**	**1**
701	701	Air Start Pipe (Lower) Cylinder #1		1	1	1	1	1
701A	701A	Air Start Pipe (Lower) Cylinder #3		....	....	1	1	
701B	701B	Air Start Pipe (Lower) Cylinder #4		....	....	....	....	1
701D	701D	Air Start Pipe (Lower) Cylinder #5		....	....	....	....	1
721D-C		**721D-C Oil Filter Storage Tank**		**1**	**1**	**1**	**1**	**1**
721D	721D	Oil Filter Storage Tank (Assembled)		1	1	1	1	1
	2586A	Oil Storage Tank Base		1	1	1	1	1
	1096B	Oil Storage Tank Cover		1	1	1	1	1
	4834	Oil Storage Tank Inlet Fitting		1	1	1	1	1
	2794	Oil Storage Tank Flanged Elbow (Not furn. sep.)		1	1	1	1	1
	5305	Oil Filter Coupling		1	1	1	1	1
	5305A	Oil Filter Coupling		2	2	2	2	2
	555	Oil Storage Tank Coupling		3	3	3	3	3
	2387A	Gauge Glass		1	1	1	1	1
	994A	Gauge Glass Arm		2	2	2	2	2
	995	Gauge Glass Gland Cap		2	2	2	2	2
	996	Gauge Glass Washer		2	2	2	2	2
	997A	Gauge Glass Guard Rod		2	2	2	2	2
	998	Gauge Glass Guard Rod End		2	2	2	2	2
	990	Gauge Glass Gasket		2	2	2	2	2
	5350	Oil Filter		1	1	1	1	1
		Tee Handle Stop Cock, ½″		1	1	1	1	1
		Drain Pipe, ½″x10″		1	1	1	1	1
		Oil Filter Storage Tank Cap Screw, ½″x1″		3	3	3	3	3
		Oil Filter Storage Tank Cap Screw Lockwasher, ½″		3	3	3	3	3
		Filter and Tank Comp. Connector, ¼″x⅜″		2	2	2	2	2
	5365	Filter to Tank Tube		1	1	1	1	1
		Filter to Tank Stop Cock, ¼″		1	1	1	1	1
		Filter to Tank Close Nipple, ¼″		1	1	1	1	1
798		Combustion Chamber Water Jacket Overflow Funnel	2115B-C	1	2	3	4	6
		Manifold Funnel Cap Screw, ½″x1¼″	2115B-C	2	4	6	8	12
805B-C		**805B-C Main Bearing Cap (Governor end)**	**14E-C / 14F-C**	**1**	**1**	**1**	**1**	**1**
805B	805B	Main Bearing Cap, Always with		1	1	1	1	1
	830	Main Bearing Cap Cover, with hinge pin		1	1	1	1	1
	342	Main Bearing Cap Dowel		1	1	1	1	1
806B-C		**806B-C Main Bearing Cap (Cpposite gov. end)**	**14E-C / 14F-C**	**1**	**1**	**1**	**1**	**1**
806B	806B	Main Bearing Cap, Always with		1	1	1	1	1
	830	Main Bearing Cap Cover, with hinge pin		1	1	1	1	1
	342	Main Bearing Cap Dowel		1	1	1	1	1
807B-C		**807B-C Main Bearing Cap (Center)**	**14E-C / 14F-C**	....	**1**	**2**	**3**	**5**
807B	807B	Main Bearing Cap, Always with		....	1	2	3	5
	830	Main Bearing Cap Cover, with hinge pin		....	1	2	3	5
	342	Main Bearing Cap Dowel (14x17)		....	1	2	3	5
812B		Main Bearing Shell Oil Stop (Governor end)	14E-C	2	2	2	2	2
813A		Main Bearing Shell Oil Stop (Opposite governor end)		2	2	2	2	2
814A		Main Bearing Shell Oil Stop (Center)	14E-C	....	2	4	6	10

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
816D-C		**816D-C Main Bearing Shell (Opp. gov. end) (12x15, 1 and 2 Cylinder; 14x17, 6 Cyl.)**	.....	**1**	**1**	....	....	**1**
816D	816D	Main Brg. Shell (Opp. gov. end) (Upper), Always with	.....	1	1	....	....	1
	817D	Main Brg. Shell (Opp. gov. end) (Lower), not fur. sep.	.....	1	1	....	....	1
		Main Bearing Shell Shim Dowel	.....	2	2	....	....	2
	820A	Main Bearing Dowel	.....	1	1	....	....	1
	823	Main Bearing Shell Shim (Thick)	.....	8	8			
	823A	Main Bearing Shell Shim (Thick)	.....	....	....	....	....	8
	824	Main Bearing Shell Shim (Thin)	.....	14	14			
	824A	Main Bearing Shell Shim (Thin)	.....	....	....	....	....	14
816E-C		**816E-C Main Bearing Shell (Opp. gov. end) (14x17)**	.....	**1**	**1**	**1**	**1**	
816E	816E	Main Brg. Shell (Opp. gov. end) (Upper), Always with	.....	1	1	1	1	
	817E	Main Brg. Shell (Opp. gov. end) (Lower), not fur. sep.	.....	1	1	1	1	
		Main Brg. Shell Shim Dowel	.....	2	2	2	2	
	820A	Main Bearing Dowel	.....	1	1	1	1	
	823A	Main Bearing Shell Shim (Thick)	.....	8	8	8	8	
	824A	Main Bearing Shell Shim (Thin)	.....	14	14	14	14	
817D		Main Brg. Shell (Lower) (Opp. gov. end); (12x15, 1 and 2 Cyl. and 14x17, 6 Cyl.), not furn. sep.	816D-C	1	1	....	....	1
817E		Main Brg. Shell (Lower) (Opp. gov. end) (14x17), not furnished separately	816E-C	1	1	1	1	
818D-C		**818D-C Main Bearing Shell (Gov. End) (12x15, 1 and 2 Cyl. and 14x17, 6 Cyl.)**	.....	**1**	**1**	....	....	**1**
818D	818D	Main Brg. Shell (Gov. End) (Upper), Always with	.....	1	1	....	....	1
	819D	Main Brg. Shell (Gov. End) (Lower), not furn. sep.	.....	1	1	....	....	1
		Main Brg. Shell Shim Dowel	.....	2	2	....	....	2
	820A	Main Bearing Shell Dowel	.....	1	1	....	....	1
	827	Main Bearing Shell Shim (Gov. End) (Thick)	.....	8	8			
	827A	Main Bearing Shell Shim (Gov. End) (Thick)	.....	....	....	....	....	8
	828	Main Bearing Shell Shim (Gov. End) (Thin)	.....	14	14			
	828A	Main Bearing Shell Shim (Gov. End) (Thin)	.....	....	....	....	....	14
818E-C		**818E-C Main Bearing Shell (Gov. End) (14x17)**	.....	**1**	**1**	**1**	**1**	
818E	818E	Main Bearing Shell (Gov. End) (Upper), Always with	.....	1	1	1	1	
	819E	Main Bearing Shell (Gov. End) (Lower), not furn. sep.	.....	1	1	1	1	
		Main Bearing Shell Shim Dowel	.....	2	2	2	2	
	820A	Main Bearing Shell Dowel	.....	1	1	1	1	
	827A	Main Bearing Shell Shim (Gov. End) (Thick)	.....	8	8	8	8	
	828A	Main Bearing Shell Shim (Gov. End) (Thin)	.....	14	14	14	14	
819D		Main Brg. Shell (Gov. End) (Lower), not furn. sep. (12x15, 1 and 2 Cyl. and 14x17, 6 Cyl.)	818D-C	1	1	....	....	1
819E		Main Brg. Shell (Gov. End) (Lower), not furn. sep. (14x17)	818E-C	1	1	1	1	
820A		Main Bearing Shell Dowel	816D-C, 816E-C, 818D-C, 818E-C, 821D-C, 821E-C	2	4	6	8	12
821D-C		**821D-C Main Bearing Shell (Center) (12x15, 2 Cyl. and 14x17, 6 Cyl.)**	.....	....	**1**	....	....	**5**
821D	821D	Main Bearing Shell (Center) (Upper), Always with	.....	....	1	....	....	5
	822D	Main Bearing Shell (Center) (Lower), not furn. sep.	.....	....	2	....	....	10
		Main Bearing Shell Shim Dowel	.....	....	2	....	....	10
	820D	Main Bearing Shell Dowel	.....	....	2	....	....	10
	831	Main Bearing Shell Shim (Center) (Thick)	.....	....	8			
	831A	Main Bearing Shell Shim (Center) (Thick)	.....	....	....	....	....	40
	832	Main Bearing Shell Shim (Center) (Thin)	.....	....	14			
	832A	Main Bearing Shell Shim (Center) (Thin)	.....	....	....	....	....	70
821E-C		**821E-C Main Bearing Shell (Center) (14x17)**	.....	....	**1**	**2**	**3**	
821E	821E	Main Bearing Shell (Center) (Upper), Always with	.....	....	1	2	3	
	822E	Main Bearing Shell (Center) (Lower), not furn. sep.	.....	....	2	4	6	
		Main Bearing Shell Shim Dowel	.....	....	2	4	6	
	820A	Main Bearing Shell Dowel	.....	....	2	4	6	
	831A	Main Bearing Shell Shim	.....	....	8	16	24	
	832A	Main Bearing Shell Shim	.....	....	14	28	42	
822D		Main Brg. Shell (Center) (Lower) (12x15, 2 Cyl.; 14x17, 6 Cyl.)	821D-C	....	1	....	....	10
822E		Main Brg. Shell (Center) (Lower) (14x17)	821E-C	....	2	4	6	
823		Main Brg. Shell Shim (Opp. gov. end) (Thick) (12x15)	816D-C	8	8			
823A		Main Brg. Shell Shim (Opp. gov. end) (Thick) (14x17)	816D-C, 816E-C	8	8	8	8	8
824		Main Brg. Shell Shim (Opp. gov. end) (Thin) (12x15)	816D-C	14	14	14	14	14
824A		Main Brg. Shell Shim (Opp. gov. end) (Thin) (14x17)	816D-C, 816E-C	14	14	14	14	14
825		Main Bearing Oil Gauge Glass	298A-C	1	1	1	2	2
825A		Outboard Bearing Oil Gauge Glass	310A-C	1	1	1	1	2

