

SHOP TIPS

Autolite



VOL. 9 NO. 8

APRIL, 1971

Tuning the Cooling System

SEE CENTER INSERT
FOR TIMELY PROMOTIONS





Tuning THE

Technical parts and service information published by the Autolite-Ford Parts Division and distributed by Ford and Lincoln-Mercury Dealers to assist servicemen in Service Stations, Independent Garages and Fleets.

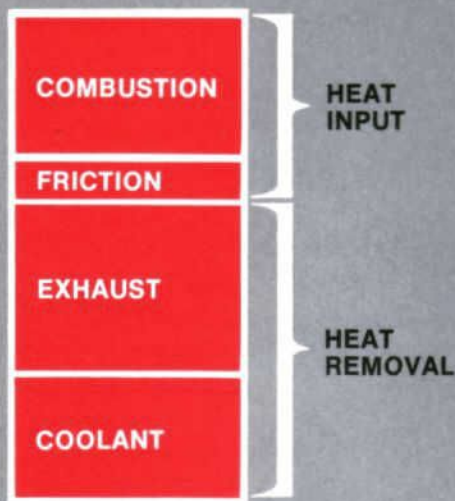


Figure 1—Engine Heat Balance Comparison Chart

ENGINES ARE "HEAT MACHINES"

Automotive internal combustion piston engines can be thought of as being basically "heat machines." They cannot develop usable power unless they create heat. And, within certain limits the hotter they run the more efficient they become.

However, only a small part of the heat produced by the burning air-fuel mixture in the combustion chamber . . . where temperatures often reach over 4000 degrees F. can be utilized for power output to drive the wheels. Waste heat from combustion and heat generated by friction must be removed.

In a typical water cooled automotive engine approximately one-half the waste heat is removed with the exhaust gas and the other half is removed through the cooling system. See Figure 1 for a rough comparison of *Heat Input* from an operating engine and the amount of *Heat Removal*.

Not well known is the fact that a car's engine dissipates heat by THREE major methods; direct radiation to the surrounding air . . . through the exhaust system and of course into the cooling system! Roughly 25,000,000 units of heat . . . often termed BTU's (British Thermal Units) are dissipated in 10,000 miles of ordinary driving.

And, as one industry research source claims, heavy driving with a high output engine can reject enough heat energy into a cooling system to melt an average 200 pound engine block in just a few minutes!

Why doesn't the engine just melt into a pool of hot molten metal since cast iron melts around 2500 degrees F., steel gets red hot at around 1500 degrees F. and aluminum melts at about 1200 degrees F.?

Naturally, it is due to the ability of the cooling system to properly handle the tremendous heat load.

To do this, as one example, the water pump of Ford's 240 cubic inch 6-cylinder engine is designed to pump about 696,000 gallons of coolant in 200 hours of operation at an engine speed of 4000 rpm.

Many of the larger V-8 powerplants have pumps that handle even greater volumes than that.

What happens when the engine cooling system is neglected and loses its efficiency?

Common problems that develop whenever metal temperatures are not controlled by proper cooling include pre-ignition, power loss, knock, burned and scored pistons, warped and burned valves and lubrication failures.

As you can see, modern cooling systems have a real tough job to do and must do it with a high level of efficiency. Thus, keeping the cooling system at its peak performance requires a complete maintenance tune-up . . . preferably twice a year.

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Be sure to file this and future issues for ready reference. If you have any suggestions for articles that you would like to see included in this publication, please write to: Autolite-Ford Parts Division, Merchandising Services Dept., P.O. Box 3000, Livonia, Michigan 48151.

The information in this publication was gathered from materials released by the National Service Department of Autolite-Ford, Ford and Lincoln-Mercury Divisions, as well as other vehicle and parts manufacturers. The descriptions and specifications contained in this issue were in effect at the time it was approved for printing. Our policy is one of continuous improvement and we reserve the right to change specifications or design without notice and without incurring obligation.



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COOLING SYSTEM

COOLING SYSTEM FUNCTION/PURPOSE

The job assigned to the cooling system is to remove the waste heat from combustion and the heat generated by friction. However, it is interesting to note that the operating parts of the engine are cooled not only by the cooling system but to some degree by the lubrication system and to a smaller extent by the fuel system. And, not only does the cooling system serve to prevent the heat produced in the combustion chamber from damaging or melting pistons, valves and cylinder heads, but to also partially control the operating temperature of the crankcase oil.

So you see, the cooling system, operating quietly and unobserved within the confines of metal castings, synthetic rubber hoses and thin-wall tubing of the radiator, has a major job to perform . . . a job that many car owners fail to realize is important to the operating efficiency of their engine. Your help in reminding owners of periodic cooling system tune-ups is therefore needed.

MAINTAINING COOLING SYSTEM EFFICIENCY

To keep the car owner's cooling system operating at peak efficiency, the radiator and engine castings must have clean surfaces (both externally and internally) with the other units such as the radiator, thermostat, pressure cap and water pump performing within the limits designed by the car maker. Fan belt tension must be correct and all hoses must be clean and clamps tight.

Ford service engineers recognize the close relationship of every part in the cooling system to the operating efficiency of other engine systems such as the fuel system, exhaust system, and lubrication system.

Therefore, it makes good sense to advise your service customers that Ford's recommendations of coolant type . . . thermostat operating temperatures and cooling system maintenance schedules should be rigidly followed to get the maximum, overall engine performance and reliability.

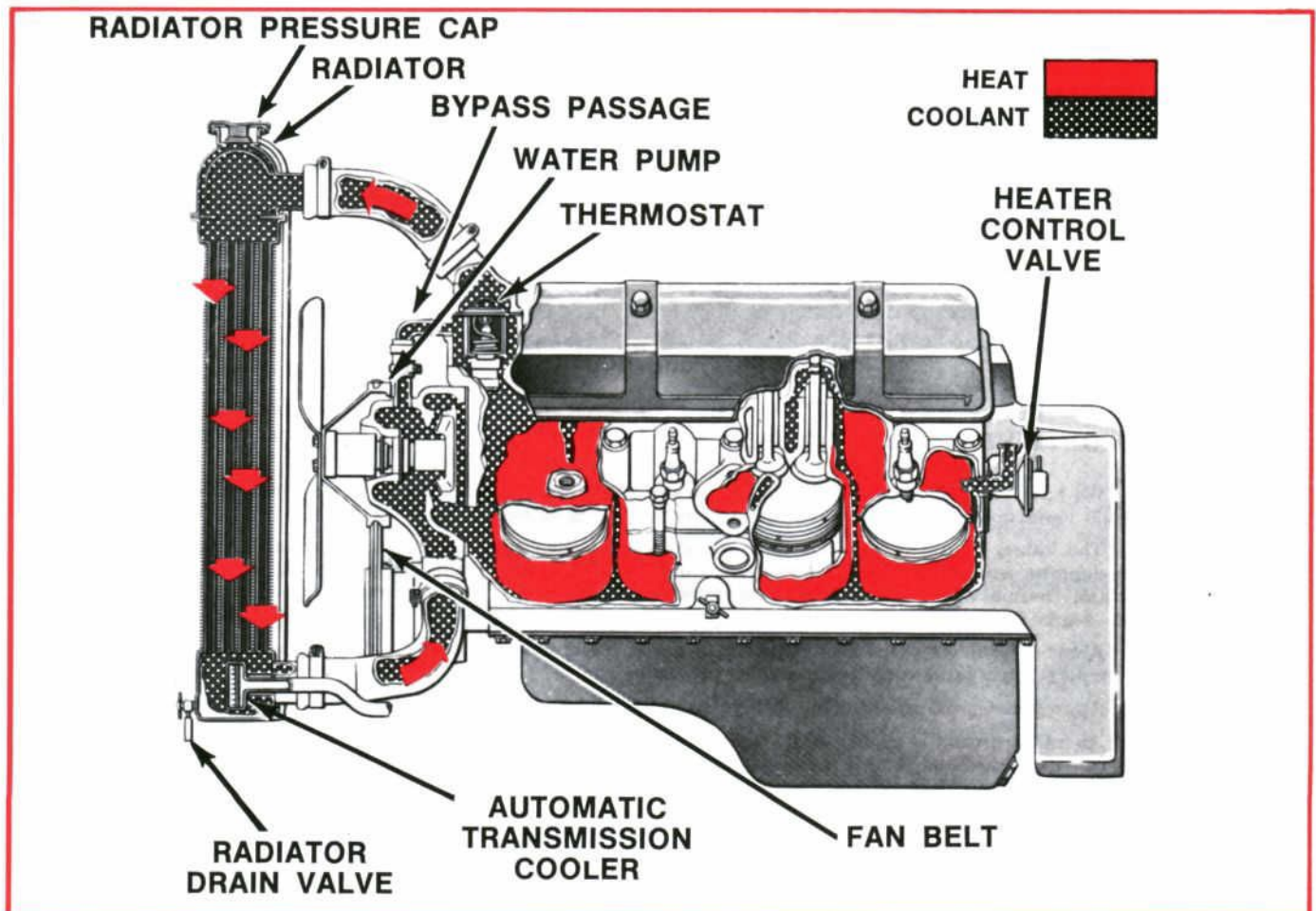


Figure 2—Typical Units in a Modern V-8 Cooling System. Each part is Important to the Efficient Operation of the Cooling system and Overall Engine Performance.



EFFECTS OF POOR COOLING SYSTEM OPERATION

Since it is so important to control the temperature range of the coolant in order to maintain top engine efficiency, let's examine for a moment the problems that develop with a poorly operating cooling system. And no doubt about it, serious damage can occur and your customers should be advised of the consequences.

