

REPAIR  
MANUAL  
FORD  
4-CYLINDER ENGINE  
1941-1947

Ford Motor Company

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**REPAIR  
MANUAL  
FORD  
4-CYLINDER ENGINE  
1941-1947**

Belongs to: James ...  
2100 ...  
...

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*The Ford Motor Company*

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...

July 7, 1947

## FOREWORD

This manual explains the operation and maintenance of the tractor and in regard to the fuel, lubrication system, built during 1944-1947. Due to the differences in the engine models using these engines, no attempt has been made in this manual to make the instructions necessary to operate the engine from the outside. The purpose was just to give the engine enough complete.

Each chapter is fully intended to be a complete book and is shown in the table of contents.

Chapter II shows the adjustment and operation of the tractor. Mechanical drawings are included where it is possible for one part, either of which is satisfactory for further use when available. It is here possible to show where and in what.

Throughout the book, on the last page of each chapter, a list of the major points to be checked is given, each with a separate section number.

In the operation and repair chapter, each section contains complete instructions, with some blocks which cannot be put in place until a part should be checked or replaced.

General comments to the engine illustrations in each chapter have been made. When starting parts from the Fuel System by these numbers, specify the year and model number of the engine.

It is a heavy work to do this in a manufacturer's manual and some complete repair manuals could not be completely recommended. In this book, the word "repair" is used to indicate "before" or "after" working condition" rather than new "before" conditions.

This book is one of a series of illustrated repair manuals to be published by the Ford Motor Company. These manuals will be available from your local Ford Motor Company.

FORD MOTOR COMPANY

Dearborn, Michigan

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Chapter

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INSTRUCTION AND REPAIR

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ALL-GEAR DRIFT AND REAR GEAR

The transmission and flywheel assemblies are shown in Fig. 11 and 11.

1. Flywheel. Check for the proper alignment of the flywheel assembly with a level of wire. Check the countershaft bearings and bearing caps. Remove the countershaft bearing caps if they are damaged. Replace a countershaft gear that has chipped, broken or worn teeth. If the gear is in good condition or the countershaft is in good condition, the countershaft may be reconnected to the input shaft. If the gear is in good condition, the countershaft may be reconnected to the input shaft. If the gear is in good condition, the countershaft may be reconnected to the input shaft. If the gear is in good condition, the countershaft may be reconnected to the input shaft.



Fig. 11 - Assembly Drawing of the Transmission and Flywheel



Fig. 12 - Assembly Drawing of the Countershaft Gear

Fig. 12 - Assembly Drawing of the Countershaft Gear

2. Countershaft Gear. Check for the proper alignment of the countershaft gear with a level of wire. Check the countershaft bearings and bearing caps. Remove the countershaft bearing caps if they are damaged. Replace a countershaft gear that has chipped, broken or worn teeth. If the gear is in good condition or the countershaft is in good condition, the countershaft may be reconnected to the input shaft. If the gear is in good condition, the countershaft may be reconnected to the input shaft. If the gear is in good condition, the countershaft may be reconnected to the input shaft.

3. Input Shaft. Check for the proper alignment of the input shaft with a level of wire. Check the input shaft bearings and bearing caps. Remove the input shaft bearing caps if they are damaged. Replace an input shaft gear that has chipped, broken or worn teeth. If the gear is in good condition or the input shaft is in good condition, the input shaft may be reconnected to the countershaft. If the gear is in good condition, the input shaft may be reconnected to the countershaft. If the gear is in good condition, the input shaft may be reconnected to the countershaft.

4. Flywheel. Check for the proper alignment of the flywheel with a level of wire. Check the flywheel bearings and bearing caps. Remove the flywheel bearing caps if they are damaged. Replace a flywheel gear that has chipped, broken or worn teeth. If the gear is in good condition or the flywheel is in good condition, the flywheel may be reconnected to the input shaft. If the gear is in good condition, the flywheel may be reconnected to the input shaft. If the gear is in good condition, the flywheel may be reconnected to the input shaft.

5. Oil Pan. Check for the proper alignment of the oil pan with a level of wire. Check the oil pan bearings and bearing caps. Remove the oil pan bearing caps if they are damaged. Replace an oil pan gear that has chipped, broken or worn teeth. If the gear is in good condition or the oil pan is in good condition, the oil pan may be reconnected to the input shaft. If the gear is in good condition, the oil pan may be reconnected to the input shaft. If the gear is in good condition, the oil pan may be reconnected to the input shaft.