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
827		Main Bearing Shell Shim (Gov. end) (Thick) (12x15)	818D-C	8	8			
827A		Main Bearing Shell Shim (Gov. end) (Thick) (14x17)	818D-C, 818E-C	8	8	8	8	8
828		Main Bearing Shell Shim (Gov. end) (Thin) (12x15)	818D-C	14	14			
828A		Main Bearing Shell Shim (Gov. end) (Thin) (14x17)	818D-C, 818E-C, 805B-C	14	14	14	14	14
830		Main Bearing Cap Cover with Hinge Pin	806B-C, 807B-C	2	3	4	5	7
		Main Bearing Cap Hinge Pin #455	830	2	3	4	5	7
831		Main Bearing Shell Shim (Center) (Thick) (12x15)	821D-C	....	8			
831A		Main Bearing Shell Shim (Center) (Thick) (14x17)	821D-C, 821E-C	....	8	16	24	40
832		Main Bearing Shell Shim (Center) (Thin) (12x15)	821D-C	....	14			
832A		Main Bearing Shell Shim (Center) (Thin) (14x17)	821D-C, 821E-C	....	14	28	42	70
833		Main Bearing Oiler Ring (Furnished in pairs)		2 Pr	3 Pr	4 Pr	5 Pr	7 Pr
833A		Outboard Brg. Oil Ring (Furn. in pairs) with Pin 1978	310A-C	2 Pr	2 Pr	2 Pr	2 Pr	4 Pr
	836A	Piston Pin Oil Scraper, Always with		1	2	3	4	6
836A	838	Piston Pin Oil Scraper Pipe (Not furnished separately)	7A-C	1	2	3	4	6
	840	Piston Pin Oil Scraper Dowel		1	2	3	4	6
	836B	Piston Pin Oil Scraper, Always with		1	2	3	4	6
836B	838	Piston Pin Oil Scraper Pipe (Not furnished separately)	7A-C	1	2	3	4	6
	840	Piston Pin Oil Scraper Dowel		1	2	3	4	6
837A		Piston Pin Oil Scraper Spring	7A-C	2	4	6	8	12
838		Piston Pin Oil Scraper Pipe (Not furnished separately)		2	4	6	8	12
839A		Piston Pin Oil Scraper Pipe Guide	7A-C	2	4	6	8	12
840		Piston Pin Oil Scraper Dowel	836A, 836B	2	4	6	8	12
849		Pump Case Housing Cover (Gov. end)	511B-C	1	1	1	1	1
		Pump Case Hous. Gov. End Cover Cap Screw, ⅝"x¾"		3	3	3	3	3
853B		Air Start Check Valve with Nut and Cotter	854A-C	1	1	2	2	3
		Air Starting Check Valve Castle Nut ⅝"—18 S.A.E.		1	1	2	2	3
		Air Starting Check Valve Cotter, ⅛"x¼"		1	1	2	2	3
854A-C		**854A-C Air Starting Check Valve Cage**		**1**	**1**	**2**	**2**	**3**
	854A	Air Starting Check Valve Cage, Always with		1	1	2	2	3
854A	2113	Air Starting Check Valve Bushing		1	1	2	2	3
		Air Starting Check Valve Cage Dowel		1	1	2	2	3
	853B	Air Starting Check Valve		1	1	2	2	3
856A	856A	Air Starting Check Valve Spring		1	1	2	2	3
	2114	Air Starting Check Valve Spring Cap		1	1	2	2	3
	1550A	Air Starting Check Valve Bonnet		1	1	2	2	3
		Air Starting Check Valve Cap Screw, ⅝"x2¾" (14x17)		2	4	6	8	12
		Air Starting Check Valve Cap Screw, ⅝"x2½" (12x15)		3	6			
		Air Starting Check Valve Cage Dowel, #306		1	1	2	2	3
858B		Air Check Valve Bonnet Cylinder Head Gasket		1	2	3	4	6
903		Air Starting Valve Spring Plug	570B-C	1	1	2	2	3
933		Injection Nozzle Spiral	201B-C	1	2	3	4	6
933A		Injection Nozzle Spiral	201D-C	1	2	3	4	6
951A		Cylinder Core Hole Cover (14x17)	1D-C	1				
		Cylinder Core Hole Cover Cap Screw, ⅝"x1½" (14x17)	1D-C	3				
952B-C		**952B-C Cylinder Cooling Water Reg. Valve Body**		**1**	**2**	**3**	**4**	**6**
952B	952B	Cyl. Cooling Water Reg. Valve Body, Always with		1	2	3	4	6
		Cyl. Cooling Water Reg. Valve Body Pipe Plug		1	2	3	4	6
	1618-C	Cooling Water Regulating Valve		1	2	3	4	6
		Water Reg. Valve Body Pipe Plug, ½"	952B-C	1	2	3	4	6
		Water Reg. Valve Body Cap Screw, ⅝"x1½"		3	6	9	12	18
975-C		**975-C Auxiliary Fuel Discharge Strainer**	**985A-C**	**1**	**1**	**1**	**1**	**1**
	975	Auxiliary Fuel Discharge Strainer, Always with		1	1	1	1	1
975	976	Auxiliary Fuel Dis. Strainer Side (Not furn. sep.)		1	1	1	1	1
	1625	Auxiliary Fuel Dis. Strainer Bottom (Not furn. sep.)		1	1	1	1	1
976		Auxiliary Fuel Dis. Strainer Side (Not furn. sep.)	975-C	1	1	1	1	1
985A-C		**985A-C Fuel Reservoir**		**1**	**1**	**1**	**1**	**1**
	985A	Fuel Reservoir, Always with		1	1	1	1	1
	1199A	Fuel Reservoir Starting Valve Bushing		1	1	2	2	3
985A	991A	Fuel Reservoir Gauge Glass		1	1	1	1	1
	989	Fuel Reservoir Gauge Glass Plug		1	1	1	1	1
	990	Fuel Reservoir Gauge Glass Gasket		1	1	1	1	1
		Air Shut-off Valve Fuel Reservoir Stud		2	2	2	2	2
	975-C	Auxiliary Fuel Discharge Strainer		1	1	1	1	1
		Air Shut-off Valve Fuel Reservoir Stud, ⅝"x2½"	985A-C	2	2	2	2	2
		Air Shut-off Valve Fuel Reservoir Stud Nut, ⅝"		2	2	2	2	2

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number: Arranged Numerically	Repair Number: Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 — NAME OF PART	Included in Group	Number Used: 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl	6 Cyl.
986B-C		**986B-C Fuel Reservoir Cover**		**1**	**1**	**1**	**1**	**1**
	986A	Fuel Reservoir Cover, Always with		1	1	1	1	1
	60A	Fuel Reservoir Cover Cap		1	1	1	1	1
986A	2313	Fuel Reservoir Cover Cap Handle		1	1	1	1	1
	2362	Fuel Reservoir Cover Cap Spring		1	1	1	1	1
	2270	Fuel Reservoir Cover Cap Screw Collar		1	1	1	1	1
		Fuel Reservoir Cover Cap Round Head Screw		1	1	1	1	1
	187A-C	Fuel Reservoir Cover Strainer		1	1	1	1	1
		Fuel Reservoir Cover Cap Rd. Hd. Screw #10—24x1″	986B-C	1	1	1	1	1
989		Fuel Reservoir Gauge Glass Plug	985A-C	1	1	1	1	1
989		Outboard Bearing Oil Gauge Glass Plug	310A-C	1	1	1	1	2
989		Main Bearing Oil Gauge Glass Plug	298A-C	1	1	1	2	2
990		Oil Filter Storage Tank Gauge Glass Gasket	721D-C	2	2	2	2	2
990		Outboard Bearing Oil Gauge Glass Gasket	310A-C	2	2	2	2	4
990		Fuel Reservoir Gauge Glass Gasket	985A-C	1	1	1	1	1
990		Main Bearing Oil Gauge Glass Gasket	298A-C	2	2	2	4	4
991A		Fuel Reservoir Gauge Glass	985A-C	1	1	1	1	1
994A		Oil Filter Storage Tank Gauge Glass Arm	721D-C	2	2	2	2	2
995		Oil Filter Storage Tank Gauge Glass Gland Cap	721D-C	2	2	2	2	2
996		Oil Filter Storage Tank Gauge Glass Washer	721D-C	2	2	2	2	2
997A		Oil Filter Storage Tank Gauge Glass Guard Rod	721D-C	2	2	2	2	2
998		Oil Filter Storage Tank Gauge Glass Guard Rod End	721D-C	2	2	2	2	2
1010B		Injection Tube Clamp to Cylinder and Pan	1015-C	2	5	8	12	14
1010D		Cylinder Lubricating Tube Clamp (One tube)	1029A-C	....	3	4	5	7
1011D		Injection Tube Clamp (One tube)	1015-C	....	1	1	1	1
1011E		Cylinder Lubricating Tube Clamp (Two tubes)	1029A-C	1	1	2	3	5
1012A		Injection Tube Clamp (Three tubes)	1015-C	....	....	1	1	1
1013A		Injection Tube Clamp (Four tubes)	1015-C	....	....	....	1	1
1014		Injection Tube Clamp (Five tubes)	1015-C	....	....	....	....	1
1015-C		**1015-C Injection Tube Clamp**		**1**	**1**	**1**	**1**	**1**
1015	1015	Injection Tube Clamp (Six tubes)		....	....	....	....	1
	1014	Injection Tube Clamp (Five tubes)		....	....	....	....	1
	1013A	Injection Tube Clamp (Four tubes)		....	....	....	1	1
	1012A	Injection Tube Clamp (Three tubes)		....	....	1	1	1
	1011D	Injection Tube Clamp (Two tubes)		....	1	1	1	1
	1010B	Injection Tube Clamp to Cylinder and Pan		2	5	8	12	14
	1329	Injection Tube Clamp (Two tubes)		....	2	2	2	2
		Injection Tube Clamp Cap Screw, ¼″x1″		....	2	2	2	2
		Injection Tube Clamp R. H. M. Screw, #10—24x½″		4	8	12	16	24
		Inj. Tube Clamp R. H. M. Screw,#10—24x¾″ (14x17)		....	4	8	12	20
		Inj. Tube C. R. H. M. Screw Lockwasher, 5/16″ (14x17)		....	4	8	12	20
		Inj. Tube C. R. H. M. Screw Lockwasher, 5/16″ (12x15)		4	8	12	16	24
		Injection Tube Clamp Screw Hex. Nut,#10—24(14x17)		....	4	8	12	20
1029A-C		**1029A-C Lubricating Tube Clamp**		....	**2**	**2**	**2**	**2**
1029	1029	Lubricating Tube Clamp (Inside of pan)		....	2	2	2	2
1029	1029	Lubricating Tube Clamp (Outside of pan)		....	....	1		
1029A	1029A	Lubricating Tube Clamp (Outside of pan)		....	1	....	1	1
1030	1030	Lubricating Tube Clamp (Inside of pan)		....	....	2	2	2
1031	1031	Lubricating Tube Clamp		....	....	....	2	2
1031A	1031A	Lubricating Tube Clamp		....	....	....	....	2
	1855	Lubricating Tube Clamp		....	....	....	....	2
	1010D	Cylinder Lubricating Tube Clamp (One tube)		1	3	4	5	7
	1011E	Cylinder Lubricating Tube Clamp (Two tubes)		1	1	2	3	5
		Lubricating Tube Clamp Machine Screw, #14—20x1″		....	2	4	8	16
		Lubricating Tube Clamp Screw Hex. Nut, #14—20		....	2	4	8	16
		Lubricating Tube Clamp Screw Lockwasher, ¼″		....	2	4	8	16
		Lubricating Tube Clamp R.H.M. Screw, #10—24x3/8″		4	8	12	16	24
		Lubricating Tube Clamp R.H.M. Screw, #10—24x5/8″		....	1	1	1	1
		Lubricating Tube Clamp Hex. Nut, #10—24		....	1	1	1	1
		Lubricating Tube Clamp Lockwasher, 3/16″		....	1	1	1	1
1039		Auxiliary Fuel Pump Valve Plug Gasket	516A-C	1	1	1	1	1
1081A-C		**1081A-C Lubricating Oil Sump**		**1**	**1**	**1**	**1**	**1**
	1081A	Lubricating Oil Sump, Always with		1	1	1	1	1
	1082A	Lubricating Oil Sump Cover		1	1	1	1	1
1081A		Lubricating Oil Sump Cover Pin		1	1	1	1	1
		Lubricating Oil Sump Pump Stud		1	1	1	1	1
		Lubricating Oil Sump Pump Stud		1	1	1	1	1
		Lubricating Oil Sump Pipe Plug		1	1	1	1	1
	187-C	Lubricating Oil Sump Strainer		1	1	1	1	1
	2316	Lubricating Oil Sump Overflow Pipe		1	1	1	1	1
	2370	Governor Case Overflow Pipe Gland Washer		1	1	1	1	1
	2317	Governor Overflow Pipe Stuffing Box		1	1	1	1	1
	2318	Governor Case Overflow Pipe Gland		1	1	1	1	1
	2319	Governor Case Overflow Pipe (14x17)		1	1	1	1	1
	2319A	Governor Case Overflow Pipe (12x15)		1	1			
	1089A	Lubricating Oil Sump Stuffing Box Packing Ring		1	1	1	1	1
	2312	Lubricating Oil Sump Plate		1	1	1	1	1
		Lubricating Oil Sump Cover Pin #469	1081A-C	1	1	1	1	1