RUNNING TOO HOT

- For one thing, an engine operating too hot will cause the engine oil temperature to rise to an excessive heat range and thus form varnish-like deposits on metal parts. These deposits can interfere with the close tolerances in today's engines and upset the efficiency and power output.
- Metal parts that are running to extremes of high temperature because of an overheated cooling system generally cause burned valves . . . scored pistons and damaged bearings.
- Increased oil temperature lowers the oil viscosity and allows it to pass through smaller clearances . . . therefore contributing to an increase in oil consumption.
- Lowered oil viscosity will also decrease the strength of the oil film and thus lessen main bearing life, camshaft bearing life and connecting rod bearing life.

RUNNING TOO COLD

- An engine running cold will result in excessive wear of internal operating parts due to the formation of acids . . . improper running clearances . . . poor combustion and an increase in the amount of pollutants sent out into the atmosphere along with the exhaust gases.
- Cylinder wall wear can be **EIGHT TIMES GREATER** with coolant operating at a temperature of 100 degrees F. or colder as compared with 180 degrees F. temperature. Maximum efficiency of Ford-built engines requires a coolant operating temperature of at least 175 degrees F.
- Operating temperature of an engine running below the car maker's designed level can also cause an equally bad engine lubricating problem, wastes fuel, causes poor performance.
- To illustrate this further, let's examine what happens when fuel is burned in the combustion chamber. The burning of one gallon of fuel produces about one gallon of water . . . most of it passes out the exhaust system. However, some of the water vapor along with partially burned fuel may blow by the piston rings and into the crankcase. When this happens, the motor oil is diluted and lubricating efficiency is reduced.

- The water combines with the oil and forms a thick sludge which may block the oil pump screen, plug small oil lines and passages leading to the valve train and gum-up piston rings, valve stems, valve lifters.
- At normal operating temperatures the water and the unburned fuel is more completely vaporized and returned to the intake manifold/carburetor through the action of the positive crankcase ventilation system.

OTHER FACTORS AFFECTING THE COOLING SYSTEM

Efficiency of the cooling system can be upset by any one of the following:

- Late or severely retarded ignition timing may lead to an engine overheating condition and can also cause the exhaust valves to literally "burn-up."
- Since the exhaust system normally removes as much waste heat as the cooling system . . . anything that reduces the "free-flow" of exhaust gases (thus increasing back pressure) will result in greater temperatures in the exhaust areas. And if the cooling system is not able to carry away this increased heat load . . . the results will be a loss of power and early failure of the exhaust valves.
- If the cooling system is operating near its limit and the automatic transmission fluid is running excessively hot because of a low fluid level or poor mechanical adjustments, the end result can lead to an overheated cooling system and transmission problems.
- An air conditioning condenser reduces air flow through the cooling system radiator fins. Also, the condenser gives off heat so that the air reaching the radiator is warmer than one with no air conditioning. It is an important factor to consider when installing one of the "hang-on" types of air conditioners and the reason these manufacturers stress the need for the cooling system to be thoroughly checked during installation.
- Brakes that are "too tight" or "dragging" cause the engine to work harder to reach and maintain a specific road speed, resulting in an overheating condition.
- Pulling trailers that exceed the limits on weight, tongue load, or specific frontal area (causing increased wind resistance) for the particular car being driven will cause an extra burden to be placed on the cooling system and of course on an automatic transmission, too. When these conditions take place, the chances of the cooling system reaching the overheat stage and/or the automatic transmission becoming severely damaged is greatly increased.

COOLING SYSTEM

Continued

TWENTY STEPS TO A COMPLETE COOLING SYSTEM TUNE-UP

Not all car manufacturers agree on the steps needed to perform a complete cooling system tune-up or the order in which they should be made. However, the following services do cover all of the service steps considered the most important when checking out the cooling system.

- 1 Check the coolant level in the radiator and look for excessive rust or oiliness in the solution. "Ford's recommendations" are to drain and refill with fresh permanent type anti-freeze which meets Ford specifications (ESE-M97B18-C) and water mixture every 24 months. Cross flow radiators should have the solution level at the COLD FILL mark. Vertical flow radiators should have the solution level ONE INCH below the ring . . . bottom of filler neck. When it is necessary to add coolant for any reason (or changing the complete coolant solution), only a high quality inhibited all-season coolant meeting Ford Specification M97B18-C should be used. The use of alcohol or menthanol type anti-freeze is NOT RECOMMENDED.

WARNING: Use extreme care when removing the radiator cap. Turn the cap slowly to the partially open stop position to relieve internal pressure before removing the cap.

- 2 Check the radiator cap sealing surfaces located in the radiator filler neck. Look for nicks, deep scratches or damage in this area of the radiator fill opening.

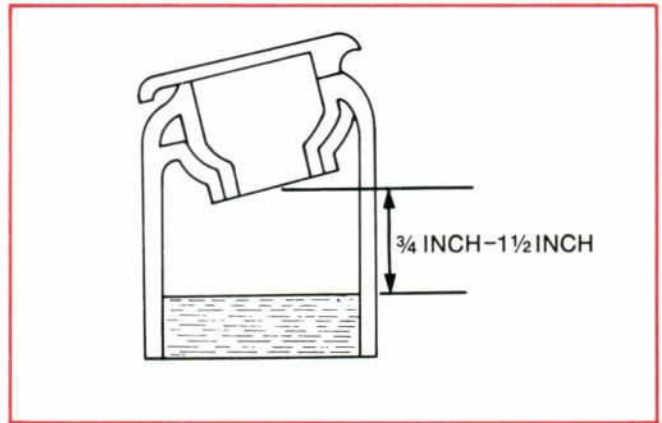


Figure 3—Correct Coolant Level of the 1971 Pinto Radiator.

- 3 Check for both external and internal leaks with an accurate pressure pump and gauge tester. Also test the radiator cap. To make these tests proceed as follows:
 - Wet the rubber sealing surfaces and reinstall the cap tightly on the radiator filler neck.
 - Disconnect the electrical connector from the engine temperature sending unit and remove the unit from the manifold or cylinder head . . . depending on where it is installed on a 6 or V8 engine.

NOTE: With the radiator cap installed only a small amount of coolant will be lost when the sending unit is removed.

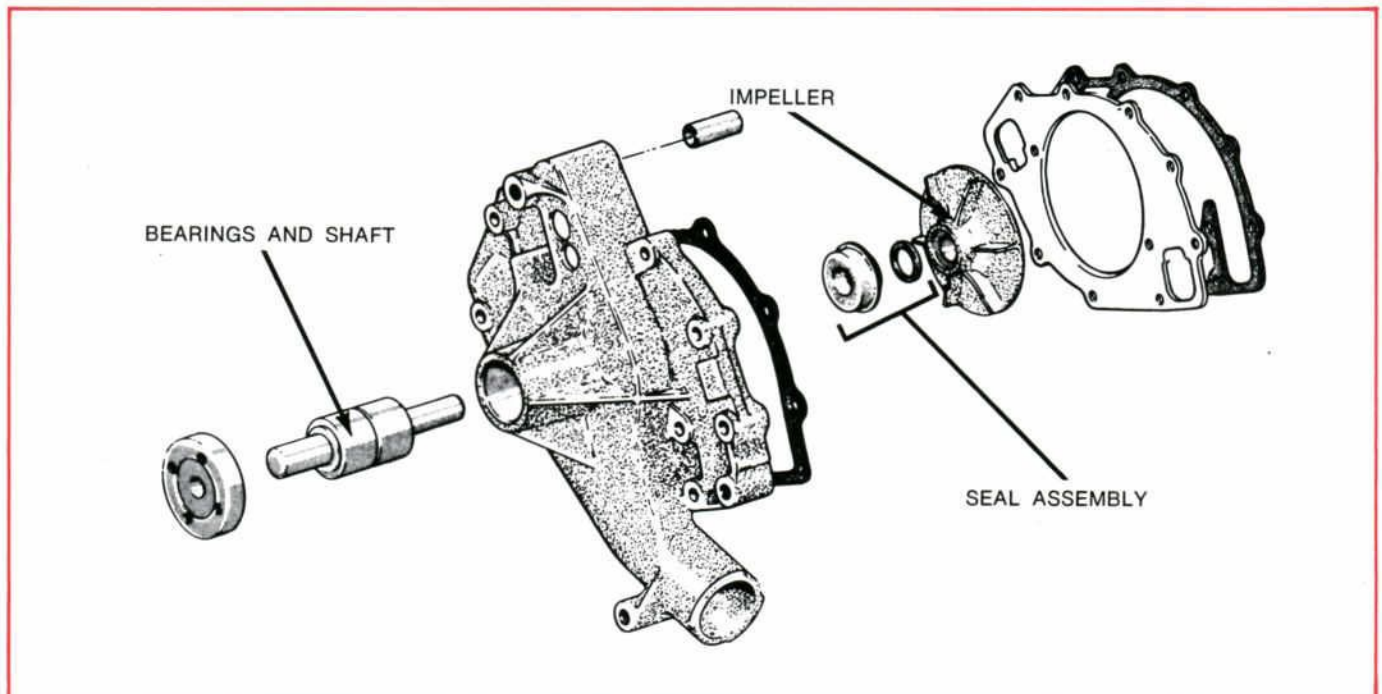


Figure 4—Typical Water Pump Parts. This is an Exploded View of a 1968 Pump Installation in a 460 CID Ford-Built Engine.



Tuning THE

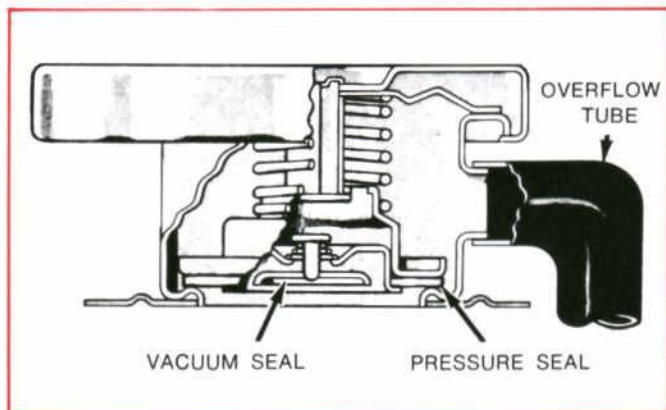


Figure 5—Typical Details in Cross Section of a Radiator Pressure Cap. Note the Two Sealing Surfaces.