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Fig. 12

Fig. 12 - Old Diesel Engine, Disassembled

**1. Fuel Meter Adjustment:** Remove the meter from the cylinder head, using a wrench (see Fig. 14). Turn the nut at the top of the meter to the correct fuel setting. Use the standard meter set of the engine. Install new gaskets, using the correct gaskets (see Fig. 15). After the meter is installed, use a standard pressure gauge to check the meter and adjust to the correct setting (see Fig. 16). If the pressure of the fuel is not correct, the meter may be broken during installation. Remove the meter and check the meter, and adjust to the correct setting.



Fig. 13 - Fuel Meter Adjustment



Fig. 14 - Fuel Meter Adjustment

**2. Fuel Meter Adjustment:** Remove the meter from the cylinder head, using a wrench (see Fig. 14). Turn the nut at the top of the meter to the correct fuel setting. Use the standard meter set of the engine. Install new gaskets, using the correct gaskets (see Fig. 15). After the meter is installed, use a standard pressure gauge to check the meter and adjust to the correct setting (see Fig. 16). If the pressure of the fuel is not correct, the meter may be broken during installation. Remove the meter and check the meter, and adjust to the correct setting.

**3. Fuel Meter Adjustment:** Remove the meter from the cylinder head, using a wrench (see Fig. 14). Turn the nut at the top of the meter to the correct fuel setting. Use the standard meter set of the engine. Install new gaskets, using the correct gaskets (see Fig. 15). After the meter is installed, use a standard pressure gauge to check the meter and adjust to the correct setting (see Fig. 16). If the pressure of the fuel is not correct, the meter may be broken during installation. Remove the meter and check the meter, and adjust to the correct setting.

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Fig. 24 - Assembly, Valve Reg. on Valve

A two-piece Valve, Piston Pin, and Connecting Rod (rod) for power which may be necessary for the... (text is partially obscured and blurry)

1. Piston and Connecting Rod Assembly. When a new piston... (text is partially obscured and blurry)

DISASSEMBLY AND REPAIR

The assembly of... (text is partially obscured and blurry)

1. Piston and Connecting Rod Assembly. When a new piston... (text is partially obscured and blurry)



Fig. 25 - Piston Assembly

When a new piston... (text is partially obscured and blurry)

1. Piston and Connecting Rod Assembly. When a new piston... (text is partially obscured and blurry)

2. Valve Piston Rod. When the... (text is partially obscured and blurry)



Fig. 26 - Piston Assembly

When a new piston... (text is partially obscured and blurry)

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Fig. 22 - Assembly of Pump Drive Shaft with Old Power Drive Gear and Shaft

11. **DRIVER GEAR SHAFT REPLACEMENT.** Drive the driver gear shaft from the oil pump body (Fig. 41). To locate the driver gear shaft, come in from the oil pump body until the end of the shaft is flush with the center of the oil pump body.

12. **DRIVER GEAR MOUNTING REPLACEMENT.** Drive the mounting from the oil pump body with a drift. To install the bearing, come in from the oil pump body until the outer edge of the bearing is flush with the oil pump body. Mount the bearing from 2000 to 2500 inch diameter.

13. **Assembly.** Place the driver gear in the oil pump body. Place the driver gear on the driver gear shaft, making sure the fit is the same in both ends on the shaft. Taper the driver gear to the oil pump body.

11. WATER PUMP

The disassembly was shown in Fig. 21.

1. **Disassembly.** Place the water pump in a vise. Drive the shaft out of the water pump with a drift and a hammer. Be sure the pump ring has left from the water pump. Drive the water pump out of the engine block.

Mount the water pump on the engine, connect the belt and pump from the engine (Fig. 23).



Fig. 23 - Assembly of Water Pump Pulley

2. **Assembly.** Clean off all the water pump thoroughly with cleaning fluid.

3. **Inspection.** Replace a bearing if changed water pump body (Fig. 24). Mount the water pump pulley if it is good. Replace an impeller if it is cracked, excessively pitted, or it has become an unusual size. Replace a pulley that is cracked or too tight on the shaft. Protect the water pump bearing. If the bearing loose or has a tendency to rattle, replace the bearing assembly. Mount the belt at a pressure of three to each pair of cam ring in the shaft.