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
		Lubricating Oil Sump Pump Stud, ½"x4¾"	1081A-C	1	1	1	1	1
		Lubricating Oil Sump Pump Stud, ½"x3¼"	1081A-C	1	1	1	1	1
		Lubricating Oil Sump Plug, ½"	1081A-C	1	1	1	1	1
		Lubricating Oil Sump Stud Hex. Nut, ½"	1081A-C	2	2	2	2	2
1082A		Lubricating Oil Sump Cover	1081A-C	1	1	1	1	1
1084A-C		**1084A-C Lubricating Oil Pump Body**		**1**	**1**	**1**	**1**	**1**
1084A	1084A	Lubricating Oil Pump Body, Always with		1	1	1	1	1
1085A	1085A	Lubricating Oil Pump Plunger		2	2	2	2	2
	1093A	Lubricating Oil Pump Plunger Pin		1	1	1	1	1
	2111	Lubricating Oil Pump Plunger Pin Collar		2	2	2	2	2
	2110	Lubricating Oil Pump Discharge Connection		2	2	2	2	2
		Lubricating Oil Pump Discharge Valve Ball, ⅝" Dia.		2	2	2	2	2
		Lubricating Oil Pump Suction Valve Ball, ⅜" Dia.		2	2	2	2	2
	1796	Lubricating Oil Pump Body Plug		2	2	2	2	2
	2582-C	Lubricating Oil Pump Strainer		2	2	2	2	2
	2369	Lubricating Oil Pump Discharge Connection Gasket		2	2	2	2	2
	3619	Lubricating Oil Pump Plunger Set Screw		2	2	2	2	2
		Lub. Oil Pump Plunger Set Screw Lockwire, #16x5"		1	1	1	1	1
1086B-C		**1086B-C Lubricating Oil Pump Drive**		**1**	**1**	**1**	**1**	**1**
1086B	1086B	Lubricating Oil Pump Rod		1	1	1	1	1
	2314	Lubricating Oil Pump Rod Connection		1	1	1	1	1
	2320	Lubricating Oil Sump Pump Rod Casing		1	1	1	1	1
		Lubricating Oil Pump Rod Nut, ½"		1	1	1	1	1
	2109	Lubricating Oil Pump Body Cover (Half)		2	2	2	2	2
	2792	Lubricating Oil Pump Body Cover Gasket (14x17)		2	2	2	2	2
	2792A	Lubricating Oil Pump Body Cover Gasket (12x15)		2	2			
		Lubricating Oil Pump Body Cover Bolt, ⅜"x1¾"		2	2	2	2	2
		Lubricating Oil Pump Body Cover Bolt Nut, ⅜"		2	2	2	2	2
1088		Lub. Oil Pump Strainer Side (Not furn. separately)	2582-C	2	2	2	2	2
1088A		Lub. Oil Pump Strainer Bottom (Not furn. sep.)	2582-C	2	2	2	2	2
1089A		Lubricating Oil Sump Stuffing Box Packing Ring	1081A-C	1	1	1	1	1
1092A		Lubricator Drive Rod Connection (Lubricator end)	216-C	1	1	1	1	1
1093A		Lubricating Oil Pump Body Plunger Pin	1084A-C	1	1	1	1	1
1096B		Oil Storage Tank Cover	721D-C	1	1	1	1	1
1097A		Lubricating Oil Pump Sump Gasket		1	1	1	1	1
1189		Air Start Shut Off Valve Spring Retainer	2293B-C	1	1	1	1	1
1193D		Con. Rod to Crank Bearing Shim (When required)	18B-C	1	2	3	4	6
1193E		Con. Rod to Crank Bearing Shim (When required)	18B-C	1	2	3	4	6
1193F		Con. Rod to Crank Bearing Shim (When required)	18B-C	3	6	9	12	18
1196E-C		**1196E-C Air Start Rocker**		**1**	**1**	**1**	**1**	**1**
		Six Cylinder Engine, Used on Cylinder No. 4.						
		Four Cylinder Engine, Used on Cylinder No. 1.						
		Three Cylinder Engine, Used on Cylinder No. 1.						
		Two Cylinder Engine, Used on Cylinder No. 1.						
		One Cylinder Engine, Used on Cylinder No. 1.						
1196E	1196E	Air Start Rocker, Always with		1	1	1	1	1
	658A	Air Starter Rocker Mushroom		1	1	1	1	1
	2331	Air Starter Rocker Roller Pin		1	1	1	1	1
	2332	Air Starter Rocker Roller		1	1	1	1	1
	2976	Air Starter Rocker Roller Pin Dowel		2	2	2	2	2
1196F-C		**1196F-C Air Start Rocker**				**1**	**1**	**1**
		Six Cylinder Engine, Used on Cylinder No. 5.						
		Four Cylinder Engine, Used on Cylinder No. 3.						
		Three Cylinder Engine, Used on Cylinder No. 3.						
1196F	1196F	Air Starter Rocker, Always with				1	1	1
	658A	Air Starter Rocker Mushroom				1	1	1
	2331	Air Starter Rocker Roller Pin				1	1	1
	2332	Air Starter Rocker Roller				1	1	1
	2976	Air Starter Rocker Roller Pin Dowel				2	2	2
1196G-C		**1196G-C Air Start Rocker**						**1**
		Six Cylinder Engine, Used on Cylinder No. 6.						
1196G	1196G	Air Starter Rocker, Always with						1
	658A	Air Starter Rocker Mushroom						1
	2331	Air Starter Rocker Roller Pin						1
	2332	Air Starter Rocker Roller						1
	2976	Air Starter Rocker Roller Pin Dowel						2
1199A		Fuel Reservoir Starting Valve Bushing	985A-C	1	1	2	2	3
1251		Air Tank (20"x60")		2	2	2	2	3
1300		Hand Rail End Bracket	1309-C	1	2	2	2	2
		Hand Rail End Bracket Stud, ½"x3¼" (12x15)	1309-C	1	2			
		Hand Rail End Bracket Stud, ½"x2" (14x17)	1309-C		2	2	2	2
		End Bracket Stud Hex. Nut, ½"	1309-C	1	2	2	2	2
		End Bracket Stud Lockwasher, ½"		1	2	2	2	2
		End Bracket Hollow Head Set Screw, ⅜"x7/16"	1309-C	1	2	2	2	2
1301		Stair Stringer Floor Beam	1304-C		2	2	2	2
1302		Stair Stringer Lower Support	1304-C		2	2	2	2
		Stair Stringer Support Cap Screw, ½"x1½"	1304A-C		2	2	2	2
		Stair Stringer Support Cap Screw Lockwasher, ½"	1304A-C		2	2	2	2
1303D		Stair Stringer	1304-C		2	2	2	2