- Install an adapter fitting ($\frac{3}{8}$ N.P.T. male thread on one end, and a hose connection on the other end to accommodate the tester hose) tightly into the intake manifold or cylinder head in place of the sending unit.
- Remove the radiator overflow hose from the retainer clips. Make sure the hose is firmly installed on the radiator overflow tube and is in good condition. Insert the free end of the overflow hose into a container of water.
- Attach the pressure pump and gauge to the adapter fitting and pressurize the cooling system until bubbles are observed in the water container. Discontinue pumping when bubbles appear.
- When the bubbles cease, read the pressure gauge. The gauge reading is the pressure relief of the cap and should be within 10 to 16 psi. If the pressure reading exceeds the specified limit, replace with a new Autolite radiator cap.
- If bubbles continue and the pressure drops below 10 psi, the radiator cap is not holding pressure. Release pressure and wash cap in clean water to dislodge any foreign matter from the valves. Check the rubber sealing surface of the cap and also the cap sealing surface in the radiator neck. Inspect the cam lock flanges on both sides of the filler neck for maximum cap engagement.
- Recheck the cooling system as outlined. If the cap still does not hold pressure, the cap is damaged. Replace with a new Autolite radiator cap and recheck system to assure that the system will now hold pressure.
- If the bubbles in the water container cease and the radiator cap is within pressure specifications, observe gauge reading for approximately two minutes. Pressure should not drop during this time.
- If pressure drops, check for leaks at the engine to heater core hoses, engine to radiator hoses, bypass hose, water valve hose (A/C equipped), thermostat housing gasket, etc. Any leaks which are found must be corrected and the system re-checked.

- If the system holds pressure, remove the radiator cap to release the pressure then install the cap.
- Remove the adapter from the manifold or cylinder head and reinstall the temperature sending unit. Check coolant level and replenish if necessary with the correct coolant solution.

NOTE: Never exceed the rated pressure indicated on the pressure cap when performing the pressure test.

- 4 Pull the engine oil dipstick and check for traces of water or an indication of coolant mixed with the oil.
- 5 Remove and test the thermostat. Compare partial opening against the factory specifications. See the specification chart on page 9 of this issue of *Shop Tips*. With the thermostat removed, place it in boiling water. If it does not open more than $\frac{1}{4}$ inch, replace it with a new Autolite thermostat.

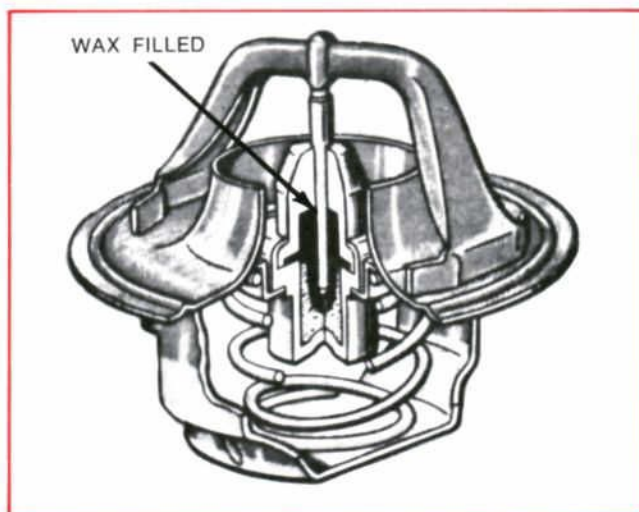


Figure 6—Cross Section View of the "Pellet" Type Thermostat Installed in Late Model Ford-Built Passenger Cars.

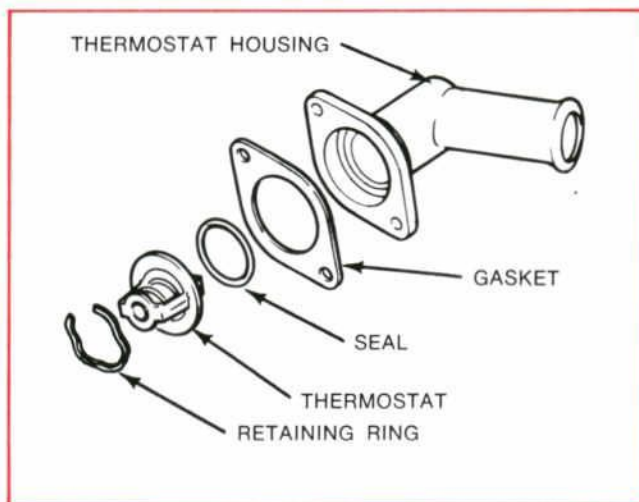


Figure 7—Proper Assembly of the Thermostat to the Housing on the 1971 Pinto Equipped with a 2000 cc Engine.

COOLING SYSTEM

Continued

If the problem being investigated is insufficient heat, the thermostat should be checked for leakage. This may be done by holding the thermostat up to a lighted background. Light leakage around the thermostat valve (thermostat at room temperature) indicates that the thermostat is unacceptable and should be replaced. It is possible, on some thermostats, that a slight leakage of light at one or two locations on the perimeter of the valve may be detected. This should be considered normal.

Make sure the heater control valves are operating properly from the full-closed (shut-off) position to the full-open position.

6 Check and test the heat gauge for accuracy.

NOTE: The sending unit (temperature switch) used with the warning indicator light system is **NOT INTERCHANGEABLE** with the sending unit used with the gauge system. Misuse of the sending units will result in an inoperative temperature indicating system and damaged sending unit or gauges. Perform the test as follows:

7 Start the engine and allow it to run until a thermometer placed in the coolant at the radiator filler cap reads a minimum of 180 degrees F. The gauge in the instrument panel should indicate within the normal band.

If the gauge does not indicate, proceed as follows:

Disconnect the gauge lead from the terminal at the sender unit. Connect the lead of a 12 volt test light or the positive lead of a voltmeter (20 volt scale) to the gauge lead that was disconnected from the sender unit. Connect the other test lead to a suitable ground. With

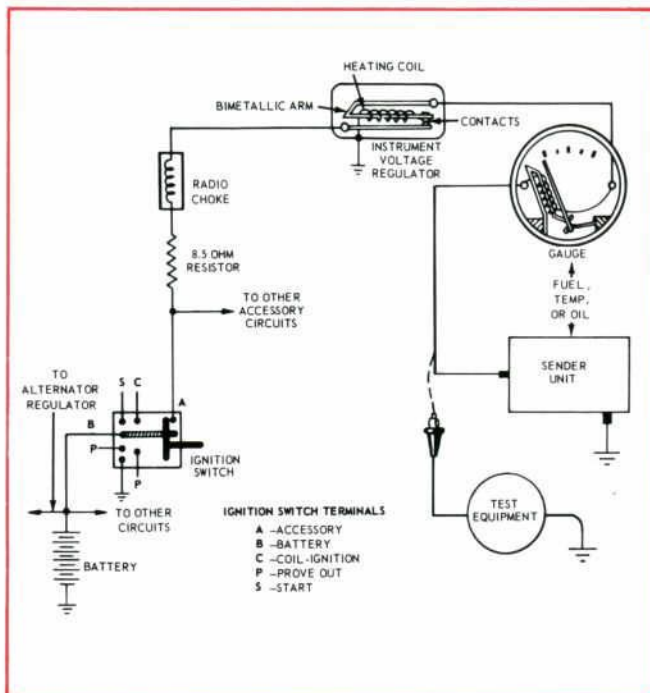


Figure 8—Wiring Diagram of the Instrument Voltage Regulator and Temperature Gauge, 1971 Ford Cars.

the ignition switch in the ON or ACC position, a flashing light or fluctuating voltage will indicate that the instrument voltage regulator is good and that the gauge circuit is not interrupted.

If a pulsating voltage is shown but the gauge is not accurate, perform a calibration test. Information on this test will be found on page 33-40-02, Vol. Three (Electrical) of the 1971 Ford Car Shop Manual.

If the light stays on or the voltage reading is steady, replace the I.V.R. (Instrument Voltage Regulator).

If no voltage is indicated by the voltmeter or test light, check the I.V.R. for proper ground and check for an open circuit in the I.V.R., the gauge windings or the printed circuit.

Do not ground or spark either terminal of the instrument voltage regulator. This will burn out the dash wiring harness or the I.V.R. or both.

8 If the coolant is due for a change (24 months use) or you find the solution badly rusted . . . drain the system and back flush until the water runs clean.

NOTE: The thermostat must always be removed prior to pressure flushing.

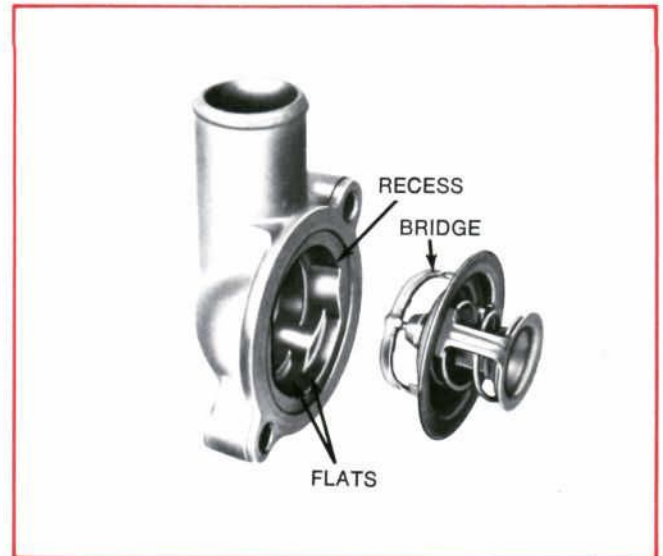


Figure 9—Note the Flats and the Recess in the Housing. The Thermostat is Properly Installed and Centered by these Surfaces.

