

SHOP TIPS

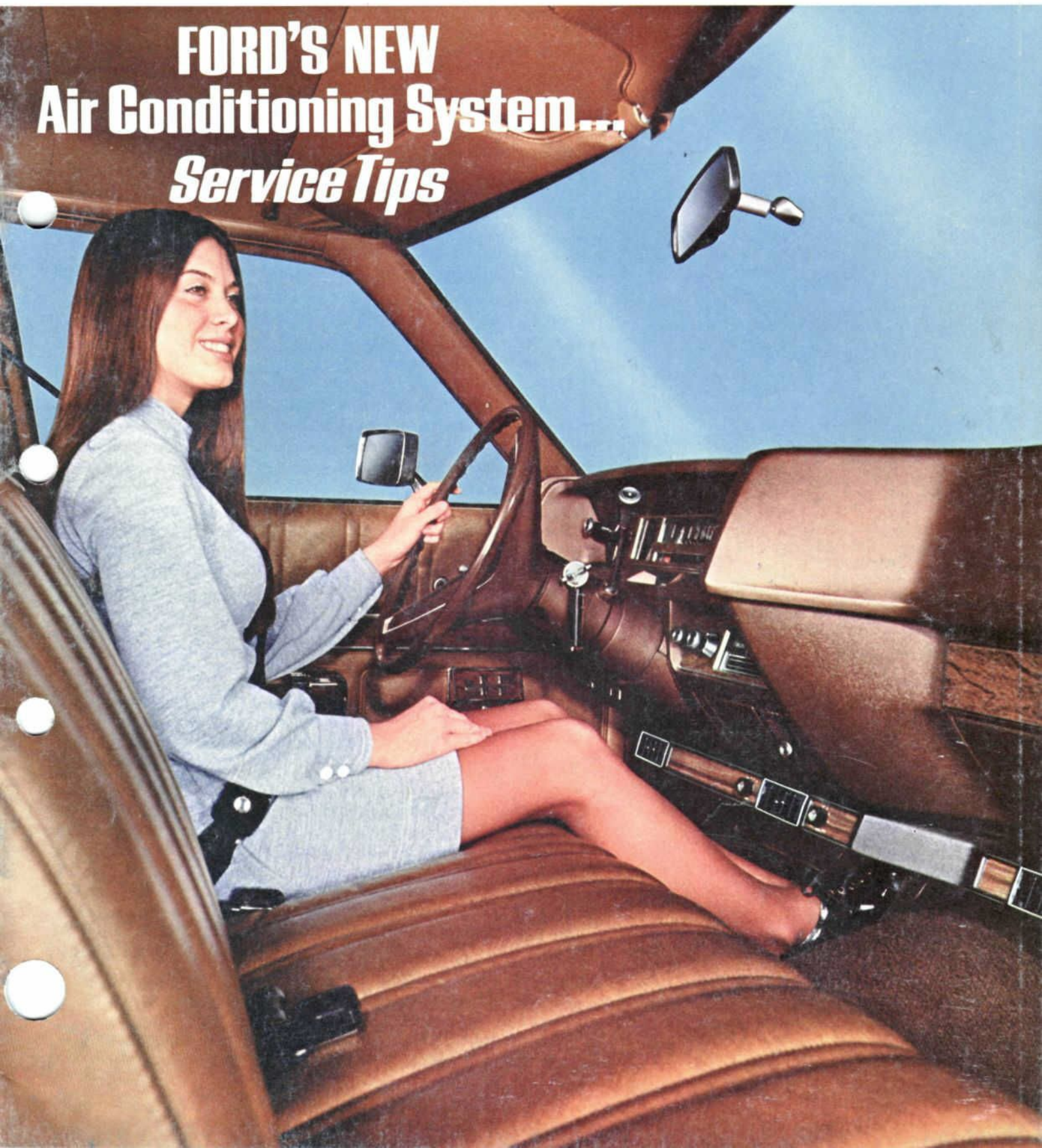
Motorcraft



VOL. 10, NO. 9

MAY, 1972

FORD'S NEW Air Conditioning System... *Service Tips*



FORD'S NEW AIR CONDITIONING

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

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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: 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 Ford Parts Division and the Ford Customer Service Division of the Ford Marketing Corporation, 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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THERE'S A LOT OF AIR OUT THERE

In the past seven years, the number of passenger cars equipped with Air Conditioning systems has mushroomed at a phenomenal rate. For example . . . 1965 industry figures reveal there were 6.8 million (U. S.) registered vehicles with "factory air" and 1.5 million with the "hang-on" type of units.

But, in 1970 . . . car models on the road with factory installed A/C totaled a whopping 21.7 million plus an added 4.3 million with the hang-on type of A/C unit.

Predictions based on solid evidence show that the trend toward A/C in all vehicles is growing by leaps and bounds. Some industry spokesmen say that by 1975 there will be a little over 49,000,000 cars on the road equipped with an air conditioner. Roughly . . . 43 million with factory installed air and 6.1 million with the hang-on type.

That's a whole lot of service business and a whale of a lot of parts that will be needed, plus a staggering amount of Refrigerant-12. When we speak of service on A/C units, we're referring to the fact that air conditioning systems require a periodic maintenance check at least once each year. This includes checking for Refrigerant-12 leakage . . . checking the magnetic clutch action . . . checking compressor drive belt tension . . . cleaning out any leaves, dust and debris from the fins of the condenser . . . checking hose condition and clamp tightness . . . checking compressor mounting and brackets.

You can get a fair share of this enormous service potential by aggressively getting into A/C service and/or installation field. But only if you decide to do so . . . NOW.