Fig. 24 - Water Pump Disassembly

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Fig. 24—Hand Bearing and Shaft Hole Puller Tool

24. Assembly. Press the bushing in the hole of the oil cup and install the oil cup over the shaft and seal nut (Fig. 21) as indicated. Press down the spring over the seal nut, lock washer, and nut (Fig. 22) to the cup. Press the bearing and shaft assembly into the hole (Fig. 23). Press the cap nut over the shaft and lock with the end of the shaft. Install the inner grease body into the hole. Press the pulley over the shaft and the spring in place with the shaft.

**144. LEVER SHAFT**

Remove the cover (Fig. 24) and install the lever shaft in the hole. Cut the spring over the hole. Remove the bushing and seal nut from the hole and install the lock washer, seal nut, and nut (Fig. 25) over the shaft. Remove the oil cup and install the cap nut over the shaft. Install the grease body into the hole and lock with the end of the shaft. Remove the dust seal and install the spring over the hole.

- 25. Inspection. Examine the grease seal and the lever shaft for proper fit.
- 26. DRIVE SHAFT. Remove the cover (Fig. 26) and install the drive shaft in the hole. Cut the spring over the hole. Remove the bushing and seal nut from the hole and install the lock washer, seal nut, and nut (Fig. 27) over the shaft. Remove the oil cup and install the cap nut over the shaft. Install the grease body into the hole and lock with the end of the shaft. Remove the dust seal and install the spring over the hole.



Fig. 26—Bearing Assembly

- 27. LOWER BALL ASSEMBLY. Remove the lower ball assembly (Fig. 28) if the plate is not secured or if the bearing is worn or damaged.
- 28. DRIVE SHAFT. Remove the drive shaft (Fig. 29) from the hole of the plate to look at the shaft or if the seal is the plate or worn.



Fig. 27—Bearing Drive Shaft Assembly

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Fig. 23—Mercury Chloride Battery Tester and Fig. 24—No. 14 and No. 15 Diesel Injector Builders



Fig. 24—Diesel Injector Builders (Illustration on opposite page)

Push the 100-gauge rod into the nozzle, across all of the holes and all parts of the 100-gauge. Clean the assembly thoroughly.

Repeat the procedure for the 100-gauge in the No. 15 injector or the 100-gauge in the No. 14.

to ensure the 100-gauge is inserted and the nozzle cleaned thoroughly.

To check the nozzle after cleaning, insert the 100-gauge into the hole, twisting it 45° a ground pin. Push the 100-gauge through the hole, and watch the pressure rise in the tank.

To check the pressure, use a pressure gauge on the nozzle. The gauge should read 100 psi. If the gauge reads less than 100 psi, the nozzle is not clean. Repeat the procedure for the 100-gauge in the No. 15 injector or the 100-gauge in the No. 14. If the gauge reads less than 100 psi, the nozzle is not clean. Repeat the procedure for the 100-gauge in the No. 15 injector or the 100-gauge in the No. 14.

If the 100-gauge is not inserted or inserted in the wrong way, the pressure will be low. The gauge should read 100 psi. If the gauge reads less than 100 psi, the nozzle is not clean. Repeat the procedure for the 100-gauge in the No. 15 injector or the 100-gauge in the No. 14.

INSPECTION AND REPAIR OF DIESEL INJECTORS

Check the oil level in the tank. The oil level should be at the top of the tank. If the oil level is low, add oil to the tank. Before the oil is added, check the oil level in the tank. If the oil level is low, add oil to the tank.

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Fig. 48 - Timing Gear

100-010

...with the timing gear of the crank. Make sure the timing marks on the crank gear will line up with the timing mark on the camshaft gear (Fig. 49).

4. Install Timing Gear and Spring Assembly. Place a gear (10) in each of the two slots. Each of the two slots in the camshaft gear is designed to hold one gear. Insert the gear into the slot and push it up until it is flush with the top of the camshaft gear. The gear will be held in place by the spring (11) and the spring assembly (12). When a timing gear is installed in the slot, the gear will be held in place by the spring (11) and the spring assembly (12) (Fig. 50).



Fig. 49 - Installation of Timing Gear

100-011



Fig. 50 - Push Timing Gear of Cam

100-012

...the timing gear of the crank. Make sure the timing marks on the crank gear will line up with the timing mark on the camshaft gear (Fig. 49).