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
1304A-C		**1304A-C Platform Stairs**			**1**	**1**	**1**	**1**
1304	1304	Stair Step			4	4	4	4
1304A	1304A	Stair Step (Top)			1	1	1	1
1305D	1305D	Stair Rail Support			2	2	2	2
	1301	Stair Stringer Floor Beam			2	2	2	2
	1302	Stair Stringer Lower Support			2	2	2	2
	1303D	Stair Stringer			2	2	2	2
		Top Stair Step Dowel, #631			2	2	2	2
		Top Stair Step Flat Head Cap Screw, ½″x1¾″			3	3	3	3
		Top Stair Step Hex. Head Nut, ½″			3	3	3	3
		Top Stair Step Screw Lockwasher, ½″			3	3	3	3
		Stair Step Dowel, #631			8	8	8	8
		Stair Stringer Support Hex. Head Cap Screw			2	2	2	2
		Stair Stringer Support Cap Screw Lockwasher			2	2	2	2
1306A		Stair Hand Rail (R. H.)	1309-C		1	1	1	1
1307A		Stair Hand Rail (L. H.)	1309-C		1	1	1	1
		Stair Hand Rail Hex. Head Cap Screw, ⅜″x2″	1309-C		2	2	2	2
		Hex. Head Cap Screw Lockwasher, ⅜″	1309-C		2	2	2	2
		Stair Hand Rail Nut, ¾″	1309-C	1				
		Stair Hand Rail Lockwasher, ¾″	1309-C	1				
309-C		**1309-C Platform Railing**			**1**	**1**	**1**	**1**
1309	1309	Front Hand Rail				1	1	1
1310B	1310B	Hand Rail		1				
1310A	1310A	End Hand Rail			2	2	2	2
1311	1311	Hand Rail Support			4	5	6	8
	1300	Hand Rail End Bracket		1	2	2	2	2
	1306A	Stair Hand Rail (R. H.)			1	1	1	1
	1307A	Stair Hand Rail (L. H.)			1	1	1	1
	1988A	End Hand Rail Extension			2	2	2	2
		Hand Rail End Bracket Stud, (12x15)		1	2			
		Hand Rail End Bracket Stud, (14x17)			2	2	2	2
		Hand Rail End Bracket Stud Hex. Nut		1	2	2	2	2
		Hand Rail End Bracket Stud Lockwasher		1	2	2	2	2
		Hand Rail End Bracket Hollow Head Set Screw		1	2	2	2	2
		Hand Rail Support Hollow Head Set Screw, ⅜″x7/16″			4	5	6	8
		Hand Rail Support Hex. Head Cap Screw, ½″x1¾″			4	4	4	4
		Hand Rail Support Cap Screw Lockwasher, ½″			8	10	12	16
		Hand Rail Support Cap Screw, ½″x2½″			4	6	8	12
		Stair Hand Rail Hex. Head Cap Screw			2	2	2	2
		Stair Hand Rail Cap Screw Lockwasher			2	2	2	2
		Stair Hand Rail Nut		1				
		Stair Hand Rail Lockwasher		1				
1314A		Platform Bracket	1320D-C		2	3	4	6
		Platform Bracket Countersunk Screw, ⅜″x1″		2				
		Platform Bracket Countersunk Screw Nut, ⅜″		2				
		Plat. Bracket Countersunk Screw Nut Lockwasher, ⅜″		2				
1318B		Platform Angle (Stair end)	1320D-C		1	1	1	1
1319B		Platform Angle (Opposite stair end)	1320D-C		1	1	1	1
1320D-C		**1320D-C Platform Floor**			**1**	**1**	**1**	**1**
1320B	1320B	Floor Plate			1	1	1	1
1320D	1320D	Floor Plate with Bracket and Rivets		1				
1321B	1321B	Floor Plate (Opposite stair end)					1	1
1322	1322	Lubricating Oil Tube Pan			1	2	3	5
		Lub. Oil Tube Pan Rd. Hd. Mach. Screw, ¼″—20x⅜″			4	8	12	20
		Lub. Oil Tube Pan Screw Lockwasher, ¼″			4	8	12	20
		Lub. Oil Tube Pan Felt (14x17) 11¾″x32½″x3/16″				2	3	5
		Lubricating Oil Tube Pan Felt, 6″x32½″x3/16″			1			
	1318B	Platform Angle (Stair end)			1	1	1	1
	1319B	Platform Angle (Opposite stair end)			1	1	1	1
	1314A	Platform Bracket			2	3	4	6
		Floor Plate Flat Head Cap Screw, ½″x1¼″ (14x17)			2	2	6	6
		Floor Plate Flat Head Cap Screw, ½″x1¾″ (12x15)			7			
		Floor Plate Flat Head Cap Screw, ½″x1¾″ (14x17)			4	6	8	12
		Fl. Plate Flat Head Cap Screw Hex. Nut, ½″ (14x17)			6	8	14	18
		Floor Plate Flat Head Cap Screw Nut, ½″ (12x15)			9			
		Fl. Plate Flat Head Cap Screw Lockwasher, ½″ (12x15)			9			
		Fl. Plate Flat Head Cap Screw Lockwasher, ½″ (14x17)			6	8	14	18
		Floor Plate Headless Set Screw, ½″x1″		1				
		Floor Plate Headless Set Screw Jam Nut, ½″		1				
1325		Injection Tube Half Union	421D-C, 422D-C, 423D-C, 423E-C, 424D-C, 424E-C, 425B-C		2	3	4	6
		Cylinder to Platform Bracket Cap Screw, ⅝″x1¾″			6	9	12	18
		Cyl. to Platform Bracket Cap Screw Lockwasher, ⅝″			6	9	12	18
		Cylinder to Platform Bracket Cap Screw, ½″x1½″			4	6	8	12
		Cylinder to Platform Bracket Lockwasher, ½″			4	6	8	12

(**Group Continued on Next Page**)

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
1329A		Injection Tube Clamp	1015-C	....	2	2	2	2
1335A		Crank Pin Lubricating Tube (Union to base)	494D, 498D, 440B, 445B	....	....	....	....	2
1336A		Crank Pin Lubricating Tube (Union to base)	450B, 494B, 498B, 439B, 444B	1	2	3	4	6
1337A		Piston Pin Lubricating Tube (Union to cylinder)	449B, 493B, 497B, 438B, 443B	....	1	2	3	5
1338A		Cylinder Front Lub. Tube (Union to cylinder)	448B, 492B, 496B, 432B, 437B	....	1	2	3	5
1339A		Cylinder Left Lub. Tube (Union to cylinder)	442B, 447B, 495B, 499B	....	2	3	4	6
1369		Lub. Oil Pump Strainer Handle (Not furn. separately)	.....	1	1	1	1	1
1379		Governor Push Rod Guide Bushing	511B-C	....	....	1	2	2
1380A		Lubricator Rod Cover	511B-C	1	1	1	1	1
1405		Connecting Rod Cap Wick Support Spring	20B-C	2	4	6	8	12
1406		Connecting Rod Cap Wick	20B-C	1	2	3	4	6
1407		Connecting Rod Cap Wick Support	20B-C	1	2	3	4	6
1499		Cooling Water Regulating Valve Packing Ring	1618-C, 1618A-C	14	14	21	28	42
1509		Injection Nozzle Check Valve Guide	2718-C	1	2	3	4	6
1549		Cylinder Head Air Valve Cage and Plug Gasket	.....	1	2	3	4	6
1550B		Air Starting Check Valve Bonnet (14x17)	854A-C	1	1	2	2	3
1554A		Lubricator Ratchet Arm with Cap Screw	216A-C	1	1	1	1	1
		Lubricator Ratchet Arm Cap Screw, ⅜″x1″	1554	1	1	1	1	1
1581D		Air and Cooling Water Manifold (12x15)	2115B-C	....	1			
1581E		Air and Cooling Water Manifold (14x17)	2115D-C	....	1	....	2	
1581F		Air and Cooling Water Manifold (14x17)	2115D-C	....	....	1	....	2
1584		Combustion Chamber to Overflow Pipe Gasket	.....	1	2	3	4	6
1584		Air and Cooling Water Manifold Overflow Pipe Gasket	.....	1	2	3	4	6
1586		Water Jacket Overflow Pipe (12x15)	2115B-C	1				
		Water Jacket Over. Pipe Cap Screw, ½″x1½″ (12x15)	2115B-C	2	4			
1586A		Water Jacket Overflow Pipe (Closed Circuit) (12x15)	.....	1				
1586B		Water Jacket Overflow Pipe (12x15)	2115B-C	....	2			
1586D		Water Jacket Overflow Pipe (Closed Circuit) (12x15)	.....	....	2			
1586E		Water Jacket Overflow Pipe, 14x17	2115D-C	1				
1586F		Water Jacket Overflow Pipe (Closed Circuit) 14x17	.....	1				
1586G		Water Jacket Overflow Pipe, 14x17	2115D-C	....	2	3	4	6
1586H		Water Jacket Overflow Pipe (Closed Circuit), 14x17	.....	....	2	3	4	6
1614		Cooling Water Regulating Valve Bonnet	1618-C, 1618A-C	2	2	3	4	6
1615		Cooling Water Regulating Valve Gland	1618-C, 1618A-C	2	2	3	4	6
1616		Cooling Water Regulating Valve Stuffing Box Nut	1618-C, 1618A-C	2	2	3	4	6
1617		Cooling Water Regulating Valve Bonnet Gasket	2115B-C, 2115D-C	2	4	6	8	12
1618-C		**1618-C Cooling Water Regulating Valve (Lower)**	**952B-C**	**1**	**2**	**3**	**4**	**6**
	1618	Cooling Water Regulating Valve, Always with	.....	1	2	3	4	6
	1499	Cooling Water Regulating Valve Packing Ring	.....	7	14	21	28	42
1618	1614	Cooling Water Regulating Valve Bonnet	.....	1	2	3	4	6
	1615	Cooling Water Regulating Valve Gland	.....	1	2	3	4	6
	1616	Cooling Water Regulating Valve Stuffing Box Nut	.....	1	2	3	4	6
	669A	Cooling Water Valve Handwheel with Pin	.....	1	2	3	4	6
1618A-C		**1618A-C Cooling Water Regulating Valve (Upper)**	**2115B-C**	**1**	**2**	**3**	**4**	**6**
	1618A	Cooling Water Regulating Valve, Always with	.....	1	2	3	4	6
	1499	Cooling Water Regulating Valve Packing Ring	.....	7	14	21	28	42
1618A	1614	Cooling Water Regulating Valve Bonnet	.....	1	2	3	4	6
	1615	Cooling Water Regulating Valve Gland	.....	1	2	3	4	6
	1616	Cooling Water Regulating Valve Stuffing Box Nut	.....	1	2	3	4	6
	669A	Cooling Water Valve Handwheel with Pin	.....	1	2	3	4	6
1625		Auxiliary Fuel Dis. Strainer Bottom (Not furn. sep.)	975-C	1	1	1	1	1
		Cooling Water Reg. Valve Handwheel Pin #205	1618-C, 1618A-C	2	4	6	8	12
1796		Lubricating Oil Pump Body Plug	1084A-C	2	2	2	2	2
1855		Lubricating Tube Clamp (Inside pan)	1029A-C	.....	.....	.....	.....	2
1861		Outboard Bearing Vertical Adjusting Shim (Thick)	310A-C	4	4	4	4	8
1861A		Outboard Brg. Vertical Adjusting Shim (Medium)	310A-C	2	2	2	2	4
1861B		Outboard Bearing Vertical Adjusting Shim (Thin)	310A-C	2	2	2	2	4
1895		Auxiliary Fuel Suction Strainer Spring	464A-C	1	1	1	1	1