MAKING MONEY OUT OF AIR

Cool air is "hot" business. How hot it gets for your service outlet depends to a great extent on *YOU*.

There are a number of choices available.

Some service stations and independent garages merely replace Refrigerant-12 in owner's A/C systems. Other outlets get into it in greater depth by offering compressor and clutch service as well, while a growing number are getting into it all the way by servicing the new climate controlled year-round combination A/C and Heater. And there is one additional choice. That is . . . getting into the installation of the "hang-on" type of A/C unit on new and used cars.

Ford offers Custom A/C units of the "hang-on" type that are hand-somely styled to complement the interiors of all Ford and Lincoln-Mercury Division passenger cars (except luxury cars), including the light truck lineup. They're ideally suited and priced for economy minded drivers.

Regardless of the depth you intend to get into this ever expanding market, there's no doubt that A/C service and/or installation of such units is **BIG BUSINESS . . . CLEAN BUSINESS . . . PROFITABLE BUSINESS.**

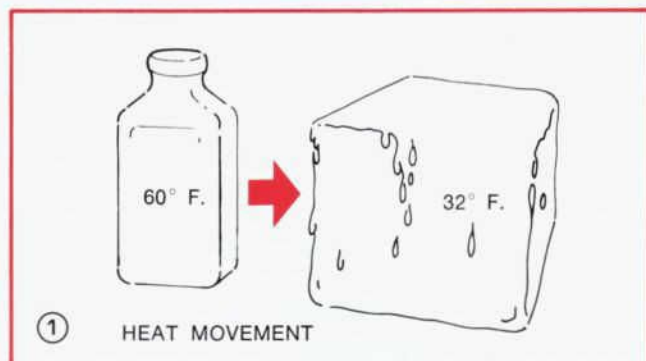
SYSTEM...SERVICE TIPS

REVIEW OF BASIC REFRIGERATION PRINCIPLES... LAWS OF NATURE

Car Air Conditioning is the cooling or refrigeration of the air in the passenger compartment. Refrigeration is accomplished by making practical use of *THREE* laws of nature. These laws of nature and their practical application are discussed in the following paragraphs.

LAW 1—HEAT TRANSFER

IF TWO SUBSTANCES OF DIFFERENT TEMPERATURE ARE PLACED NEAR EACH OTHER, THE HEAT IN THE WARMER SUBSTANCE WILL ALWAYS TRAVEL TO THE COLDER SUBSTANCE UNTIL BOTH ARE OF EQUAL TEMPERATURE. For example, a cake of ice in an ice box does not communicate its coldness to the bottle of milk standing nearby. Rather, in obedience to nature's law, the heat in the warm milk automatically flows into the ice which has a lesser degree of heat. See 1.



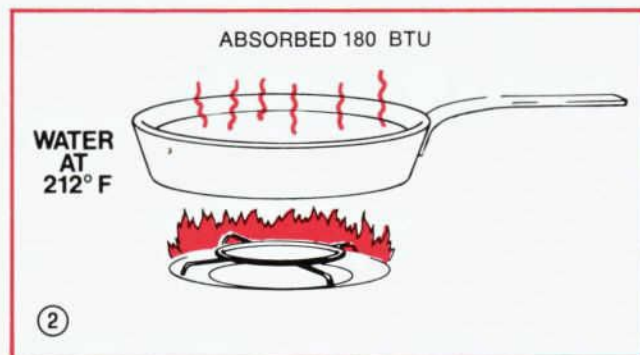
In order to determine the amount of heat that transfers from one substance to another, science has established a definite standard of measurement called the British Thermal Unit or BTU. One BTU is the amount of heat required to raise the temperature of one pound of water 1 degree F. For example, to raise the temperature of one pound of water from 32 degrees F. to 212 degrees F., one BTU of heat must be added for each degree rise in temperature or a total of 180 BTU's of heat.

And, in order to lower the temperature of one pound of water from 212 degrees F. to 32 degrees F., 180 BTU's of heat must be removed from the water.

LAW 2—LATENT HEAT OF VAPORIZATION

WHEN A LIQUID BOILS (CHANGES TO A GAS) IT ABSORBS HEAT WITHOUT RAISING THE TEMPERATURE OF THE RESULTING GAS. WHEN THE GAS CONDENSES (CHANGES BACK TO A LIQUID), IT GIVES OFF HEAT WITHOUT LOWERING THE TEMPERATURE OF THE RESULTING LIQUID.

For example, place one pound of water at 32 degrees F. in a container over a flame. With each BTU of heat that the



water absorbs from the flame, its temperature rises 1 degree F. Thus, after it has absorbed 180 BTU's of heat, the water reaches a temperature of 212 degrees F. See 2.

Here the law of nature is encountered.

Even though the flame continues to give its heat to the water, the temperature of the water remains at 212 degrees F. The water, however, starts to boil or change from the liquid to the gaseous state, and it continues to boil until the water has passed off into the atmosphere as vapor.

If this vapor were collected in a container and checked with a thermometer, it also would show a temperature of 212 degrees F.

In other words, there was a rise of only 180 degrees F. (from 32 to 212) in the water and vapor temperature even though the flame applied many more than 180 BTU's of heat.

In this case, the heat is absorbed by the liquid in the process of boiling and disappears in the vapor. If the vapor were brought in contact with cool air, the hidden heat would reappear and flow into the cooler air as the vapor condensed back to water. Scientists refer to this natural law as the latent (hidden) heat of vaporization.