4. Install Timing Gear and Spring Assembly. Place a gear (10) in each of the two slots. Each of the two slots in the camshaft gear is designed to hold one gear. Insert the gear into the slot and push it up until it is flush with the top of the camshaft gear. The gear will be held in place by the spring (11) and the spring assembly (12). When a timing gear is installed in the slot, the gear will be held in place by the spring (11) and the spring assembly (12) (Fig. 50).



Fig. 51 - Connecting Timing Gear to Crank Gear and Push Gear

100-013

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Fig. 27—Assembling Connecting Rod and Piston, Inserting Oil Seal into Piston

To prevent chafe, Place No. 1 Lubricating oil and grease assembly in the No. 4 container and the oil again into the connecting rod being inserted into that of the engine. 11. Insert a piston ring compressor in the piston rings and the oil again down into the cylinder with the handle end of a screwdriver (Fig. 28). Place one half of the connecting rod into the connecting rod and the other half in the connecting rod bearing, and then the connecting rod into the connecting rod bearing with a light line of oil. Carefully position the connecting rod on the crankpin, and insert the bearing pin into the connecting rod, making sure the pin is in the bearing cap. 12. Insert the connecting rod into the engine. Make sure that the bearing cap is not pulled up at 1200 RPM, but is at 1200 RPM, the time. Remove the piston compressor when inserting the connecting rod and piston assembly. Tighten all the connecting rod bolts to 25 to 30 lb. ft. torque, and insert a cotter pin in each end.



Fig. 28—Assembling Connecting Rod and Piston, Tightening Connecting Rod Bolts



Fig. 29—Assembling Connecting Rod and Piston, Tightening Connecting Rod Bolts

12. Remove the oil seal from the connecting rod and piston assembly.

13. Insert the connecting rod into the engine. Make sure that the bearing cap is not pulled up at 1200 RPM, but is at 1200 RPM, the time. Remove the piston compressor when inserting the connecting rod and piston assembly. Tighten all the connecting rod bolts to 25 to 30 lb. ft. torque, and insert a cotter pin in each end.

To insert the connecting rod into the engine, make sure that the bearing cap is not pulled up at 1200 RPM, but is at 1200 RPM, the time. Remove the piston compressor when inserting the connecting rod and piston assembly. Tighten all the connecting rod bolts to 25 to 30 lb. ft. torque, and insert a cotter pin in each end.

14. Insert the connecting rod into the engine. Make sure that the bearing cap is not pulled up at 1200 RPM, but is at 1200 RPM, the time. Remove the piston compressor when inserting the connecting rod and piston assembly. Tighten all the connecting rod bolts to 25 to 30 lb. ft. torque, and insert a cotter pin in each end.

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Install the connecting rod pin to the crank according to the cylinder head cover. Check a few gears, and replace them again on the engine. Insert a 100 lb test gauge between the connecting rod and cylinder block while loading the connecting rod with a heavy weight (Fig. 10). If a clearance of more than 0.001 inch exists, replace the cylinder head cover.

#### 4. Install Oil Pan

**NOTE:** Check the connecting rod pin oil Pan seal before engine installation.

Insert the packing in the groove at each end of the oil pan. Coat the 5/16 inch threaded section of the connecting arm gasket in both the oil pan gasket in place. Install the oil pan gasket on the cylinder block. Push in the oil pan on the cylinder block, and mount the oil cover.

**1. Install Crankshaft Pulley.** Position crankshaft pulley on the crankshaft. Tighten the pulley by hand until the slot in the pulley is lined up with the mounting key in the crankshaft. Draw the pulley to the crankshaft with a blue lock. Install the crankshaft pulley.

**2. Install Cylinder Head.** Place a new head gasket on the cylinder head. Make sure there is no foreign matter either in the gasket or on the surface of the cylinder head or block. Place the cylinder head on the cylinder block. Tighten just lightly. The cylinder head will draw 10 to 14 pounds/in. When tightening with torque from a torque wrench, do not tighten alternately each end.

**1. Install Water Pump.** Position the water pump and gasket on the cylinder block, and install the nuts and washers.

**2. Install Igniter and Intake Manifold.** Place the spark plug and nut on the igniter gasket on the cylinder block studs. Insert the manifold on the cylinder head with the two bolts.

### III. INSTALLATION OF ACCESSORIES

The following instructions are based on the assumption that the correct accessories are to be used. For more information, refer to the manuals for the accessories.