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl
1898		Governor Case Lower Base Gasket		5	5	5	5	5
1899		Governor Case End Plate Gasket	2341-C	1	1	1	1	1
1902		Fuel Oil Reservoir Cover Gasket		1	1	1	1	1
1941A		Long Rocker Shaft with Air Start Rocker		1	1	2	2	3
1977A		Lower Base Air Inlet Screen, Always with	355B-C	1	1	1	2	2
	4045	L. Base Air Inlet Screen Seam Strip (Not furn. sep.)	355B-C	1	1	1	2	2
1978		Main Bearing Oiler Ring Hinge Pin		4	6	8	10	14
1978		Outboard Bearing Oil Ring Hinge Pin	310-C	4	4	4	4	8
1988A		End Hand Rail Extension	1309-C	....	2	2	2	2
1989A		Lower Base Air Inlet Screen Plate	355B-C	1	1	1	2	2
		L. B. Air Inlet Sc. P. R.H.M. Screw, #14—20x⅜"		8	8	8	16	16
2056		Injection Pump Relief Valve	531A-C	....	2	3	4	6
2057A		Injection Pump Relief Valve Spring	531A-C	....	2	3	4	6
2058		Injection Pump Relief Valve Seat	531A-C	....	2	3	4	6
2059		Injection Pump Relief Valve Seat Gasket	531A-C	2	4	6	8	12
2059		Base to Sump Pipe Gasket Washer		1	2	3	4	6
2060B		Injection Pump Relief Valve Seat Clamping Nut	531A-C	....	2	3	4	6
2060A		Injection Pump Relief Valve Seat Plug	531A-C	1				
2068		Lower Base Crank Pin Oiler Bracket	14E-C	1	2	3	4	6
		Lower Base Crank Pin Oiler Br. Cap Screw, ⅜"x1"	14E-C	2	4	6	8	12
		Lower Base Crank Pin Oiler Br. Lockwasher, ⅜"	14E-C	2	4	6	8	12
		Lower Base Crank Pin Oiler Fitting, ⅛"	14E-C	2	4	6	8	12
		Lower Base Crank Pin Oiler Tube, ¼" O.D.x17¼"	14E-C	1	2	3	4	6
2070		Air Valve Guide Stud Washer	597A-C	1	2	3	4	6
2070		Crankshaft to Governor Spider Stud Washer	25A-C 25B-C	3	3	3	3	3
2071		Cylinder Exhaust Hand Hole Cover	1B-C	2	4	6	8	12
		Cyl. Exhaust Hand Hole Cover Cap Screw, ½"x1¼"	1B-C	8	16	24	32	48
2075B		Connecting Rod Key	18B-C	1	2	3	4	6
		Connecting Rod Key F. H. Screw, #14—20x½"	18B-C	2	4	6	8	12
2079A		Lubricating Oil Tube Cinch Fitting Sleeve		12	24	44	64	104
2101		Upper Base Hand Hole Cover Knob		1	2	3	4	6
2108		Injection Pump Discharge Valve Cage Gasket	531A-C	1	2	3	4	6
2109		Lubricating Oil Pump Body Cover (Half)	1086B-C	2	2	2	2	2
2110		Lubricating Oil Pump Discharge Connection	1086A-C	2	2	2	2	2
2111		Lubricating Oil Pump Plunger Pin Collar		2	2	2	2	2
2112		Auxiliary Fuel Pump Suction Valve Plug	516A-C	1	1	1	1	1
2113		Air Starting Check Valve Bushing	854A-C	1	1	2	2	3
2114		Air Starting Check Valve Spring Cap	854A-C	1	1	2	2	3
2115B-C		**2115B-C Air and Cooling Water Manifold (12x15)**		**1**	**1**			
	2115B	Air and Cooling Water Manifold		1				
2115B	1581D	Air and Cooling Water Manifold		....	1			
		Air and Cooling Water Manifold Pipe Plug		2	5			
		Manifold to Overflow Funnel Cap Screw, ½"x1¼"		2	4			
	277A	Cooling Water Thermometer		1	2			
	1586	Water Jacket Overflow Pipe		1				
	1586B	Water Jacket Overflow Pipe		....	2			
		Water Jacket Overflow Pipe Cap Screw		2	4			
	798	Water Jacket Overflow Funnel		1	2			
	1618A-C	Cooling Water Regulating Valve		....	2			
		Air and Cooling Water Man. to Cyl. Hd. Cap Screw		4	8			
	1617	Cooling Water Regulating Valve Bonnet Gasket		2	4			
2115D-C		**2115D-C Air and Cooling Water Manifold (14x17)**		**1**	**1**	**1**	**1**	**1**
	2115B	Air and Cooling Water Manifold		1				
2115B	1581E	Air and Cooling Water Manifold		....	1	....	2	
	1581F	Air and Cooling Water Manifold		....	....	1	....	2
		Air and Cooling Water Manifold Pipe Plug		2	5	7	10	12
		Overflow Funnel Cap Screw ½"x1¼"		2	4	6	8	12
	277A	Cooling Water Thermometer		1	2	3	4	6
	1586E	Water Jacket Overflow Pipe		1				
	1586G	Water Jacket Overflow Pipe		....	2	3	4	6
		Water Jacket Overflow Pipe Cap Screw		2	4	6	8	12
	798	Water Jacket Overflow Funnel		1	2	3	4	6
	1618A-C	Cooling Water Regulating Valve		....	2	3	4	6
		Air and Cooling Water Man. to Cyl. Hd. Cap Screw		4	8	12	16	24
	1617	Cooling Water Regulating Valve Bonnet Gasket		2	4	6	8	12
		Air and Cooling W.Man. to Cyl.Hd.C.Screw, ⅝"x3¾"		4				
		Air and Cooling W. Man. to Cyl. Hd. C. Screw, ⅝"x5"		....	8	12	16	24
		Air and Cooling Water Manifold Pipe Plug, 2½"		....	....	2	....	4
		Air and Cooling Water Man. Pipe Plug, 1½" (12x15)	2115B-C	2	2			
		Air and Cooling Water Man. Pipe Plug, 1½" (14x17)		2				
		Air and Cooling Water Man. Pipe Plug, 2" (14x17)		....	2	....	4	
		Air and Cooling Water Man. Pipe Plug, ½" (14x17)	2115B-C	....	3	4	6	8
		Manifold to Drain Pipe, 1"x27¾" (12x15)		1	1			
		Manifold to Drain Pipe, 1"x31" (14x17)		1	1	1	1	1
2118A		Combustion Chamber Sleeve	117H-C 117J-C	1	2	3	4	6

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Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	
2173-C		**2173-C Fuel Hand Control**		**1**	**1**	**1**	**1**	**1**
2173	2173	Fuel Hand Control Shaft and Cam		1	1	1	1	1
	2203	Hand Control Quadrant Plate		1	1	1	1	1
	2202	Fuel Hand Control Lever Quadrant		1	1	1	1	1
	2201-C	Hand Control Lever		1	1	1	1	1
		Hand Control Lever Quadrant Plate Screw		3	3	3	3	3
2201-C		**2201-C Hand Control Lever**	**568A-C**	**2**	**2**	**2**	**2**	**2**
2201	2201	Hand Control Lever		2	2	2	2	2
	2204	Hand Control Lever Latch Spindle		2	2	2	2	2
	2205	Hand Control Lever Latch		2	2	2	2	2
	2257	Hand Control Lever Latch Spring		2	2	2	2	2
		Hand Control Lever Hex. Cap Screw, 5/16"x1 1/4"		2	2	2	2	2
		Hand Control Lever Woodruff Key, #6		2	2	2	2	2
2202		Fuel Hand Control Lever Quadrant	2173-C	1	1	1	1	1
		Fuel Hand Control Lever Quad. Plate R.H.M. Screw		3	3	3	3	3
2202A		Air Start Hand Control Lever Quadrant	568A-C	1	1	1	1	1
2203		Fuel Hand Control Quadrant Plate	2173-C	1	1	1	1	1
		Fuel Hand Con. Lever Quad. Plate Screw, 1/4"—20x5/8"	2173-C	3	3	3	3	3
2204		Hand Control Lever Latch Spindle	2201-C	2	2	2	2	2
2205		Hand Control Lever Latch	2201-C	2	2	2	2	2
2257		Hand Control Lever Latch Spring	2201-C	2	2	2	2	2
2270		Fuel Reservoir Cover Cap Screw Collar	986B-C	1	1	1	1	1
2271		Lub. and Fuel Res. Strainer Fl. (Not furn. sep.)		2	2	2	2	2
2272		Lub. and Fuel Res. Strainer Bottom (Not furn. sep.)		2	2	2	2	2
2293D-C		**2293D-C Air Starting Shut Off Valve**		**1**	**1**	**1**	**1**	**1**
2293D	2293D	Air Starting Shut Off Valve Cage		1	1	1	1	1
2294A	2294A	Air Starting Shut Off Valve		1	1	1	1	1
2295A	2295A	Air Starting Shut Off Valve Spring		1	1	1	1	1
	1189	Air Start Shut Off Valve Spring Retainer		1	1	1	1	1
	574	Air Start Inlet Elbow		1	1	1	1	1
	3143	Air Start Shut Off Valve Spring Guide		1	1	1	1	1
	2335A	Air Start Inlet Elbow Gasket		1	1	1	1	1
		Air Start Shut Off Valve Cage Stud		2	2	2	2	2
		Air Start Shut Off Valve Cage Stud Nut		2	2	2	2	2
2296		Auxiliary Fuel Suction Strainer Plug	464A-C	1	1	1	1	1
2297		Air Starter Eccentric Strap Cap	524A-C	1	1	1	1	1
2307		Auxiliary Fuel Pump Rocker Pin Washer	39-C	1	1	1	1	1
2311		Upper Base Side Hand Hole Cover	2D-C	2	4	6	8	12
		Upper Base Side Hand Hole Cover Capscrew, 3/8"x3/4"	2D-C	8	16	24	32	48
2312		Lubricating Oil Sump Plate	1081B-C	1	1	1	1	1
2313		Fuel Reservoir Cover Cap Handle	986B-C	1	1	1	1	1
2314		Lubricator Drive Rod Connection (Rocker end)	216A-C	1	1	1	1	1
2314		Lubricator Oil Pump Rod Connection	1086B-C	1	1	1	1	1
2315		Auxiliary Fuel Pump Eccentric Oil Pipe	271A-C	1	1	1	1	1
		Auxiliary Fuel Pump Eccentric Oil Pipe, 1/2"x6"	271A-C	1	1	1	1	1
		Auxiliary Fuel Pump Eccentric Oil Pipe Union, 1/2"	1081A-C	1	1	1	1	1
2316		Lubricator Oil Sump Overflow Pipe	1081A-C	1	1	1	1	1
2317		Governor Case Overflow Pipe Stuffing Box	1081A-C	1	1	1	1	1
2318		Governor Case Overflow Pipe Gland	1081A-C	1	1	1	1	1
2319		Governor Case Overflow Pipe (14x17)	1081A-C	1	1	1	1	1
2319A		Governor Case Overflow Pipe (12x15)	1081A-C	1	1			
2320		Lubricating Oil Sump Pump Rod Casing	1086B-C	1	1	1	1	1
2321		Pump Case Housing Stud	511B-C	4	4	4	4	4
2322		Pump Case Housing to Lower Base Tap Bolt		4	4	4	4	4
2323		Cylinder Head to Manifold Gasket		1	2	3	4	6
2324		Injection Pump Rocker Dowel	654A-C	2	4	2	4	4
			654B-C	....	....	2	4	4
			654D-C	....	....	2	....	2
			654E-C	....	....	....	....	2
2325		Injection Pump Rocker Mushroom	654D-C	....	....	1	....	1
			654E-C	....	....	....	....	1
2326		Injection Pump Rocker Auxiliary Spring		1	2	3	4	6
2326		Air Starter Rocker Auxiliary Spring		1	1	2	2	3
2327		Injection Pump Rocker Spacer		3	6	9	12	18
2328		Fuel Hand Control Shaft Support		....	....	....	1	1
2329		Fuel Hand Control Shaft Dowel		....	....	....	1	1
2331		Governor Cam Rocker Roller Pin	656A-C	1	2	1	2	2
			656B-C	....	....	1	2	2
			656D-C	....	....	1	....	1
			656E-C	....	....	....	....	1
2331		Air Starter Rocker Roller Pin	1196E-C	1	1	2	2	3
2332		Air Starter Rocker Roller	1196E-C	1	1	2	2	3
2332		Governor Cam Roller	656A-C	1	2	1	2	2
			656B-C	....	....	1	2	2
			656D-C	....	....	1	....	1
			656E-C	....	....	....	....	1
2333		Governor Cam Rocker Bushing	656A-C	1	2	1	2	2
			656B-C	....	....	1	2	2
			656D-C	....	....	1	....	....
2333A		Governor Cam Rocker Bushing	656D-C	....	....	....	....	1
2333B		Governor Cam Rocker Bushing	656E-C	....	....	....	....	1