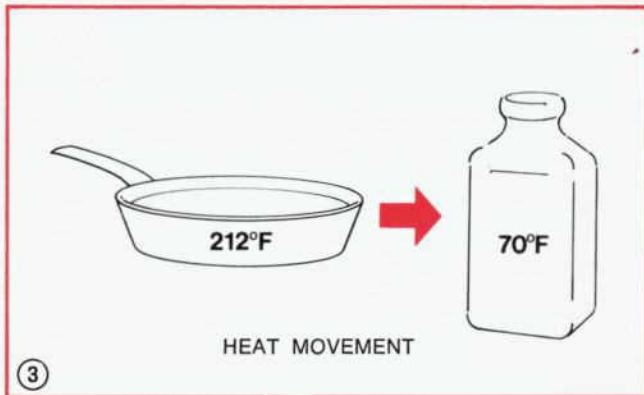
Water has a latent heat of vaporization of 970 BTU's and a boiling point of 212 degrees F. This means that 1 pound of water at 212 degrees F. will absorb 970 BTU's of heat in changing to vapor at 212 degrees F. The opposite effect is that the vapor will give off 970 BTU's of heat in condensing back to water at 212 degrees F.

This tremendous heat transfer, that occurs when a liquid boils or a vapor condenses, forms the basic principle of all conventional refrigeration systems.

For a liquid to be a good refrigerant, the amount of heat that it absorbs when vaporizing is not the only factor. It must also have a low boiling point. That is, the temperature at which it boils must be lower than the substance to be cooled.

To illustrate with water, place a bottle of milk at room temperature (70 degrees F.) next to boiling water (212 degrees F.). See 3. The heat would flow from the (higher temperature) water to the (lower temperature) milk. The milk would be heated rather than cooled, because the boiling point of water is too high.

FORD'S NEW AIR CONDITIONING



In order to make practical use of the heat transfer that takes place when a liquid boils, we must choose a liquid with a low boiling point. Refrigerant-12 is the liquid with a low boiling point. Refrigerant-12 is the liquid most commonly used in automotive air conditioning systems because it boils at 21.7 F. below zero at atmospheric pressure. At elevated pressures, R-12 boils at a higher temperature. Here is a liquid that boils or vaporizes well below passenger compartment temperatures and, in vaporizing, will absorb tremendous amounts of heat without getting any warmer itself.

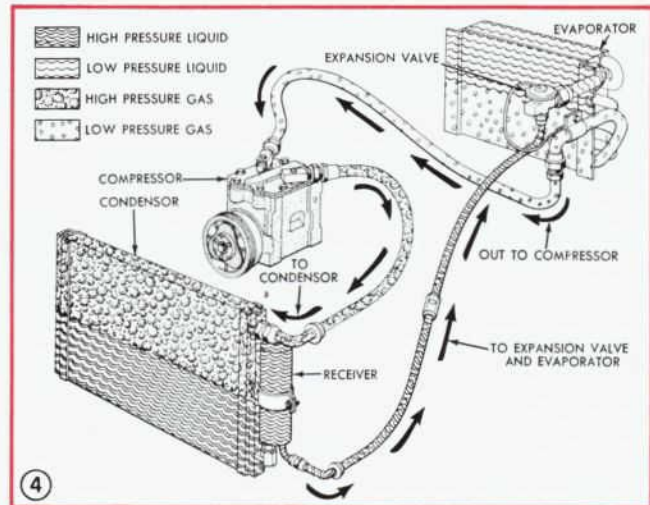
LAW 3—EFFECT OF PRESSURE ON BOILING OR CONDENSATION

THE TEMPERATURE OF A LIQUID OR VAPOR INCREASES OR DECREASES ACCORDING TO THE PRESSURE EXERTED ON IT.

In any Ford air conditioning system, liquid refrigerant (R-12) is filtered through the receiver under high pressure. See 4. When the liquid R-12 is released into the evaporator by the expansion valve the resulting decrease in pressure lowers its temperature (usually to about 32 degrees F. which is its boiling point at 30 psig. As the R-12 flows through the evaporator coils, passenger compartment or outside air passes over the outer surface of the coils. As it boils, the R-12 absorbs heat from the air and thus cools the passenger compartment air. The heat from the passenger compartment is absorbed by the boiling refrigerant. The refrigeration cycle is now under way. To complete the cycle, the following remains to be done:

- (1) Dispose of the heat in the vapor.
- (2) Convert the vapor back to liquid for re-use.
- (3) Return the liquid to the starting point in the refrigeration cycle.

The compressor (see 4), pumps the refrigerant out of the evaporator and forces it under high pressure into the condenser which is located in the outside air stream at the front of the car. The increased pressure in the condenser raises the R-12 vapor temperature to a point higher than that of the outside air. As the heat transfers from the hot vapor to the cooler air, the R-12 condenses back to a liquid. The liquid under high pressure now returns to the receiver-dryer where it is once again filtered.



HEAT AND COOLING

It may seem difficult to understand how heat can be transferred from a comparatively cooler car passenger compartment to the hot outside air. The answer lies in the difference between the refrigerant pressure that exists in the evaporator and the pressure that exists in the condenser.

In the evaporator, the expansion valve meters the refrigerant flow and thereby reduces the pressure and boiling point below the temperature of the air. Thus, heat transfers from the passenger compartment air to the boiling refrigerant.

In the condenser, the compressor raises the condensation point above the temperature of the outside air. Thus, the heat transfers from the condensing refrigerant to the outside air. The expansion valve and the compressor simply create pressure conditions that permit the laws of nature to function.