**1. Install Timing Belt.** Position the timing roller (Fig. 1) on the cylinder block, and follow the recommended timing roller

**2. Install Crankshaft Pulley.** Place the pulley on the pin on the crank according to Fig. 11. Install and tighten the two cap screws with the lock washers.

**3. Install Igniter and Spark Plug Wires.** Place the igniter in contact on the distributor. Place the distributor in position on the cylinder head cover, making sure that the ring on the distributor shaft is seated in the slot in the crankshaft. Spread the distributor on the cylinder head cover with two cap screws and lock washers. Insert the spark plug wire terminal in the cylinder head with the two cap screws.

**4. Install Oil Filter.** Insert the oil filter in the cylinder head (Fig. 12) with the two cap screws. Contact the oil filter with the two in the gasket and oil filter. Examine the oil filter with the two cap screws located at the right-hand side of the cylinder head and to the oil filter.

**5. Install Water Pump.** Mount the water pump on the cylinder head cover (Fig. 13). Install the cap screws and washers, but do not tighten until the two bolts are released after the engine is started.

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## Chapter

## IV

## FITS AND TOLERANCES

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## 110. INTERPRETING OF FITS.

The Table of Fit and Tolerances (Table 10.1) gives the various standard specifications between various parts of the class of components, as well as some and limit dimensions that indicate to what extent the tolerances were exercised before the parts can be regarded as non-conforming and hence in the waste level, and hence as NCF. The following definitions of the various types of fit are given to assist in getting the correct meaning of dimensions between parts are included in section 10.1, as well as to give a better appreciation of what the various tolerances mean to achieve by. Generally speaking, all parts are made to a tolerance that the final assembled assembly (the gauge, etc.) may be used with a plus tolerance. The maximum size of the work parts is usually a standard size less the minimum tolerance required for the type of fit desired. The tolerance can be used to give a fit standard size when the tolerance is:

a. **With Fit.** It is a fit in the case of the required tolerance limit within plus gauge, when using the plus gauge, to determine the width tolerance of the hole. When a wrong fit, it is necessary to look at taking the plus gauge or part to force it through the hole. This type of fit does not provide space for a film of oil.

b. **With Fit.** A fit in which when the hole and a slightly smaller than the hole size and reverse the clearance than a running fit (the + tolerance) the tolerance allowance clearance the + tolerance for a given fit that the fit is not made to pass through the constraining or a limited plus hole. In such cases

most of the parts is covered by the fit and specified tolerance. It is an important dimension (the clearance) of the hole size, enough with the tolerance will result in change the type of fit to a running fit (the + tolerance) was possible adequate clearance for a film of oil.

c. **Running Fit.** A running fit is a fit providing enough clearance for a continuous film of oil between the two parts. A running fit means (tolerance) that for all the plus a maximum of 0.011 mm for each 1 inch of diameter (0.0475%).

d. **Free Fit.** A free fit is a fit that requires force to assemble the work parts into the hole. Accepted practice for free fit is to have the hole plus gauge be 0.001 inch for each inch of diameter. That the hole size should be 0.001 inch.

e. **Shrink Fit.** Generally speaking, a shrink fit is a fit that is given by a hole. The amount of the shrink ranging from 0.001 inch to 0.002 inch for each 1 inch of diameter, 0.001 inch for each 1 inch of diameter. This means having a hole fit only be determined either by force or by the parts worked. There are two methods of shrink fit: one is to give a hole size of which size for each hole may be used for work measured. The other is to give a dimension of the hole size by using. The other method involves contracting the hole assembly by cooling with dry ice or liquid air.

f. **Clearance of Expansion on Fit.** Allowance is a term in manufacturing that is given that are required to higher manufacturing level to provide for the dimensional variation of the part. A part is given by a plus tolerance tolerance clearance for the type of fit required. Allowance means also to make the general tolerance of (tolerance) tolerance. Absolute minimum allowance for tolerance of parts required by force or through plus tolerance, plus hole and reverse a hole (tolerance) each of diameter or height. It is a fit that the clearance of a part to make allowance for the additional tolerance required in the tolerance. Hole inch for each 1 inch of diameter is added. In interpreting the tolerance of a certain size, to make a running fit, the tolerance of the hole is 0.001 inch for each 1 inch of diameter.

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