A pulsating or reversed direction of flushing water will loosen sediment more quickly than a steady flow in the normal direction of coolant movement in the system. In severe cases where cleaning solvents will not properly clean the cooling system for efficient operation, it will be necessary to use the pressure flushing method. Various types of excellent flushing equipment are available and you will find this equipment a valuable addition to your service shop.

9 Clean all leaves, bugs and other foreign objects from the radiator fins.



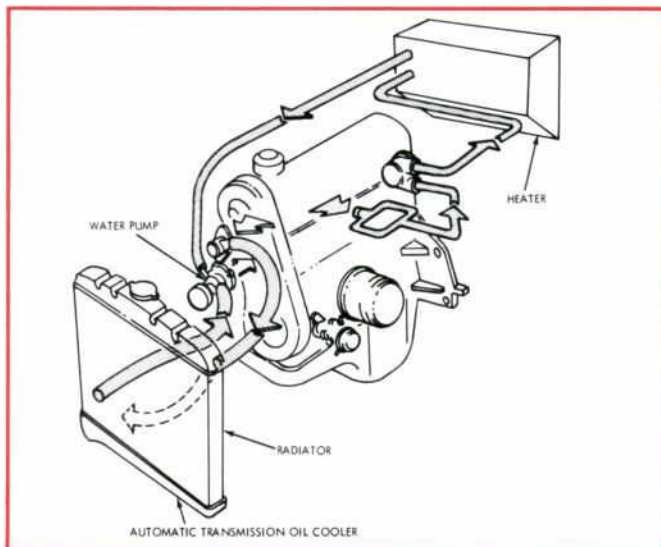
Tuning THE COOLING SYSTEM

Continued

- 10** If the outer surfaces of the engine are heavily covered with an insulating "blanket" of dirt, grease or road mud . . . then a steam cleaning of the engine should be performed. Here is one piece of equipment which can pay for itself and finds countless uses around your service shop. Check with your local supplier who carries this equipment product.

NOTE: Avoid steam cleaning near or at the air conditioning condenser in front of the radiator.

- 11** Remove the fan/water pump drive belt and test the water pump bearings by turning the pulley with your hand. Also check for excessive side or end play. If you find a "rough" bearing or one that has a grating/grinding feel, the pump should be replaced immediately. Advise the owner of this condition and emphasize the damage that can result if not replaced.



- 12** Rotate the fan and while doing so check the fan blades for alignment and their balance.

If the engine is equipped with a fan-drive clutch, see Figure 12, test it as follows:

Spin the fan blade. A resistance to movement should be felt. If there is no resistance, or the opposite . . . high resistance, you will have to perform a minimum and maximum fan speed test. To do this, see page 27-01-02 of the 1971 Ford Car Shop Manual, Volume Two.

- 13** Inspect the condition of the fan belt and if badly worn, frayed or cracked, replace with an Autolite fan belt.

Autolite Pacesetter V-Belts are specially designed to meet the demands of high powered engines and belt driven accessories. They resist stretching and are designed for quieter, cooler running.

- 14** Inspect the condition of the cooling system hoses, the heater hoses and all clamps. Replace as necessary with an Autolite Pacesetter Flexible or Molded Curved Radiator Hose.

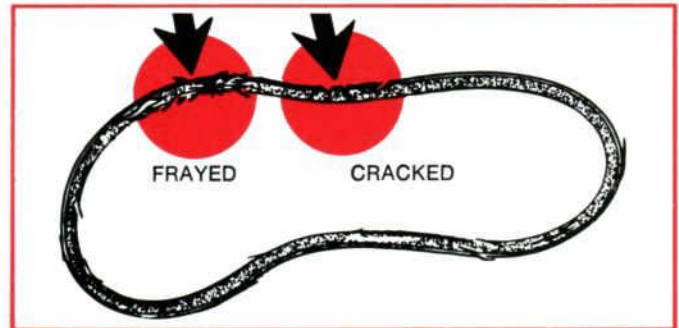


Figure 11—When Inspecting any Drive Belt, Look for These Two Damage Conditions and Replace if Found.

- 15** Check the cylinder block core hole plugs and the drain cock at the bottom of the radiator for any evidence of leakage.

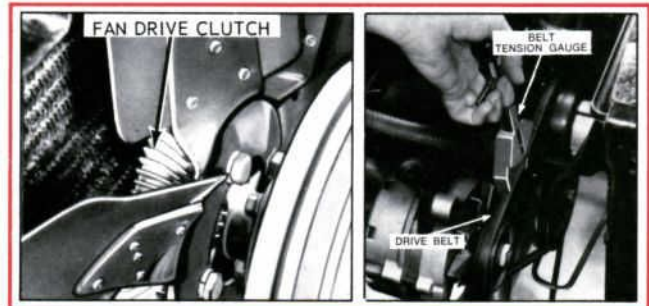


Figure 12—Typical Installation of the Fan Drive Clutch Assembly on Ford-Built Passenger Cars.

Figure 13—Typical Method For Checking the Fan Belt Tension Using an Accurate Tension Gauge.

- 16** Refill the cooling system with the factory approved coolant (refer to step 1) and water to bring the protection range down to -20 degrees F. temperature. In climates where temperatures are more severe, you will have to bring the protection range down even further to prevent freeze-up during the winter months.

- 17** Reinstall fan belt or its Autolite replacement and be sure to adjust it to factory specifications. See the Cooling System Specification Chart on page 9 of this issue of *Shop Tips*.

Use a belt tension gauge such as the one offered by Autolite . . . T63L-8620-A which measures pounds of V-belt tension accurately and quickly.

- 18** Double check the entire cooling system for any leakage of the fresh solution. Run the engine for at least five minutes to bring engine temperature to normal.

- 19** Check ignition timing and if required . . . reset to factory specifications.

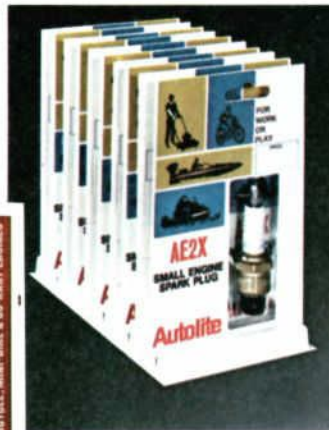
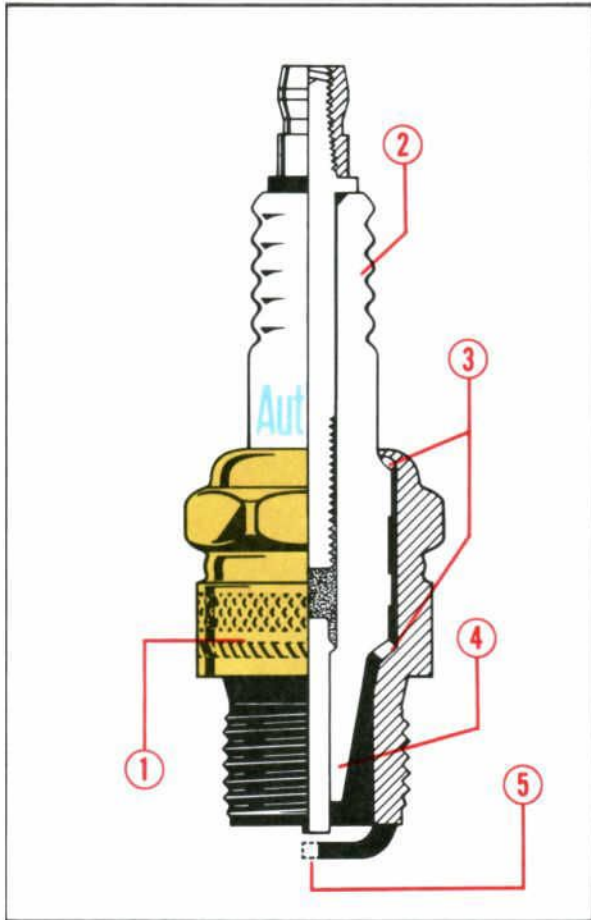
- 20** If you are servicing a cooling system that has a history of overheating, then check for restrictions in the exhaust system . . . check for a frozen heat riser valve (if so equipped) and for brake drag. It may be necessary to pull the water pump and check the condition of the impeller blades. Corrosion may have eaten away at the blades and reduced their effectiveness in moving coolant throughout the cooling system.

Autolite SMALL ENGINE

SPARK PLUGS!