1972 FORD MOTOR COMPANY REFRIGERANT SYSTEM CHANGES

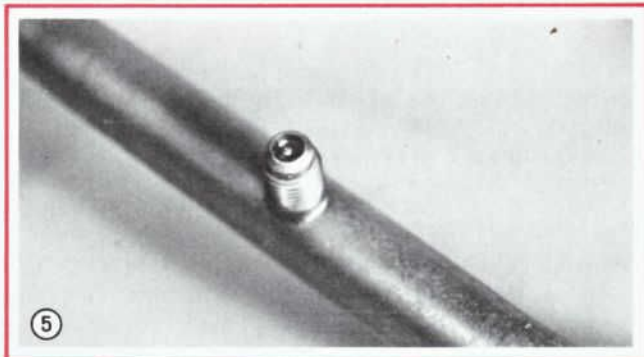
Some extensive changes have been made in a number of Ford Motor Company passenger car models for 1972. One of these is the method by which the system is evacuated and charged because of the removal of the service valves.

SCHRADER CHARGING VALVES

This valve is not new to the refrigeration field. For many years now, it's been known as a Schrader Valve. You'll find this type of service valve (see 5 and 6), on 1971 Lincoln models and on 1972 Lincoln-Continental, Continental Mark IV, Torino and Montego models, both the manual and the automatic temperature controlled systems. 1972½ Ford, Mercury and Meteor models also have this Schrader valve.

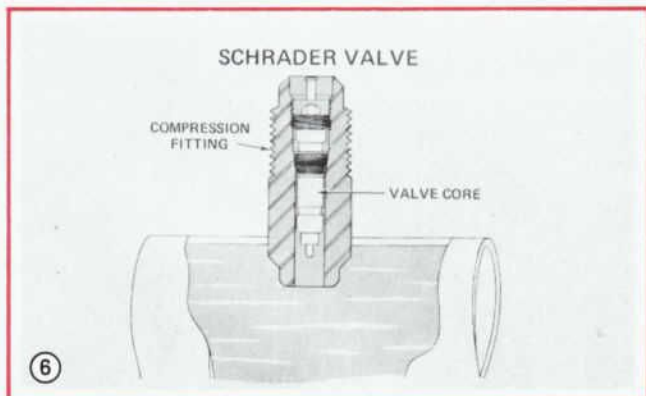
NOTE. The *heating, ventilating, Air Conditioning and Automatic Temperature Control* systems for FORD, METEOR and MERCURY passenger car models are carryover from the 1971 model year.

SYSTEM...SERVICE TIPS Continued

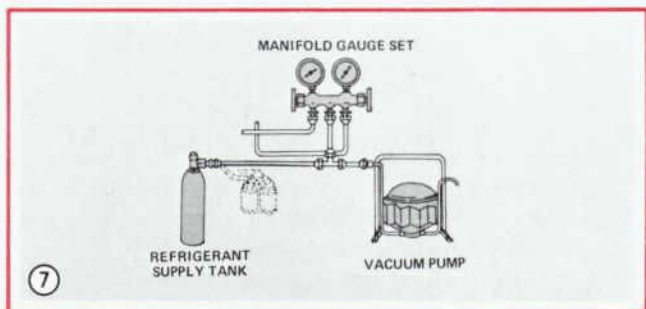


This type service valve is actually a compression fitting (see 6), with a "tire valve type" valve core that seals the center opening. It permits a direct reading of the suction and discharge lines without having to manually front seat or back seat a valve.

The Schrader valve in the high pressure line (from compressor to condenser) allows access to the high pressure side of the system for attaching a service hose and pressure gauge. The Schrader valve in the low pressure line (from evaporator to condenser) allows access to the low pressure side of the system for attaching a service hose and pressure gauge.



When servicing a system with Schrader valves, the discharging, evacuation and charging operations will still be controlled by the valves on the manifold gauge set, the vacuum pump and the refrigerant supply tank. See 7.



An important point to remember about Schrader valves is that you can't isolate the compressor. The system will have to be discharged before an oil level check can be made, and before removing the compressor. See 8.



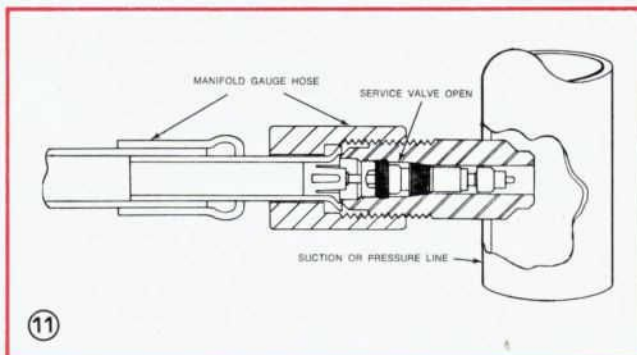
The manifold gauge set suction and discharge hoses must have pins (see 9) in the center of their connectors, to push the valve stems back and open the valves. If the connectors in your set do not have these pins, connect some adapters to the ends of the hoses.



You may also have to install pulsation restrictors (see 10), in the base of your pressure gauges. The restrictors will steady your gauge readings, making diagnosis more accurate.



Here is a cross-section view (see 11), of a Schrader type charging valve connected to a manifold gauge set hose. Note that the pin in the center of the hose connector has lifted the Schrader charging valve pin off its seat and opened the system for taking a gauge reading.