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in	Number Used				
Arranged Numerically	Group Part	NAME OF PART	Group	1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
2334		Auxiliary Fuel Suction Strainer Casing Gasket	.....	1	1	1	1	1
2335		Air Starting Valve Spring Plug Gasket	570B-C	1	1	1	2	3
2335A		Air Start Inlet Elbow Gasket	2293B-C	1	1	1	1	1
2336		Governor Cam Rocker Auxiliary Spring	.....	1	2	3	4	6
2337		Short Rocker Auxiliary Spring Post	.....	....	1	1	2	3
2338		Long Rocker Auxiliary Spring Post	.....	1	1	2	2	3
		Gov. Cam Rocker Spring Post Cotter, 3/32"x1"	.....	3	5	8	10	15
2340		Governor Case to Hand Hole Cover Gasket	2341-C	1	1	1	1	1
2341-C		**2341-C Governor Case**	.....	**1**	**1**	**1**	**1**	**1**
	2341	Governor Case, Always with	.....	1	1	1	1	1
2341		Governor Case End Plate Cap Screw	.....	6	6	6	6	6
		Governor Case Hand Hole Cover Cap Screw	.....	2	2	2	2	2
		Governor Case Pipe Plug	.....	1	1	1	1	1
		Governor Case Dowel	.....	1	1	1	1	1
	1899	Governor Case End Plate Gasket	.....	1	1	1	1	1
	2340	Governor Case Hand Hole Cover Gasket	.....	1	1	1	1	1
2342	2342	Governor Case End Plate	.....	1	1	1	1	1
2343	2343	Governor Case Hand Hole Cover	.....	1	1	1	1	1
2344	2344	Governor Case Timing Pointer	.....	1	1	1	1	1
		Gov. Case Timing Pointer R.H.M. Screw, #10—24x3/8"	.....	2	2	2	2	2
		Governor Case End Plate Cap Screw, 3/8"x1"	2341-C	6	6	6	6	6
		Gov. Case Hand Hole Cover Cap Screw, 3/8"x3/4"	2341-C	2	2	2	2	2
		Governor Case Pipe Plug, 1/4"	2341-C	1	1	1	1	1
2345		Outboard Bearing Oil Throw Ring	310A-C 460A-C	2	2	2	2	4
2346		Outboard Bearing Body Sole Plate Cap Screw Washer	310A-C	4	4	4	4	4
2360		Pump Case Housing Injection Pump Hole Cover	511B-C	1				
2361		Pump Case Housing Injection Pump Push Rod Plug	511B-C	1				
2362		Reservoir Cover Cap Spring	986B-C	1	1	1	1	1
2364		Upper Base Side Hand Hole Cover Gasket	2D-C	2	2	2	2	2
			2E-C	....	2	4	6	10
2365		Cylinder Exhaust Hand Hole Cover Gasket	1D-C	2	4	6	8	12
2366		Auxiliary Fuel Pump Body Gasket	.....	1	1	1	1	1
2369		Lubricating Oil Pump Discharge Connection Gasket	1084A-C	2	2	2	2	2
2370		Governor Case Overflow Pipe Gland Washer	1081A-C	1	1	1	1	1
2387A		Oil Filter Gauge Glass	721D-C	1	1	1	1	1
2401		Fuel Reservoir Housing Gasket	.....	1	1	1	1	1
2409		Injection Nozzle Valve Seat (Not furn. separately)	201B-C	1	2	3	4	6
2582-C		**2582-C Lubricating Oil Pump Strainer**	**1084A-C**	**2**	**2**	**2**	**2**	**2**
	2582	Lubricating Oil Pump Strainer Plug, Always with	.....	2	2	2	2	2
2582	1088	Lubricating Oil Pump Strainer Side (Not furn. sep.)	.....	2	2	2	2	2
	1088A	Lub. Oil Pump Strainer Bottom (Not furn. separately)	.....	2	2	2	2	2
2586A		Oil Storage Tank Base	721D-C	1	1	1	1	1
2604		Auxiliary Fuel Pump Rocker Shaft Screw	39-C	1	1	1	1	1
		Aux. Fuel Pump Rocker Shaft Screw Lockwasher, 1/2"	39-C	1	1	1	1	1
2605		Auxiliary Fuel Pump Rocker Pin Set Screw Jam Nut	39-C	1	1	1	1	1
		Auxiliary Fuel Pump Rocker Pin Lockwasher, 5/8"	.....	1	1	1	1	1
2682		Auxiliary Fuel Pump Plunger Spring Retainer	516A-C	1	1	1	1	1
2718-C		**2718-C Injection Nozzle Check Valve Body**	.....	**1**	**2**	**3**	**4**	**6**
2718	2718	Injection Nozzle Check Valve Body	.....	1	2	3	4	6
2719	2719	Injection Nozzle Check Valve Spring	.....	1	2	3	4	6
	1509	Injection Nozzle Check Valve Guide	.....	1	2	3	4	6
		Injection Nozzle Check Valve Ball, 1/4"	.....	1	2	3	4	6
2745		Conduit Tee	2753A-C	....	....	3	4	6
2746		Conduit Tee Cover	2753A-C	....	....	3	4	6
		Conduit Tee Cover R.H.M. Screw, #8—32x9/16"	2753A-C	4	4	6		
		Conduit Tee Cover, R.H.M. Screw, #10—24x1/2"	2753A-C	....	....	....	8	12
2751		Lubricator to Bracket Cap Screw Washer	271A-C	2	2	4	4	4
2752		Conduit Support Strap	2753A-C	....	....	6	8	12
		Conduit Support Strap Machine Bolt, 1/2"x2 1/2"	2753A-C	....	2	3	4	6
		Conduit Support Strap Machine Bolt Nut, 1/2"	2753A-C	....	2	3	4	6
2753A-C		**2753A-C Pyrometer Equipment**	.....	....	1	1	1	1
2753A	2753A	Thermo-couple Short	.....	....	2	3	4	6
		Flexible Conduit	.....	....	2	3	4	6
		Flexible Conduit Connector, 90° Angle	.....	....	2	3	4	6
	2745	Conduit Tee	.....	....	2	3	4	6
	2746	Conduit Tee Cover	.....	....	2	3	4	6
		Conduit Tee Cover R.H.M. Screw, #8—32x9/16"	.....	....	4	6		
		Conduit Tee Cover, R.H.M. Screw, #10—24x1/2"	.....	....	....	....	8	12
	2978	Conduit (Ream Ends)	.....	....	1	2	3	5
	2977	Conduit	.....	....	1	1	1	1
		Pipe Plug, 1"	.....	....	1	1	1	
		Pipe Plug, 1 1/4"	.....	....	....	....	1	1
		Conduit Lock Nut, 1"	.....	....	2	2		
		Conduit Lock Nut, 1 1/4"	.....	....	....	....	2	2
		Negative Lead Wire, 8'-0" Long (12x15)	.....	....	1			
		Negative Lead Wire, 8'-6" Long (14x17)	.....	....	1			
		Positive Lead Wire, 8'-0" Long (12x15)	.....	....	1			

(Group Continued on Next Page)

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in	Number Used				
Arranged Numerically	Group Part	NAME OF PART	Group	1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
		Positive Lead Wire, 8'-6" Long (14x17)			1			
		Positive Lead Wire, 16 feet long				1		
		Negative Lead Wire, 16 feet long				1		
		Positive Lead Wire, 26 feet long					1	
		Negative Lead Wire, 26 feet long					1	
		Positive Lead Wire, 55 feet long						1
		Negative Lead Wire, 55 feet long						1
	2752	Conduit Support Strap			4	6	8	12
		Conduit Support Strap Machine Bolt, ½"x2½"			2	3	4	6
		Conduit Support Strap Machine Bolt Nut, ½"			2	3	4	6
		Flex. Con. Conn. 45° Angle, ½" (Exh. pot only)			2	3	4	6
	3337	Pyrometer				1	1	1
2763		Upper Base Cylinder Stud Washer	2D-C	2				
2764		Air Starter Eccentric Strap Cap Stud	524A-C	2	2	2	2	2
2766A		Air Stop Ring Driving Set Screw	165F-C					12
		Air Stop Ring Driving Spring Lockwasher, ⅞"						24
		Air Stop Ring Set Screw Jam Nut, ⅞"						12
2773		Lower Step Nut	2A-C	2				
2774		Lower Step Washer	2A-C	2				
2776		Air Stop Ring Driving Spring Plug	165E-C					12
2777		Air Stop Ring Driving Clamp	165E-C					6
		Air Stop Ring Driving Clamp Cap Screw, ⅜"x1¾"	165E-C					6
		Air Stop Ring Driving Clamp Cap Screw Nut, ⅜"						6
		Air Stop Ring Driv. Cl. Cap Screw Lockwasher, ⅜"						6
		Air Stop Ring Driving Clamp Nut, ½"						6
	2780	Air Stop Ring Driving Clamp Lockwasher, ½"						6
2780		Exhaust Pipe Conduit Thimble, Always with		1	2	3	4	6
		Exhaust Pipe Gland Thimble Stud, ⅝"x4"		4	8	12	16	24
2789		Air Start Pipe Clamp	700B-C					2
2789A		Air Start Pipe Clamp	700B-C			2	2	
		Air Start Pipe Clamp Cap Screw, ⅜"x2"				1	1	2
		Air Start Pipe Clamp Cap Screw Nut, ⅜"				1	1	2
2792		Lubricating Oil Pump Body Cover Gasket (14x17)	1086B-C	2	2	2	2	2
2792A		Lubricating Oil Pump Body Cover Gasket (12x15)	1086B-C	2	2			
2794		Oil Tank Fl. Elbow (Not furnished separately)	721D-C	1	1	1	1	1
2884		Outboard Brg. Ex. Shaft Thrust Collar, with Set Screw	460A-C					1
		Outboard Bearing Extension Shaft Thrust Collar Hollow Head Set Screw, ⅝"x1 1/16"						1
2976		Governor Cam Rocker Roller Pin Dowel	656A-C	2	4	2	4	4
			656B-C			2	4	4
			656D-C			2		2
			656E-C					2
2977		Conduit				1	1	1
2978		Conduit (Ream Ends)				2	3	5
3093A		Combustion Chamber Indicator Hole Plug	117J-C		2	3	4	6
3143		Air Start Shut Off Valve Spring Guide	2293B-C	1	1	1	1	1
3337		Pyrometer	2753A-C			1	1	1
3359		Rocker Shaft Plate		1	2	3	4	6
3360		Rocker Shaft Plate Screw		2	4	6	8	12
		Rocker Shaft Plate Screw Wire, #19x4"		1	2	3	4	6
3375		Connecting Rod Bolt Nut Cotter, (14x17)	18B-C	2	4	6	8	12
3428A		Starting Plug	117H-C	1				
3454		Gov. Weight Stop Pin	501B-C	2	2	2	2	2
		Gov. Weight Stop Pin Jam Nut, ⅝"	501B-C	2	2	2	2	2
		Gov. Weight Stop Pin Cotter, ⅛"x1¼"	501B-C	2	2	2	2	2
3619	3780	Lubricating Oil Pump Plunger Set Screw	1084A-C	2	2	2	2	2
3780		Outboard Bearing Pedestal, Always with	310A-C					2
		Outboard Bearing Horizontal Adjusting Set Screw						8
		Outboard Bearing Hori. Adj. Set Screw Jam Nut						8
		Outboard Bearing Hori. Adj. Set Screw, ⅝"x3½"						8
		Outboard Bearing Hori. Adj. Set Screw ⅝"x3"		4	4	4	4	
		Outboard Bearing Hori. Adj. Set Screw Jam Nut, ⅝"						8
3818		Rocker Shaft Lockwasher		2	2	4	4	6
4045		Lower Base Air Inlet Screen Seam Strip (Not fur. sep.)	355B-C	1	1	1	2	2
4502		Combustion Chamber Sleeve Gasket		1	2	3	4	6
4596		Air Starter Distributor Body		1	1	1	1	1
		Air Starter Distributor Body Stud, ½"x2"		2	2	3	3	
		Air Starter Distributor Body Stud, ½"x4¼"		2	2	1	1	
		Air Starter Distributor Body Stud, ½"x4¾"						4
		Air Starter Distributor Body Stud, ½"x3¼"						2
		Air Starter Distributor Body Stud Nut, ½"		4	4	4	4	6
4645		Base to Sump Pipe Gasket (Lead)		1	2	3	4	6
4687		Lubricator Pipe (Lub. Pump to Lubricator)		1	1	1	1	1
		Lub. Pipe Comp. Elbow, ¼"x⅜"		1	1	1	1	1
		Lub. Pipe Comp. Connector, ¼"x⅜"		1	1	1	1	1
4688		Starting Plug Handle with 3428A	117H-C	1				
4689A		Starting Plug Seat	117H-C	1				
4764		Auxiliary Fuel Pump Plunger Tip	516A-C	1	1	1	1	1
4765		Auxiliary Fuel Pump Plunger Push Rod	516A-C	1	1	1	1	1
4766		Aux. Fuel Pump Plunger Push Rod Nut	516A-C	1	1	1	1	1
4834		Oil Storage Tank Inlet Fitting	721D-C	1	1	1	1	1
5303		Air Valve Cover	597A-C	1	2	3	4	6
5304		Air Valve Cover Washer	597A-C	1	2	3	4	6
		Air Valve Cover R.H.M. Screw, ¼"—20x½"	597A-C	1	2	3	4	6
		Air Valve Cover Lockwasher, ½"	597A-C	1	2	3	4	6