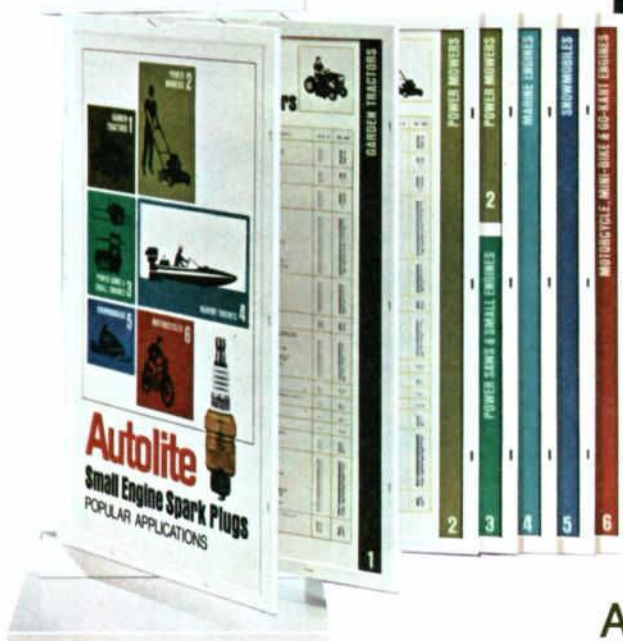
Only Autolite offers you a premium Small Engine Spark Plug line that can be sold profitably at regular prices. For reliable power . . . work or play . . . all plugs incorporate:

- 1 Gold Shell Surface Treatment**
Autolite is the only small engine spark plug with the special shell of gold epoxy to resist rust and corrosion.
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Autolite's special 5-rib insulator of high density ceramic compound stops power-robbing misfire caused by oil and moisture problems.
- 3 Zero-Leakage Seal**
Autolite's hermetic seal stops escape of compression gases . . . to end overheating and pre-ignition ping.
- 4 Non-Fouling Insulator Tip**
Autolite's slender insulator tip stays cleaner longer . . . burns away fouling deposits that drain power.
- 5 Special Electrode Design**
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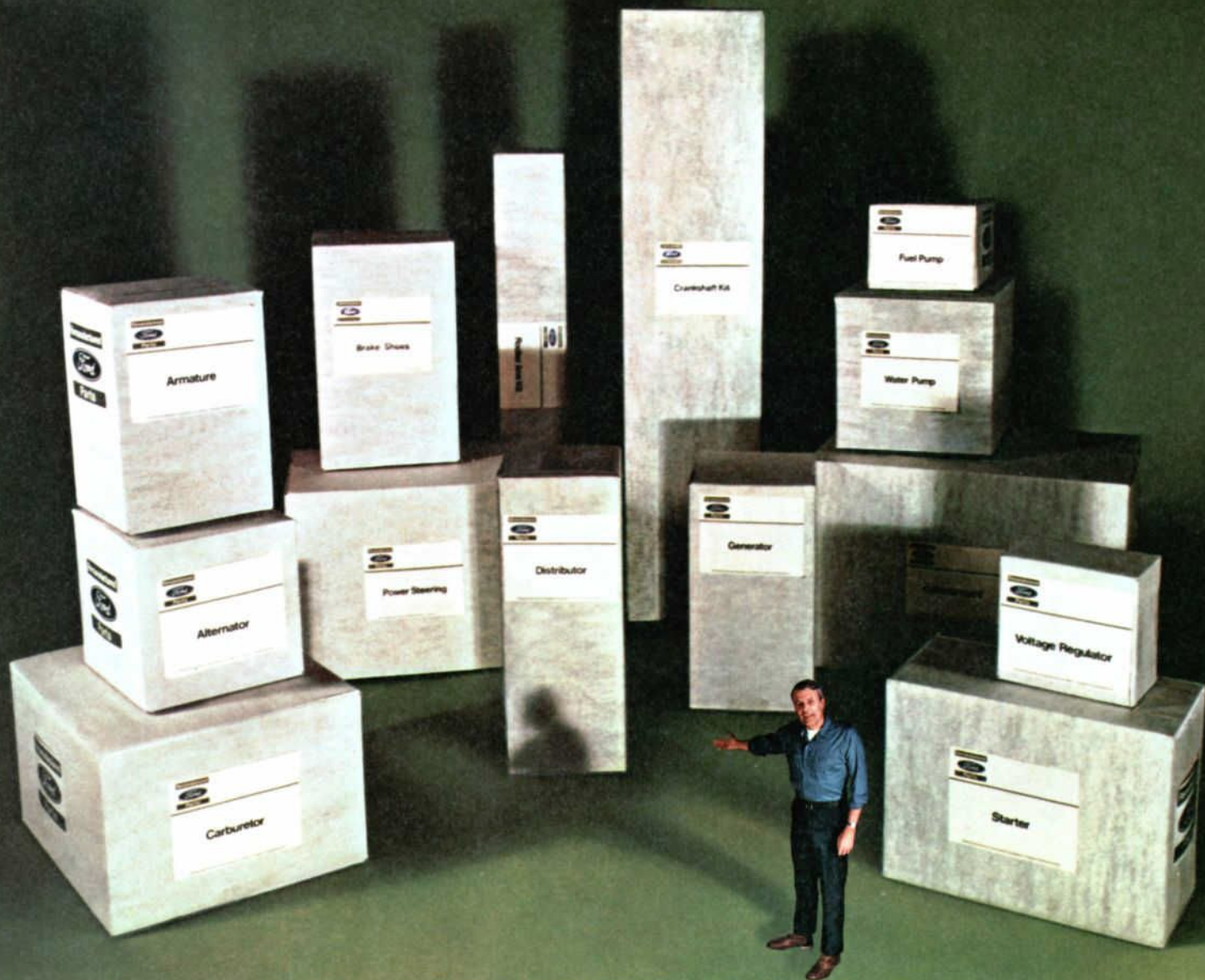
Autolite Power Tip Spark Plugs give all cars more power, improved acceleration, and better gas mileage. Autolite is also your best choice for the resistor plugs now installed as original equipment on Ford and G.M. vehicles . . . because Autolite, first to produce original equipment resistor plugs, continues to lead the industry in design improvements.

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Every part is remanufactured to the strictest Ford Motor Company engineering specifications and is made exclusively for Ford-built cars and trucks.

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NATIONAL WARRANTY

Every Remanufactured Ford Part is warranted nationally by the Remanufacturer to be free of defects in materials and workmanship for 90 days or 4000 miles from date of installation, whichever occurs first. Complete OHV engine assemblies are warranted for 12 months or 12,000 miles on passenger vehicles, and 6 months or 12,000 miles on trucks, whichever occurs first. This Warranty includes parts replacement plus related labor.

Ford and Lincoln-Mercury dealers will honor this warranty anywhere in the country.

Remanufactured



Engines • Parts



Tuning THE COOLING SYSTEM

Continued

COOLING SYSTEM SPECIFICATIONS 1971 PASSENGER CARS

ALL (EXCEPT PINTO & CAPRI)

1971 COOLING SYSTEM CAPACITY AND SUPPLEMENTAL PROTECTION—U.S. QUARTS

Vehicle	C.I.D. Engine	Coolant Capacities	
		Std.	Extra & A/C
Maverick	170	9.0	9.2
Maverick	200	8.7	9.0
Mustang	250	11.2	11.2 [ⓐ]
Torino, Ranchero, Montego	250	11.2	11.2 [ⓐ]
Ford, Meteor	240	14.1	14.1 [ⓐ]
Torino, Ranchero, Montego	302	15.1	15.5
Mustang	302	15.1	15.5
Ford, Meteor	302	15.2	15.6 [ⓐ]
Torino, Ranchero, Montego	351	15.3	16.3
Mustang, Cougar	351	15.7	16.3

Vehicle	C.I.D. Engine	Coolant Capacities	
		Std.	Extra & A/C
Torino, Ranchero, Montego	429	18.8	19.4
Ford, Meteor, Mercury	351	16.3	16.7
Ford	390	20.3	20.9 [ⓐ]
Ford, Mercury, Meteor	400	17.6	18.2
Torino, Montego, Ranchero	429 CJ	19.4	19.4
Mustang, Cougar	429 CJ	19.4	19.4
Ford, Mercury, Meteor	429	18.8	18.8 [ⓐ]
Thunderbird	429	19.4	19.4 [ⓐ]
Lincoln	460	19.4	19.4 [ⓐ]
Mark III	460	19.4	19.4 [ⓐ]

ⓐ/A/C Only Air Conditioning Only
 ⓑ/X/C Only Extra Cooling Only

ⓒ/Multiply U.S. quarts by 0.83 for equivalent Imperial Quarts.
 ⓓ/Approximate

TORQUE VALUES ALL CARS (EXCEPT PINTO AND CAPRI)

Fan shroud assembly to radiator where applicable	24-48 inch-lbs.
Fan to pulley hub (All engines)	12-18 foot-lbs.
Radiator hose clamps (170-200 CID Maverick-Comet std. radiator)	16-24 inch-lbs.
(All others)	20-30 inch-lbs.
Transmission oil cooler tubes to oil cooler—All engines	9-12 foot-lbs.

RADIATOR

Pressure Cap—All engines	12-16 psi
--------------------------	-----------

DRIVE BELT TENSION

All belts	Lbs.
New	140
Used (any belt operated over 10 minutes)	110

THERMOSTATS

Low Temperature	
Opens °F	157°-164°
Fully Open	184°
High Temperature	
Opens °F	188°-195°
Fully Open	212°

CAPRI

Cooling System Capacity	U.S. Pints
1600 cc engine (with heater)	12½
2000 cc engine (with heater)	15
Radiator —Cap release pressure	13 psi
Fan Belt —Free play	½ inch
—Fan mounting bolts torque	7 to 9 foot-lb.
—Tension (new)	50 lb.
(used)	35 lb.
Thermostat —(new) starts to open	185° to 192° F.
—Fully open	210° to 216° F.
—(used) starts to open	178° to 199° F.
—Fully open	203° to 223° F.

PINTO

Cooling System Capacity	1600 cc engine (with heater)	12½ pts.
	2000 cc engine (with heater)	15 pts.
Radiator	Torque (inch-lb.)	
Radiator upper hose clamps		
to radiator (1600-2000 cc)	20-30	
to thermostat housing (1600 cc)	20-30	
to thermostat housing (2000 cc)	16-24	
Radiator lower hose clamps		
to water pump (1600-2000 cc)	16-24	
to radiator (1600-2000 cc)	20-30	
Radiator shroud attaching bolts (1600-2000 cc)	24-48	
Thermostats —Opens °F	183-190° F.	
Fan Belt Tension —New	140 lbs.	
Used (any belt operated over 10 minutes)	110 lbs.	