FORD'S NEW AIR CONDITIONING

EXPANSION VALVE AND SUCTION THROTTLING VALVE

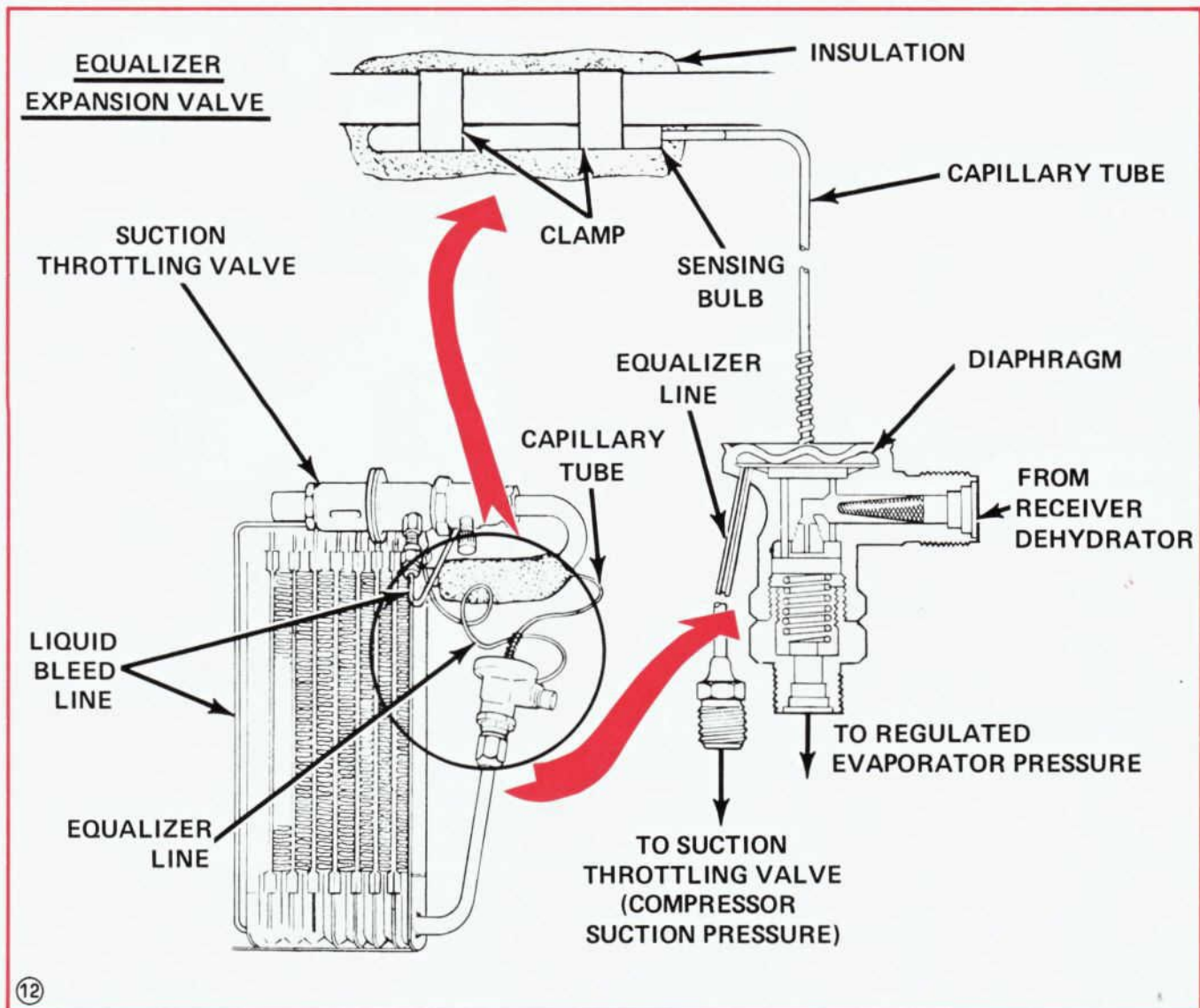
The rate of R-12 evaporation is controlled by an expansion valve which meters the liquid refrigerant into the evaporator thus reducing the pressure. The valve also meters just enough refrigerant into the evaporator to meet all cooling requirements within the design limits of the system.

The expansion valve is opened and closed by opposing pressures on either side of the diaphragm (see 12). The temperature sensing bulb, which is clamped to the evaporator outlet pipe, contains liquid R-12. As evaporator outlet temperature rises, the R-12 expands and exerts pressure against the diaphragm to open the valve further and admit more refrigerant into the evaporator for increased cooling. As evaporator outlet temperature falls, the R-12 in the bulb contracts decreasing the pressure against the diaphragm. This permits the inlet pressure on the opposite side of the diaphragm to start closing

the valve. The cycle is repeated over and over again. The practical result is that the expansion valve is never completely closed when the system is in operation.

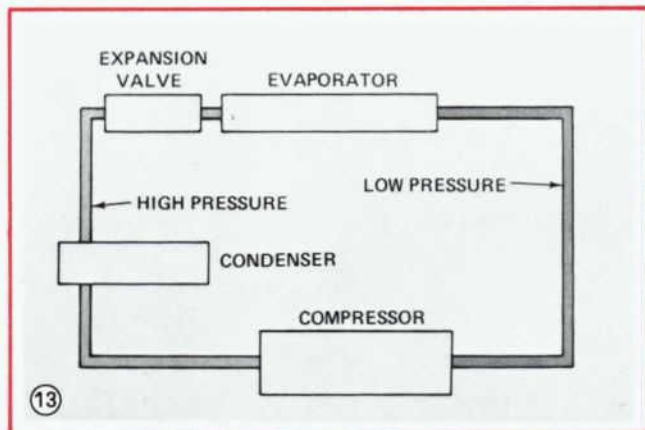
The suction throttling valve performs the same function as that performed by the thermostatic (de-icing) switch in the other car lines. Since pressure affects temperature, the main function of the valve is to maintain the refrigerant gas in the evaporator at a pressure which will maintain the temperature of the evaporator core surface above 32 degrees F. This will prevent evaporator icing.