Repair List—Fairbanks-Morse Stationary Diesel Engines

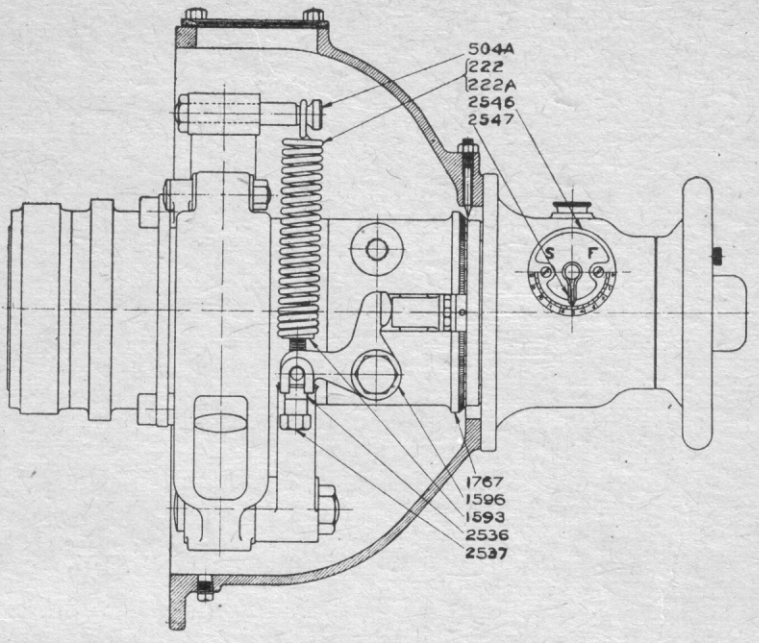
Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in	Number Used				
Arranged Numerically	Group Part	NAME OF PART	Group	1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cy.
		Air Valve Cover Dowel, #409 (12x15)	597A-C	2	4			
5305		Oil Filter Coupling	721D-C	1	1	1	1	1
5305A		Oil Filter Coupling	721D-C	2	2	2	2	2
5350		Oil Filter	721D-C	1	1	1	1	1
5365		Oil Filter to Tank Tube	721D-C	1	1	1	1	1
5429		Starting Cartridges		1				
5545		Cylinder Head Stud Nut		2	4	6	8	12
5565		Adapter Tube	362D-C	1	2	3	4	6
5566		Adapter Tube Packing Gland	362D-C	1	2	3	4	6
5567		Adapter Tube Packing	362D-C	1	2	3	4	6
5841		Cylinder Pad Plug		3				
5841A		Cylinder Pad Plug		2				
5876		Air Start Check Valve Tube, (Not furn. separately) (Inserted with special tool)	3A-C	1	2	3	4	6
6071		Injection Nozzle Drill	201D-C	1	2	3	4	6
		AIR START FITTINGS						
		Air Start Fittings		1	1	1	1	1
		Dial Pressure Gauge, 4½" diam.		2	2	2	2	3
		Pop Safety Valve, ⅜"		1	1	1	1	1
		Globe Valve, 1½" (On tank)		2	2	2	2	3
		Railroad Union, 1½"		3	3	3	3	4
		Railroad Union, ¾"		1	1	1	1	1
		Tee, 1½" Extra Heavy		1	1	1	1	2
		Tee, 1½"x¾"x1½", Extra Heavy		2	2	2	2	2
		Tee, ¾"x¾"x⅜", Extra Heavy		1	1	1	1	1
		Elbow, 1½", Extra Heavy		4	4	4	4	4
		Elbow, ¾" Extra Heavy		3	3	3	3	3
		Pipe Plug, ¾"		1	1	1	1	1
		Nipple, 1½"x10"		4	4	4	4	6
		Nipple, 1½"x2½"		7	7	7	7	9
		Nipple, ¾"x2"		4	4	4	4	4
		Complete Set of Gaskets and Packing		**1**	**1**	**1**	**1**	**1**
	33C	Cylinder Head Gasket (14x17)		6	12	18	24	36
	33D	Cylinder Head Gasket (12x15)		5	10			
	76	Exhaust Nozzle Hand Hole Cover Gasket		2	4	6	8	12
	76	Exhaust Pot Hand Hole Cover Gasket		1	1	1	2	3
	76A	Exhaust Pipe Hand Hole Cover Gasket		1	2	3	4	6
	77A	Exhaust Nozzle to Cylinder Gasket		1	2	3	4	6
	118E	Cylinder Head Combustion Chamber Sleeve Gasket		1	2	3	4	6
	179A	Air Pipe to Base Gasket		1	2	3	4	6
	197A	Upper Base Lower Base Gasket		2	4	6	8	12
	198B	Upper Base Cylinder Gasket		1	2	3	4	6
	199A	Upper Base Air Valve Seat Gasket		1	2	3	4	6
	199A	Upper Base Front Hand Hole Cover Gasket		1	2	3	4	6
	213D	Combustion Chamber Cooling Water Tube Gasket		2	4	6	8	12
	213E	Comb. Chamber Water Tube Gasket		1	2	3	4	6
	214	Injection Tube Union Gasket			2	3	4	6
	405	Crank Pin Oiler Ring Shaft Gasket		1	2	3	4	6
	407A	Cylinder Core Hole Cover Gasket		1				
	407A	Cylinder Platform Bracket Gasket			2	3	4	6
	416	Exhaust Nipple Flange Gasket		2				
	467A	Auxiliary Fuel Suction Strainer Plug Gasket		1	1	1	1	1
	469A	Pump Case Housing to Side Cover Gasket		2	2	2	2	2
	470	Auxiliary Fuel Pump Discharge Valve Cap Gasket		1	1	1	1	1
	472A	Pump Case Housing Gasket		2	2	2	2	2
	473A	Injection Pump Body Housing Gasket		1	2	3	4	6
	573D	Air Starter Shut Off Valve Cage Gasket		1	1	1	1	1
	573B	Air Starter Distributor Body Gasket		1	1	1	1	1
	617	Exhaust Pot Cover Gasket		2	2	2	4	6
	618	Exhaust Nipple Flange Gasket		1				
	618	Exhaust Elbow Gasket			2	5	4	6
	632A	Cylinder Head Counterbore Gasket		1	2	3	4	6
	858B	Air Check Valve Bonnet Cylinder Head Gasket		1	2	3	4	6
	990	Fuel Reservoir Gauge Glass Gasket		1	1	1	1	1
	990	Oil Filter Gauge Glass Gasket		2	2	2	2	2
	990	Outboard Bearing Oil Gauge Glass Gasket		2	2	2	2	4
	990	Main Bearing Gauge Glass Gasket		2	2	2	4	4
	1039	Auxiliary Fuel Pump Valve Plug Gasket		1	1	1	1	1
	1089A	Lubricating Oil Sump Stuffing Box Packing Ring		1	1	1	1	1
	1097A	Lubricating Oil Pump Sump Gasket		1	1	1	1	1
	1499	Air and Cooling Water Regulating Valve Packing		14	14	21	28	42
	1549	Cylinder Head Air Valve Cage and Plug Gasket		1	2	3	4	6
	1584	Air and Cooling Water Man. to Overflow Pipe Gasket		1	2	3	4	6
	1584	Combustion Chamber Overflow Pipe Gasket		1	2	3	4	6
	1617	Cooling Water Regulating Valve Bonnet Gasket		2	4	6	8	12
	1898	Governor Case Lower Base Gasket		1	1	1	1	1
	1899	Governor Case End Plate Gasket		1	1	1	1	1
	1902	Fuel Oil Reservoir Cover Gasket		1	1	1	1	1
	2059	Injection Pump Relief Valve Seat Gasket		2	4	6	8	12
	2059	Base to Sump Pipe Gasket Washer		1	2	3	4	6
	2108	Injection Pump Discharge Valve Cage Gasket		1	2	3	4	6