1971 SHOP MANUALS & FACTORY

THE NEW, EASIER TO USE FORD & LINCOLN-MERCURY SHOP MANUALS!

Here they are . . . the "Bibles" of approved service methods and factory specifications.

SEVEN compact manuals cover all passenger car lines produced by Ford.

Volumes ONE thru FIVE contain all the service information needed on the *Chassis* (Vol. One), *Engine* (Vol. Two), *Electrical* (Vol. Three), *Body* (Vol. Four), *Pre-Delivery, Maintenance and Lubrication* (Vol. Five).

The Pinto* and Capri* Shop Manuals are separate

publications that cover all service information pertaining to these two individual models.

Save \$8.05 by purchasing the complete set for only \$7.95 (Form No. 7098-71) of Volumes One thru Five covering Maverick, Torino, Mustang, Ford, Thunderbird, Montego, Cougar, Comet, Meteor, Mercury, Lincoln Continental, Continental Mark III.

Individual prices are shown in the text.

*NOT INCLUDED WITH FULL FORD SHOP MANUAL SET

VOLUME ONE / CHASSIS

This is a very comprehensive manual covering everything on the chassis, including Identification Codes, Wheels and Tires, Brakes, Steering, Suspension, Driving Axle, Clutch plus Manual and Automatic Transmissions.

Purchased separately, \$3.75 (form 7098-71-1)



VOLUME TWO / ENGINE

Full coverage of all 1971 Ford-built Gasoline Engines used in passenger cars, complete information on the Ignition System, Fuel System, Exhaust System, Cooling System and the Starting System.

Purchased separately, \$3.50 (form 7098-71-2)

VOLUME THREE / ELECTRICAL SYSTEM

Everything you'll need to know to test, adjust, service, overhaul and diagnose electrical problems in the Charging System, Lighting System, Instruments, Controls, Circuits, Ventilating, Heating and Air Conditioning Systems. Speed Control and Anti-Skid Control Systems also included.

Purchased separately, \$3.50 (form 7098-71-3)



VOLUME FOUR / BODY

Here's a necessary addition to your technical library if you do body work of any kind. Detailed drawings, and full service information on Seats, Window Glass and Mechanisms, Doors, Hood, Luggage Compartment, Tailgates, Interior and Exterior Trim, Tops and Exterior Finishes, the Body Shell, Frame and Underbody.

Purchased separately, \$3.50 (form 7098-71-4)

VOLUME FIVE / MAINTENANCE AND LUBRICATION

Curious or confused about the maintenance schedules and lubrication requirements of 1971 Ford-built passenger cars? Here's a must for all servicemen who need the facts about factory recommended lubricants and mileage intervals. Includes when and how to perform proper maintenance and procedures for all the frequently performed service operations.

Purchased separately, \$1.75 (form 7098-71-5)



SPECIFICATIONS . . . NOW AVAILABLE!

ADDITIONAL SHOP MANUALS AND TECHNICAL PUBLICATIONS!

1971 PINTO CAR SHOP MANUAL*

Everything you'll need to know to service Ford's newest idea in a little car, the new 1971 Pinto.

Contained in this One Volume are Twenty-eight Groups that cover such a wide range of information as Identification Codes, Brakes and Tires, Engines and Transmissions, Ignition and Fuel Systems, Body Shell, Interior and Exterior Trim and much more.

Purchase price, \$3.75 (form 7986-71)

*NOT INCLUDED WITH FULL FORD SHOP MANUAL SET

CAPRI SHOP MANUAL*

Here in One Volume is all the service information you'll need when you are called upon to Adjust, Test, Overhaul and Maintain this imported personal sports car in the Lincoln-Mercury car line.

Twenty-seven Groups are listed covering every area of the car. You'll find it rich in service information plus maintenance schedules and lubrication details.

Purchase price, \$9.95 (form LM-7987-70)

*NOT INCLUDED WITH FULL FORD TRUCK SHOP MANUAL SET

1971 FORD CAR SERVICE SPECIFICATIONS*

Here in two condensed service specifications handbooks is all the quick reference information you'll need on the 1971 models . . . Torino, Mustang, Meteor, Maverick, Thunderbird, Mercury, Comet, Montego, Lincoln Continental, Ford, Cougar and the Continental Mark III. Each section has identifying Group and Part Numbers that correspond to similar Group and Part Numbers in the appropriate Shop Manuals.

Can only be purchased separately . . . \$1.95, includes supplement (form 7202C-71)

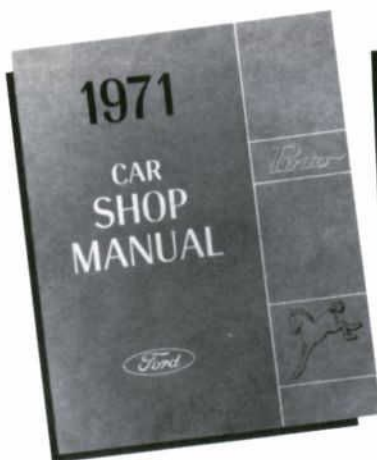
*NOT INCLUDED WITH FULL FORD SHOP MANUAL SET

1971 FORD TRUCK SERVICE SPECIFICATIONS*

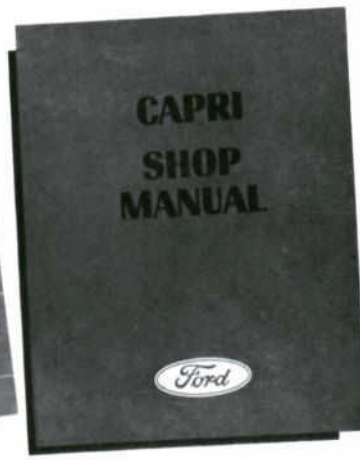
A service specification handbook for servicemen who work on Ford-built trucks. This pocket-sized booklet contains summarized repair and adjustments specifications in a handy, easy to use form.

Can only be purchased separately . . . \$1.95 (form 7202T-71)

*NOT INCLUDED WITH FULL FORD TRUCK SHOP MANUAL SET



PINTO MANUAL



CAPRI MANUAL



TWO
POCKET-SIZE
HANDBOOKS

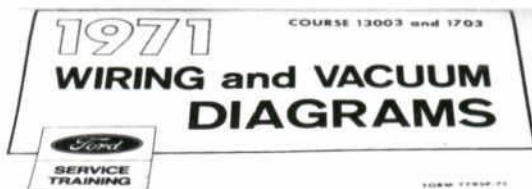


TRUCK
SERVICE
SPECIFICATIONS

1971 CAR AND TRUCK WIRING DIAGRAMS

Contains complete schematic diagrams of both wiring and vacuum actuated systems for all Ford-built cars and trucks (except Capri). See list below.

15 SECTIONS! ONLY \$13.50 (FORM 7795P-71)



Vehicle	Form No.	Bought Separately	Purchased with Shop Manual
Lincoln	7795P-71-L	\$ 2.50	\$.65
Mark III	7795P-71-B	2.50	1.40
Thunderbird	7795P-71-A	2.50	1.40
Ford-Meteor	7795P-71-C	2.50	1.40
Mercury	7795P-71-D	2.50	1.40
Torino	7795P-71-H	2.50	1.40
Maverick-Comet	7795P-71-M-N	1.75	.65
Mustang-Cougar	7795P-71-F-G	2.50	1.40
Montego	7795P-71-J	1.75	.65
Pinto	7795P-71-K	1.75	.65
Bronco-Econoline	7795P-71-P	2.25	1.15
Truck F-100/750 Series	7795P-71-R	4.25	3.15
Truck C Series	7795P-71-S	2.50	1.40
Truck L Series	7795P-71-Q	2.25	1.15
Truck W Series	7795P-71-T	2.25	1.15

1971 FORD TRUCK SHOP MANUALS ORDER TODAY

Here is the most complete set of Ford truck service information volumes ever published! Each contains service procedures and specifications for making repairs or adjustments on 1971 vehicles ranging from the Bronco on up to the big W-Series Trucks.

Save \$5.75 by purchasing the complete set for only \$9.75 (form 7099-71) covering Bronco, Club Wagon, Econoline, B-Series, C-Series, F-Series, L-Series, P-Series, W-Series.

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VOLUME ONE—CHASSIS

All the service information you'll need to service Wheels and Tires, Brakes, Steering, Suspension, Driving Axles, Driveshafts, Clutch and Manual Transmissions plus Automatic Transmissions.

Purchased separately, \$5.50 (form 7099P-71-1)

VOLUME TWO—ENGINE

Contains solid information on all truck Gasoline and Diesel Engines. Sections covered include Ignition, Fuel and Exhaust Systems, Cooling and Starting Systems.

Purchased separately, \$4.25 (form 7099P-71-2)

VOLUME THREE & FOUR—BODY AND ELECTRICAL

Here in ONE SHOP MANUAL is service information covering two major groups . . . Electrical and Body. All the inside details for effective service work on these essential areas of truck repair.

Subjects covered in the Electrical Section include such diversified information as Charging and Lighting Systems, Instruments, Clusters and Controls, Main Wiring Harness and Circuit Protection, Auxiliary Equipment such as Wipers, Horns, etc., and Ventilating, Heating and Air Conditioning.