To make the expansion valve work effectively in conjunction with the suction throttling valve, an equalizer line is connected between the suction side of the suction throttling valve and the expansion valve diaphragm. See 12.

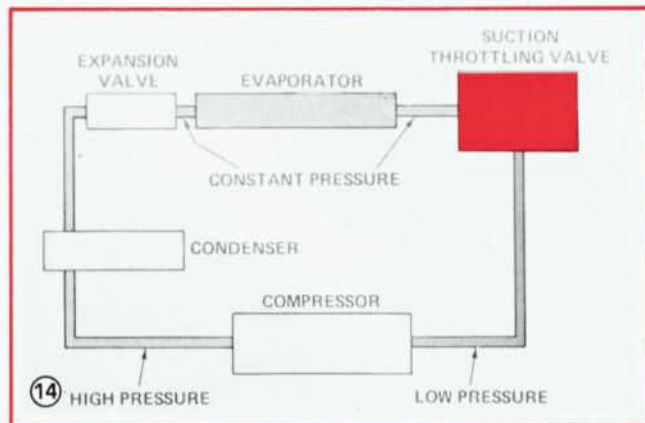


HOW THE STV AND EQUALIZER LINE FUNCTION

In a conventional refrigerant system (using only an expansion valve), two pressures are used; high pressure on the discharge side of the compressor and low pressure on the suction side. See 13. A thermostatic or de-icing switch in the evaporator automatically cuts out the compressor when the evaporator fins begin to ice up.



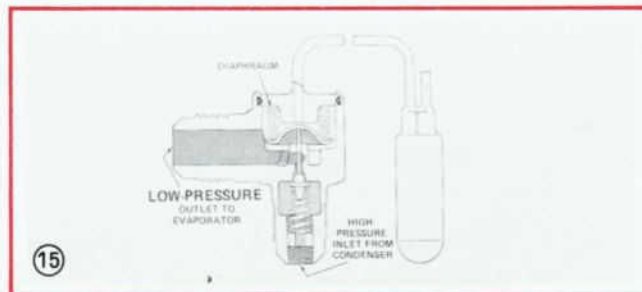
In the revised system (see 14), three pressures are used; the additional pressure being a constant pressure between the expansion valve and the suction throttling valve.



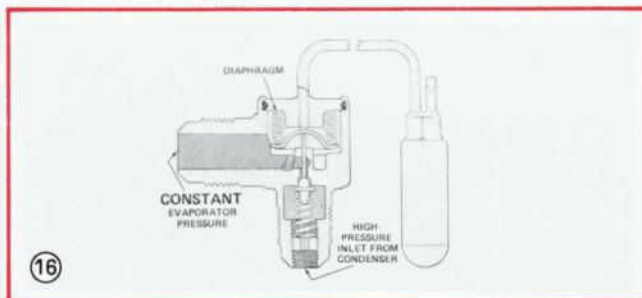
This suction throttling valve provides the constant pressure of about 30 pounds in the evaporator to keep the evaporator fins as cold as possible without allowing them to ice up. This allows us to do two additional things in this new type of A/C system.

No longer is an icing switch used, therefore the compressor runs in all modes when the ambient temperature is above 40 degrees F. (except on the *Vent* or *Off* positions). Running the compressor all the time of course reduces wear and tear on the compressor clutch and drive belt because they no longer have to cut-in at high engine speeds.

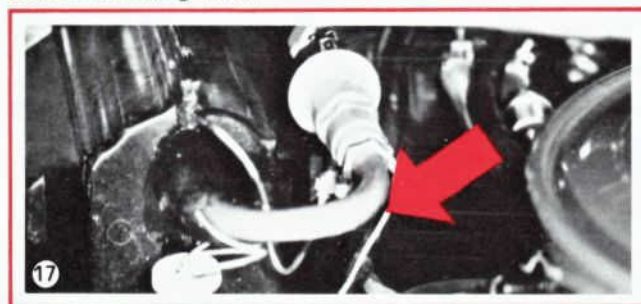
In the past, Ford Motor Company passenger cars had the diaphragm of the expansion valve connected directly to the evaporator. Evaporator pressure, for all practical purposes, was equal to the pressure on the suction side of the compressor. See 15. This aided in opening and closing the valve.



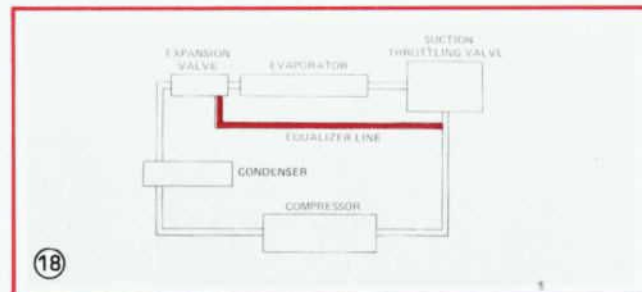
In the modified system as shown in 16, the evaporator is at a constant pressure; a pressure that won't help as much in opening and closing the valve. Thus, to make the expansion valve open completely and return oil from the evaporator, an equalizer line has been added between the STV and the expansion valve diaphragm.



Shown in 17, is a view of the equalizer line installed on a car. It's connected between the expansion valve and the suction throttling valve.



With the equalizer line connected as shown in 18, the expansion valve will function differently than it did in past models. When the pressure difference between the evaporator and suction sides of the compressor is large, the expansion valve opens, allowing more R-12 to flow. When the difference is small, the valve closes.