Repair List—Fairbanks-Morse Stationary Diesel Engines

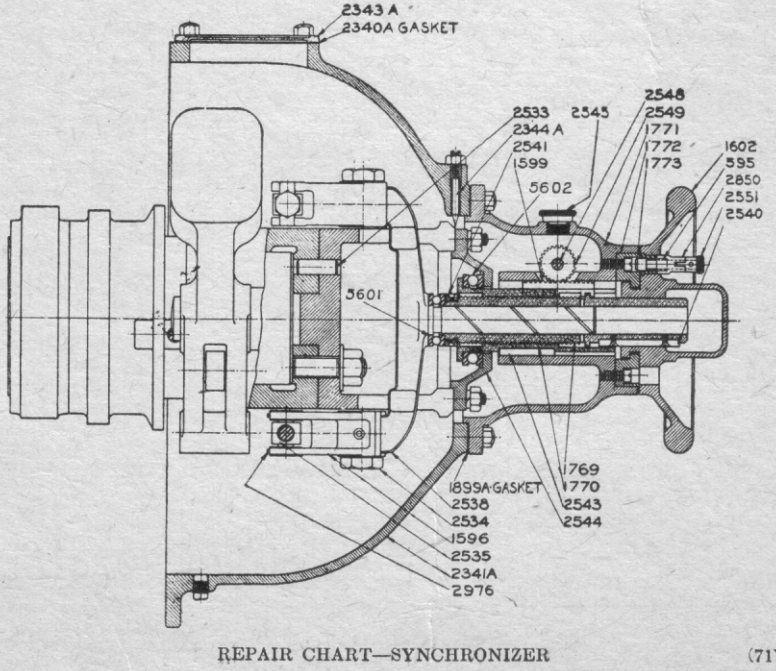
Repair Number Arranged Numerically	Repair Number Group Part	Before Ordering Repair Parts Read the Instructions on Page 54 NAME OF PART	Included in Group	Number Used 1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
	2323	Cylinder Head Manifold Gasket		1	2	3	4	6
	2334	Auxiliary Fuel Suction Strainer Casing Gasket		1	1	1	1	1
	2335	Air Starting Valve Spring Plug Gasket		1	1	2	2	3
	2335A	Air Start Inlet Elbow Gasket		1	1	1	1	1
	2340	Governor Case Hand Hole Cover Gasket		1	1	1	1	1
	2364	Upper Base Side Hand Hole Cover Gasket		2	4	6	8	12
	2365	Cylinder Exhaust Hand Hole Cover Gasket		2	4	6	8	12
	2366	Auxiliary Fuel Pump Body Gasket		1	1	1	1	1
	2369	Lubricating Oil Pump Discharge Connection Gasket		2	2	2	2	2
	2370	Governor Case Overflow Pipe Gland Gasket		1	1	1	1	1
	2401	Fuel Oil Reservoir Housing Gasket		1	1	1	1	1
	2792	Lubricating Oil Pump Body Cover Gasket (14x17)		2	2	2	2	2
	2792A	Lubricating Oil Pump Body Cover Gasket (12x15)		2	2			
	4172	Upper Base Cylinder Transfer Gasket		1	2	3	4	6
	4502	Combustion Chamber Sleeve Gasket (12x15)		1	2			
	4645	Base to Sump Pipe Gasket		1	2	3	4	6
		SET OF SPRINGS						
		Complete Set of Springs		**1**	**1**	**1**	**1**	**1**
	178	Piston Pin Dowel Spring		1	2	3	4	6
	193A	Air Stop Ring Spring		8	16	24	32	48
	203A	Injection Nozzle Valve Spring		1	2	3	4	6
	256B	Governor Spring with Plug 52A		2	2	2	2	2
	259	Injection Pump Suction Valve Spring		1	2	3	4	6
	260A	Injection Pump Plunger Spring		1	2	3	4	6
	266	Injection Pump Suction Valve Push Rod Spring		1	2	3	4	6
	392	Air Stop Ring Back Lash Spring		2	4	6	8	
	392	Air Stop Ring Driving Spring						12
	537	Injection Pump Discharge Valve Spring		1	2	3	4	6
	572	Air Starting Valve Spring		1	1	2	2	3
	595	Air Valve Spring (14x17)		24	48	72	96	144
	595A	Air Valve Spring (12x15)		20	40			
	837A	Piston Pin Oil Scraper Spring		2	4	6	8	12
	856A	Air Starting Check Valve Spring		1	1	2	2	3
	1405	Connecting Rod Cap Wick Support Spring		2	4	6	8	12
	1895	Auxiliary Fuel Suction Strainer Spring		1	1	1	1	1
	2057A	Injection Pump Relief Valve Spring			2	3	4	6
	2257	Hand Control Lever Latch Spring		2	2	2	2	2
	2295A	Air Starting Shut-Off Valve Spring		1	1	1	1	1
	2326	Injection Pump Rocker Auxiliary Spring		1	2	3	4	6
	2326	Air Starter Rocker Auxiliary Spring		1	1	2	2	3
	2336	Governor Cam Rocker Auxiliary Spring		1	2	3	4	6
	2362	Reservoir Cover Cap Spring		1	1	1	1	1
	2719	Injection Nozzle Check Valve Spring		1	2	3	4	6
		SPECIAL TOOLS						
		Piston Eyebolt, ¾″		2	2	2	2	2
	189A	Fuel Reservoir Eyebolt		2	2	2	2	2
	400	Flywheel Hub Bolt Wrench (14x17)		1	1	1	1	1
	419A	Flywheel Turning Bar		1	1	1	1	1
	2384	Governor Socket Wrench		1	1	1	1	1
	2600	Piston Clamp		2	2	2	2	2
		Piston Clamp Cap Screw, ½″x1″ (12x15)		2	2			
		Piston Clamp Cap Screw, ⅝″x1¼″ (14x17)		2	2	2	2	2
		Hex. Head Cap Screw, ⅜″x2″		1	1	1	1	1
		Oiler		1	1	1	1	1
	2778	Main Bearing Socket Wrench		1	1	1	1	1
		Open End Wrench (Double) #27		1	1	1	1	1
		Open End Wrench (Double) #34		1	1	1	1	1
		Open End Wrench (Double) #39		1	1	1	1	1
		Open End Wrench (Double) #43		1	1	1	1	1
		Open End Single Wrench #13		1	1	1	1	1
		Open End Single Wrench #14		1	1	1	1	1
		Open End Single Wrench #16		1	1	1	1	1
		Open End Single Wrench #702		1	1	1	1	1
		Open End Single Wrench #704		1	1	1	1	1
		SPEED REGULATOR (See Page 97) (Furnished only when ordered)						
222		Speed Regulator Slow Down Spring with plug 1593 (For 100 R. P. M. Reduction)		2	2	2	2	2
222A		Synchronizer Spring with plug 1593 (For 25 R. P. M. Reduction)		2	2	2	2	2
504A		Speed Regulator Spring Post		2	2	2	2	2
		Speed Regulator Spring Post Hex. Jam Nut, ⅝″		2	2	2	2	2
595		Hand Wheel Stop Spring		1	1	1	1	1

Repair List—Fairbanks-Morse Stationary Diesel Engines

Repair Number		Before Ordering Repair Parts Read the Instructions on Page 54	Included in Group	Number Used				
Arranged Numerically	Group Part	NAME OF PART		1 Cyl.	2 Cyl.	3 Cyl.	4 Cyl.	6 Cyl.
1593		Speed Regulator Spring Plug		2	2	2	2	2
1596		Speed Regulator Rocker		2	2	2	2	2
1599		Speed Regulator Indicator Rack		1	1	1	1	1
1602		Hand Wheel		1	1	1	1	1
1767	{1767	Governor Spider Hub, Always with		1	1	1	1	1
		Governor Spider Hub to Bearing Retainer Stud		4	4	4	4	4
		Gov. Spider Hub to Bearing Retainer Stud, 3/8"x1 1/2"		4	4	4	4	4
		Gov. S. Hub to Brg. Retainer Stud Lockwasher, 3/8"		4	4	4	4	4
		Gov. S. Hub to Brg. Retainer Stud CPSF Nut, 5/8"		4	4	4	4	4
1769		Speed Regulator Adjusting Screw		1	1	1	1	1
1770		Speed Regulator Adjusting Screw Nut		1	1	1	1	1
		Speed Reg. Adjusting Screw Nut Bearing SKF2911		1	1	1	1	1
1771		Adjusting Screw Housing		1	1	1	1	1
		Adjusting Screw Housing Cap Screw, 3/8"x1"		6	6	6	6	6
1772		Hand Wheel Retaining Ring		1	1	1	1	1
		Hand Wheel Ret. Ring Fil. Hd. Cap Screw, 5/16"x3/4"		4	4	4	4	4
1773		Hand Wheel Stop Pin		1	1	1	1	1
1899A		Governor Case End Plate Gasket		1	1	1	1	1
2340A		Governor Case Hand Hole Cover Gasket		1	1	1	1	1
2341A		Governor Case		1	1	1	1	1
2343A		Governor Case Hand Hole Cover		1	1	1	1	1
		Governor Case Hand Hole Cover Cap Screw, 3/8"x3/4"		4	4	4	4	4
2344A		Injection Pointer		1	1	1	1	1
		Injection Pointer S. A. E. Nut, 5/16"		1	1	1	1	1
2533		Governor Spider to Hub Dowel		1	1	1	1	1
2534		Speed Regulator Rocker Pin		2	2	2	2	2
		Speed Regulator Rocker Pin Hollow Head Set Screw		2	2	2	2	2
2535		Speed Regulator Rocker Trunnion		2	2	2	2	2
2536		Speed Regulator Rocker Trunnion Washer		2	2	2	2	2
2537		Speed Regulator Spring Adjusting Screw		2	2	2	2	2
2538		Speed Regulator Rocker Yoke		1	1	1	1	1
		Speed Reg. Rocker Yoke Thrust Bearing SKF2905		1	1	1	1	1
2540		Speed Regulator Adjusting Screw Key		1	1	1	1	1
		Speed Reg. Adj. Screw Key FHM Screw, #8—32x3/8"		2	2	2	2	2
2541		Speed Regulator Adjusting Screw Collar		1	1	1	1	1
2543		Speed Regulator Adjusting Screw Nut Key		1	1	1	1	1
2544		Governor Spider Hub Bearing Retainer		1	1	1	1	1
2545		Adjusting Screw Housing Oil Plug		1	1	1	1	1
2546		Speed Regulator Indicator Dial		1	1	1	1	1
		Sp. Reg. Ind. Dial to H. R.H.M. Screw, #10—24x1/2"		2	2	2	2	2
2547		Speed Regulator Indicator Hand		1	1	1	1	1
		Speed Regulator Indicator Hand Pin, #105		1	1	1	1	1
2548		Speed Regulator Indicator Pinion Shaft		1	1	1	1	1
2549		Speed Regulator Indicator Pinion		1	1	1	1	1
		Speed Regulator Indicator Pinion Key Pin, #103		1	1	1	1	1
2551		Hand Wheel Stop Pin Knob		1	1	1	1	1
		Hand Wheel Stop Pin Knob Pin #105		1	1	1	1	1
2850		Hand Wheel Stop Pin Guide		1	1	1	1	1
2976		Speed Regulator Rocker Pin Dowel		2	2	2	2	2
		Governor Spider to Crankshaft Stud, 5/8"x3 1/4"		3	3	3	3	3
5601		Speed Regulator Yoke Thrust Bearing SKF2905		1	1	1	1	1
5602		Speed Reg. Adj. Screw Collar Thrust Brg. SKF2911		1	1	1	1	1



REPAIR CHART—SYNCHRONIZER (71YKA18)



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