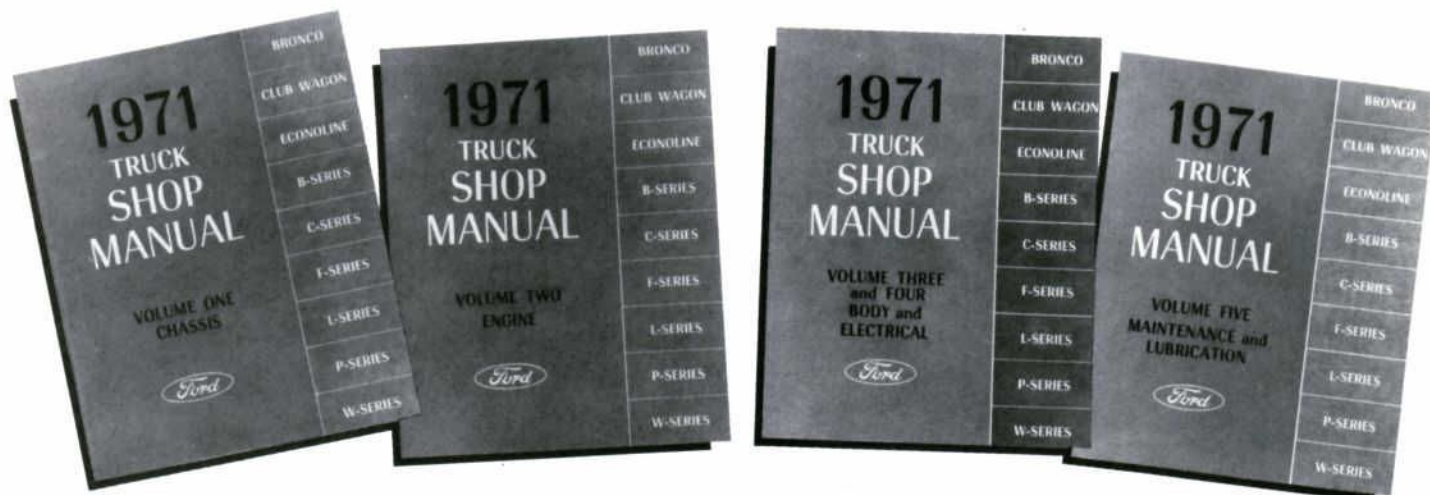
The Body Section covers such information as Seats, Window and Glass, Doors, Hood, Interior/Exterior Trim and Body Shell. Frame and Underbody components are also included.

Purchased separately, \$3.75 (form 7099P-71-3 & 4)

VOLUME FIVE—MAINTENANCE AND LUBRICATION

Want to know the maintenance schedules and lubricant intervals for all Ford-built Trucks? In this one volume you'll find all the necessary details plus Identification Codes and instructions on Hoisting, Jacking and Towing, as well as procedures for all the frequently performed maintenance operations.

Purchased separately, \$2.00 (form 7099P-71-5)



PRIOR YEAR TRUCK SERVICE PUBLICATIONS . . . FOR SERVICEMEN WHO DO TRUCK MAINTENANCE & REPAIR

1969 and 1970 MODEL YEAR . . . FORD-BUILT TRUCKS

ITEM	DESCRIPTION	FORM NO.	1969 PRICE	FORM NO.	1970 PRICE
COMPLETE SET:	Truck Shop Manual 4 Manuals include all Ford truck lines	7099-69	\$9.75	7099-70	\$9.75
SEPARATELY:	Volume 1 Chassis	7099-69	5.50	7099-70	5.75
	Volume 2 Engine	7099-69	4.75	7099-70	4.50
	Volume 3 Electrical	7099-69	2.75		
	Volume 3 & 4 Electrical & Body	—	—	7099-70	2.95
	Volume 4 Maintenance & Lubrication	7099-69	2.25	—	—
	Volume 5 Maintenance & Lubrication	—	—	7099-70	2.45
	*Ford truck service specifications	7202T-69	1.50	6202T-70	1.50

*Not included with full Ford Shop Manual set

CHECK THESE SERVICE PUBLICATIONS... ROUND OUT YOUR TECHNICAL INFORMATION

**NOW'S YOUR OPPORTUNITY TO PLACE AN ORDER FOR THESE
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SHOP MANUALS/1969 and 1970 MODEL YEAR... FORD PASSENGER CARS

ITEM	DESCRIPTION	FORM NO.	1969 PRICE	FORM NO.	1970 PRICE
COMPLETE SET:	Car Shop Manual (5 volume) Includes ALL Ford Car Lines	7098-69	\$7.95	7098-70	\$7.95
SEPARATELY:	Volume 1 Chassis	7098-69	4.00	7098-70-1	4.00
	Volume 2 Engine	7098-69	4.00	7098-70-2	4.00
	Volume 3 Electrical	7098-69	3.50	7098-70-3	3.50
	Volume 4 Body	7098-69	3.25	7098-70-4	3.25
	Volume 5 Maintenance & Lubrication	7098-69	2.25	7098-70-5	2.25
	*Ford Car Service Specifications	7098-69	1.50	7202C-70	1.50
	MAVERICK MAINTENANCE & LUBRICATION	—	—	7098M-70-5	1.95

*Not included with full Ford Shop Manual set

WIRING & VACUUM SYSTEMS/HERE'S 1969 and 1970 WIRING DIAGRAMS... VACUUM SYSTEMS & SCHEMATICS

DESCRIPTION	FORM NO.	1969 PRICE	FORM NO.	1970 PRICE
WIRING DIAGRAM BOOK 9 SECTIONS	7795P-69	\$11.50	7795P-70	\$13.50
Lincoln	7795P-69-L	(a) 3.00 (b) 1.50	7795P-70-L	(a) 3.00 (b) 1.50
Thunderbird—Mark III	—	—	7795P-70-A	(a) 2.85 (b) 1.60
Mark III	7795P-69-M	(a) 3.25 (b) 1.50	—	—
Thunderbird	7795P-69-A	(a) 2.85 (b) 1.60	—	—
Ford—Mercury	7795P-69-B	(a) 2.75 (b) 1.35	7795P-70-B	(a) 2.75 (b) 1.35

DESCRIPTION	FORM NO.	1969 PRICE	FORM NO.	1970 PRICE
Falcon—Fairlane—Montego	7795P-69-C	(a) \$2.75 (b) 1.35	7795P-70-C	(a) \$2.75 (b) 1.35
Cougar—Mustang	7795P-69-F	(a) 2.82 (b) 1.60	7795P-70-F	(a) 2.82 (b) 1.60
Maverick (Total vacuum schematic)	—	—	7795N-70	(a) 3.25 (b) 1.50
Cortina	7795P-69-J	(a) 2.25 (b) 1.00	7795P-70-J	(a) 2.25 (b) 1.00
Bronco—Econoline	7795P-69-G	(a) 2.65 (b) 1.25	7795P-70-G	(a) 2.65 (b) 1.25
Truck	7795P-69-K	(a) 4.00 (b) 2.75	7795P-70-K	(a) 4.00 (b) 2.75

NOTE: (a) Purchased separately (b) Purchased with Shop Manual

OWNER MANUALS/AN OPPORTUNITY TO GET FORD PASSENGER CAR AND TRUCK OWNER'S MANUALS

IMPORTANT NOTE: BE SURE TO SPECIFY MODEL YEAR DESIRED

VEHICLE	YEAR	FORM NO.	PRICE
Thunderbird	1958 thru 1960 and 1963 thru 1967 and 1969 thru 1971	7513	\$1.50
Ford	1956 thru 1971	3692	1.50
Falcon	1963 thru 1969 and 1970½	7759	1.50
Fairlane	1962 thru 1970, Torino 1971	7779	1.50
Mustang	1966 thru 1971	7833	1.50
Maverick	1970 thru 1971	7970	1.50
Pinto	1971 only	7759	1.50
Bronco	1966 thru 1971	7901	1.50

VEHICLE	YEAR	FORM NO.	PRICE
Econoline	1961 thru 1971	7767	\$1.50
Truck Operators Manuals (Series 100/350)	1956 thru 1971	3651	1.50
Truck Operators Manuals (Series 500/1100)	1963 thru 1971	7808	1.50
Truck Operators Manuals (Series 500/750)	1970 thru 1971	7977	1.50
Truck Operators Manuals (Series 800/900)	1970 thru 1971	7978	1.50

CORTINA SERVICE PUBLICATIONS/SHOP AND OWNER'S MANUALS FOR THIS IMPORTED CAR

YEAR	DESCRIPTION	FORM NO.	PRICE
1962-66	Cortina and Cortina GT Owner Manual *Cortina GT Shop Manual	C13 C13M	\$2.25 9.25
1966	Cortina Lotus Owner Manual *Cortina Lotus Shop Manual	CL1 CLM	2.25 3.25
1967	Cortina and Cortina GT (model C) Owner Manual	C670	2.25
	Cortina and Cortina GT (model C) Shop Manual	C67M	8.95
	Cortina Specifications	C67S	1.75

YEAR	DESCRIPTION	FORM NO.	PRICE
1968	Cortina Owner Manual (1600cc Engine) Cortina Shop Manual (1600cc Engine)	C680 C68M	\$2.25 9.95
1969	Cortina Owner Manual Cortina Shop Manual	C690 C69M	2.25 9.95
1970	Cortina Owner Manual Cortina Shop Manual	C700 C70M	2.25 9.95
	*Loose Leaf Binder 6 score (with Shop Manual)	GS2	2.50
	(without Shop Manual)		3.50

ADDITIONAL SERVICE PUBLICATIONS

WANT TO KNOW MORE ABOUT 1968 AND EARLIER MODEL PASSENGER CARS AND TRUCKS? TAKE ADVANTAGE OF THIS FINE OFFER NOW!