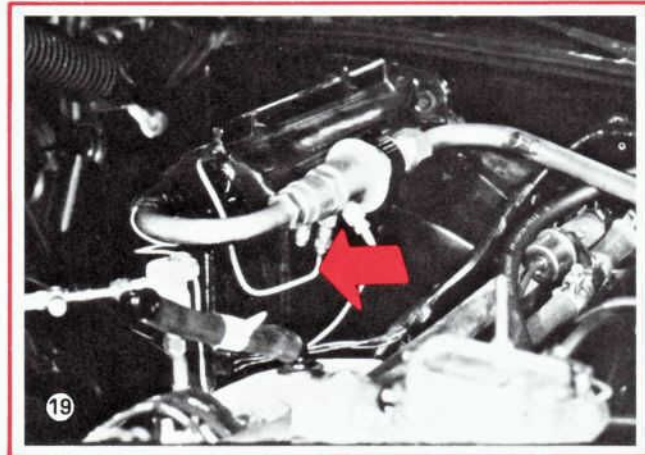


FORD'S NEW AIR CONDITIONING SYSTEM... SERVICE TIPS *Continued*

LIQUID BLEED LINE

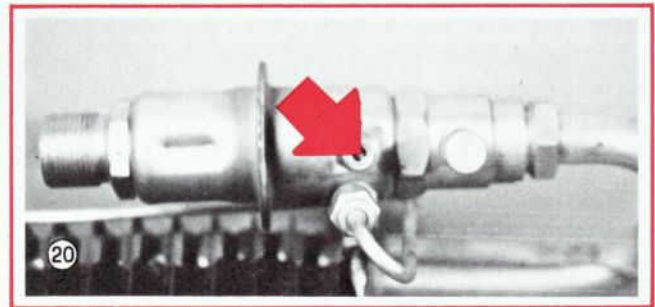
Also connected to the suction throttling valve, near the equalizer line connector, is a liquid bleed line. See 19. It's connected to the suction side of the compressor too, but it has an entirely different purpose than the equalizer line.

The liquid bleed line uses a valve stem at the suction throttling valve that looks a lot like the Schrader valve stem. Don't be misled! It's actually a specially calibrated pressure differential valve.



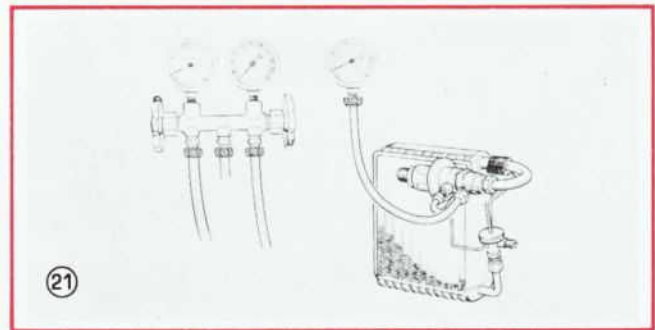
It starts to open when there's a small pressure difference between evaporator pressure and compressor suction pressure. If the pressure difference reaches twenty pounds (20 lbs.), the valve will be fully open. See 20.

The other end of the liquid bleed line is attached to a low point on the evaporator core. At this location, it will pick up a quantity of refrigerant oil and liquid refrigerant and return both to the compressor.



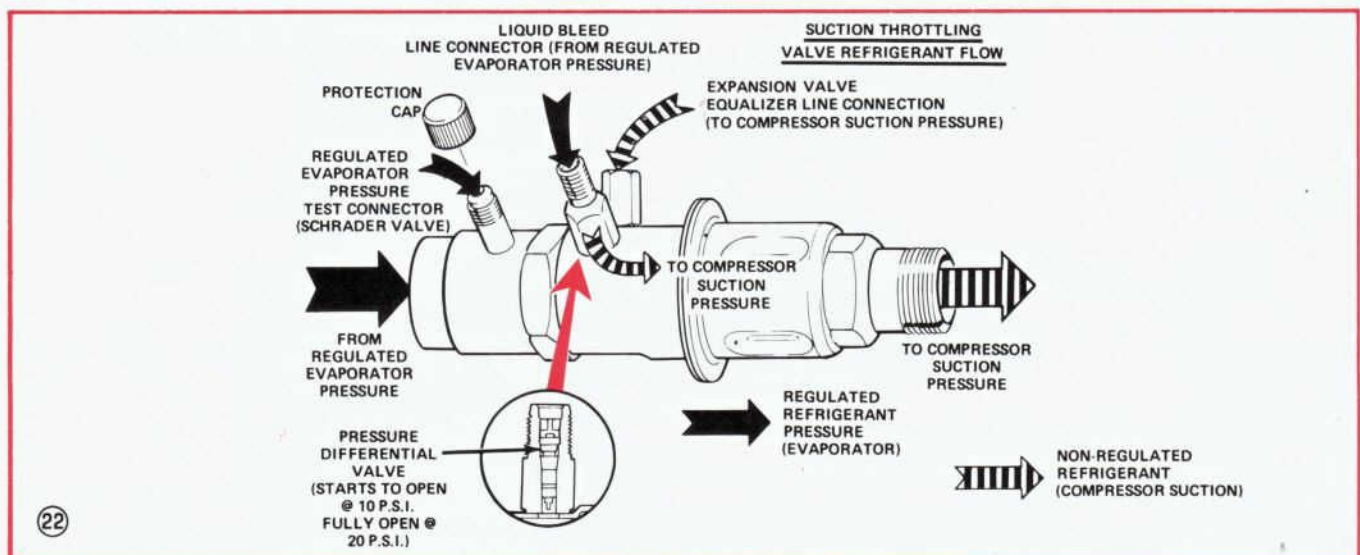
There is, however, a Schrader valve located on the side of the suction throttling valve. You can connect your low pressure gauge to it and check the constant pressure of the evaporator, as shown in 20.