1959-1968 PASSENGER CAR SERVICE INFORMATION

YEAR	PUBLICATION	FORM NO.	PRICE
1959	Lincoln and Continental Maintenance Manual	6076-59	\$5.95
	Edsel Maintenance Manual	5703-59	5.95
	Ford Car Shop Manual	7098-59	5.95
	Mercury Maintenance Manual	6077-59	5.95
1960	Edsel Maintenance Manual	5703-60	5.95
	Ford Car Shop Manual	7098-60	5.95
	Comet Maintenance Manual	10249-60	4.95
1961	Mercury Maintenance Manual	6077-61	5.95
1961-62	Falcon Shop Manual	7760-61-62	4.95
1964	Lincoln Continental Maintenance Manual	6076-64	6.95
	Ford/Mercury Shop Manual	7098-64	5.95
	Comet/Falcon Shop Manual	7760-64	5.95
1965	Lincoln Continental Maintenance Manual	6076-65	6.95
	Thunderbird Shop Manual	7750-65	5.95
	Ford/Mercury Shop Manual	7098-65	5.95

*Includes 1-7920C-67 Maintenance & Lubrication Manual

YEAR	PUBLICATION	FORM NO.	PRICE
1966	Lincoln Continental Maintenance Manual	6076-66	\$6.95
	Thunderbird Shop Manual	7750-66	5.95
	Ford/Mercury Shop Manual	7098-66	5.95
1967	Comet/Falcon/Fairlane/Mustang Shop Manual	7760-66	5.95
	Thunderbird Shop Manual*	7750-67	5.95
1968	Ford/Mercury Shop Manual*	7098-67	5.95
	Comet/Cougar/Falcon/Fairlane/Mustang Shop Manual*	7760-67	5.95
	Continental Mark III Technical Data Shop Manual**	LM-6076-MIII	5.95
1968	Thunderbird Shop Manual Supplement (includes 1-7750-67 Thunderbird Shop Manual)**	7750-68	6.95
	Ford Car Service Specifications	7202-C-68	1.50
	Ford/Mercury Shop Manual**	7098-68	5.95
	Cougar/Falcon/Fairlane/Montego/Mustang Shop Manual**	7760-68	5.95

**Includes 1-7920C-68 Maintenance & Lubrication Manual

1961-1968 TRUCK SERVICE INFORMATION

YEAR	PUBLICATION	FORM NO.	PRICE
1961	Econoline Truck Shop Manual	7766-61	\$4.95
1962-63	Econoline Truck Shop Manual Supplement (includes 1-7766-61 Econoline Truck Shop Manual)	7766-62/63	4.95
1964	Econoline Truck Shop Manual Supplement (includes 1-7766-61 and 1-7766-62/63 Econoline Truck Shop Manuals)	7766-64	5.95
	Truck Shop Manual (Series 100-350)	7099A-64	5.95
	Truck Shop Manual (Series 500-800)	7099C-64	6.95
1965	Econoline Truck Shop Manual (includes Falcon Bus)	7766-65	5.95
	Truck Shop Manual (3 Volumes)	7099-65	7.95

†Includes 1-7920-67 Maintenance and Lubrication Manual

YEAR	PUBLICATION	FORM NO.	PRICE
1966	Econoline Truck Shop Manual (includes Falcon Bus)	7766-66	\$5.95
	Ford Truck Service Specifications	7202T-66	1.50
	Truck Shop Manual (4 Volumes)	7099-66	7.95
1967	Ford Truck Service Specifications Truck Shop Manual (3 Volumes) (includes 1-7920T-67 Maintenance and Lubrication Manual)	7202T-67	1.50
1968	Truck Shop Manual (3 Volumes)	7099-67	8.95
	Bronco Econoline Shop Manual†	7766-68	6.95
	Ford Truck Service Specifications	7202T-68	1.50
1968	Truck Shop Manual (3 Volumes)†	7099-68	8.95

ORDERING INFORMATION

PLEASE PRINT CLEARLY

SEND TO: Ford Service Publications
P.O. Box 7750, Detroit, Michigan 48207

YEAR	PUBLICATIONS WANTED: DESCRIPTION	FORM NO.	PRICE	QUANTITY	AMOUNT

NOTE: Purchasers outside Domestic U.S.A. add 30¢ to EACH Publication, payable in U.S. Currency. Allow up to 4 weeks for Postal Service. For further information phone (313) 871-6606.

TOTAL ORDER:

Michigan Residents Sales Tax:

GRAND TOTAL:

Prices subject to change without notice. Michigan Purchasers add 4% Sales Tax.

Name of Purchaser _____ Street Address _____
City _____ State _____ Zip _____

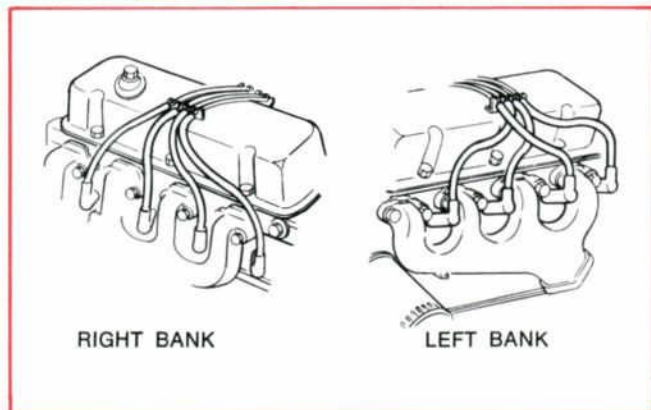
WE MUST HAVE YOUR ZIP CODE

SPARK PLUG WIRE ROUTING, 1971 ECONOLINE, 302 CID ENGINE

Because there is little clearance between the engine and the "dog house" covering the engine, the spark plug wires may be pressed down against the exhaust manifold. Before closing the "dog house" after any service work is performed, double check to see that the wires:

- (1) are routed properly as shown
- (2) the "dog house" is positioned carefully

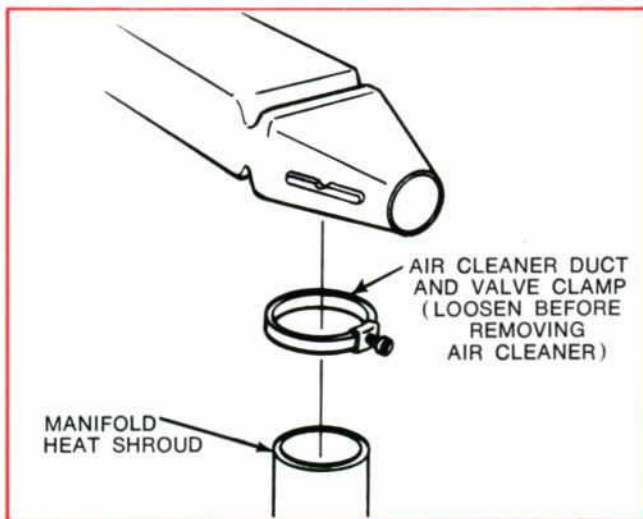
Failure to observe these precautions may damage the high tension plug wires and cause poor engine operation.



PINTO AIR CLEANER DAMAGE DURING REMOVAL—1971 PINTO

Damage may occur to the temperature operated duct and valve assembly when the *clamp is not loosened from the heat shroud before removing this unit.*

It is very important to back-off the clamp screw to prevent damage to the plastic air cleaner.



REVISED TIMING SPECIFICATIONS

302 CID and 401 CID Engines built after January 1, 1971

There has been a change from early service publications regarding the timing specifications. To fully comply with the 1971 Government regulations for exhaust emission certification of the 302 and 401 CID engines used in Econoline and Club Wagon over 6000 LBS. GVW and L & C 900 SERIES Heavy Duty Trucks, a revision in ignition timing must be made. Please make these changes in the service publications you have or are now using:

Econoline and Club Wagon (Over 6000 lbs. GVW)—302 CID Engine: Revise to 4° BTC—was 6° BTC

L & C 900 SERIES Heavy Duty Trucks—401 CID Engine: Revise to 7° BTC—was 8° BTC

AIR CLEANER ELEMENT REPLACEMENT INTERVAL

All Ford-built passenger car 4 and 6 cylinder engines

The service replacement interval for the air cleaner element on all 4 and 6 cylinder engines in passenger cars should be 24,000 miles rather than the 12,000 miles previously recommended or formerly published.

REVISION TO FORD-BUILT AUTOMATIC TRANSMISSION ON "DRY" REFILL INSTRUCTIONS

Instructions for automatic transmission fluid refill as outlined in Ford vehicle Shop Manuals and other applicable Ford service literature as well as *Shop Tips*, February 1971 issue (bottom of page 7) are revised as follows:

When refilling a "dry" transmission and the converter, install the following quantities of fluid before starting the engine.

- 8 qts. fluid Type F C6 . . . FMX MX Transmissions
- 5 qts. fluid Type F C4 . . . Transmissions

Be sure to shift the transmission selector lever slowly through all ranges after running the engine for a few moments.

Partial refill instructions . . . that is, when the converter is not drained . . . remain unchanged. Be sure to check the fluid level on the transmission dipstick and if necessary, add only enough fluid to bring the fluid level between the Add and Full markings.

PINTO REAR AXLE RATIOS 1971 AVAILABILITY

Ford Service engineering reports that Pinto rear axle ratios are as listed below. This information supersedes any previous listing:

CODE:			
YEAR	REGULAR AXLE	TAG	RATIO
1971	*7	**WDV-R	3.18:1
1971	*G	**WDV-T	3.55:1
1971	*H	—	3.82:1

No locking type of rear axle is available for the 1971 Pinto

*Listed on vehicle certification label

**Tag attached to one of the rear cover-to-housing bolts.

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DISC or DRUM...We have the brake parts for that original equipment performance!

Ford parts are manufactured to the same degree of high quality as factory-installed parts. Ford brake parts for example—they're built to last longer. Materials for brake linings are specially engineered to dissipate heat fast and resist brake fade. Of course, this quality often does not reveal itself until a driver is involved in a panic stop situation and the performance of the braking system means the difference between a safe stop and a collision. Thorough checks of brake systems on cars in for service often reveal the need for repairs or replacements. Do the job right and install Ford parts in Ford vehicles. We can supply you with the *right* brake parts and also serve all your other Ford parts requirements.

**Call us today...
we're headquarters
for all Ford and
Autolite Parts!**