Better yet, use a separate gauge. That way, by using the manifold gauge set and the extra gauge, you'll be able to check the whole system at the same time. See 21.



For a more complete understanding of the function of the Suction Throttling Valve, take a few moments to study the STV flow chart (22) below. Note that in the fitting of the liquid bleed line there is a pressure differential valve.

REFRIGERATION FLOW WITH THE SUCTION THROTTLING VALVE



seasons have changed ...cooling systems are ready for a Spring Tune-up!

Get ready for this Spring's profitable cooling system market!

During Winter, all parts of a cooling system undergo constant stress to deliver top-notch performance under varying driving conditions. You can cash in on the many opportunities this Spring to check and replace worn or deteriorating cooling system components at the same time you are providing other tune-up services for warm weather driving.

Be sure your customers are made aware of the importance of a cooling system "Spring Tune-up." Order your supply of Motorcraft V-Belts, Radiator Hose, Thermostats and Radiator Pressure Caps now. Get an extra bonus—Pacemaker Prize Points with your V-Belt and Hose purchases! Every Motorcraft V-Belt has a sleeve tear tab with an imprinted part number.

Both Flexible and Molded Radiator Hoses also have bonus hose label tear tabs with an imprinted part number on each. Ten of either of these tear tabs equal one Pacemaker Prize Point. Use them in any combination for your choice of Pacemaker merchandise and travel awards!

Motorcraft has everything you'll need. In addition to the popular, fast-moving items shown here, Motorcraft's complete line also includes Special Purpose Hose, Water Outlet Gaskets, Oil Breather Caps, Gas Caps and other parts required for "spring-into-summer" travel maintenance.

All Motorcraft products meet or exceed original equipment specifications to help assure complete customer satisfaction.



Motorcraft Molded Radiator Hose

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- Extra strong to resist buckling and reduce strain at connections



Motorcraft Flexible Radiator Hose

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- High-flow nozzle for full flow of coolant to engine
- Also available—Air Bellows Thermostats for air-cooled engines and Heavy-Duty Thermostats



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- Premium-quality Neoprene body with high-strength Polyester cords
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- Stretch resistant to give full power delivery
- Built to original equipment specifications



Motorcraft Radiator Caps

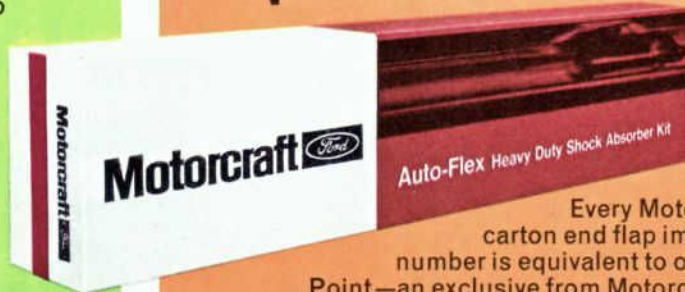
- Safety Lever Vent Cap releases pressure safely
- Synthetic rubber heavy-duty sealing gasket withstands high temperatures; coolant chemicals
- Zinc plated cold-rolled steel to prevent rust
- Pressure rating embossed on cap

Motorcraft cooling system parts are available at our Parts Counter now!

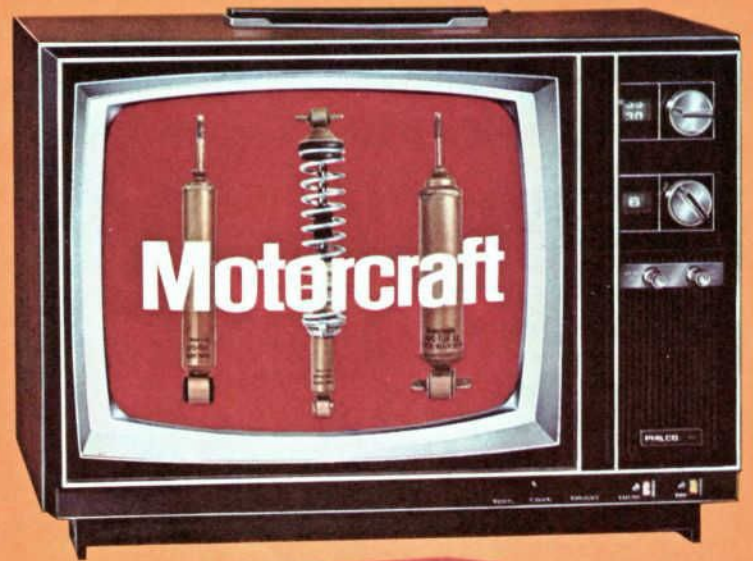
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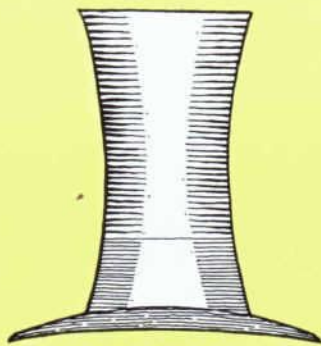


Four solid reasons to join the Motorcraft Service Center Program. Together they provide an exceptional opportunity to increase parts sales, assure quality service, and improve efficiency. And, you get the entire package simply by purchasing \$400 worth of Motorcraft/Autolite Parts at stocking dealer prices (for the Service Control Center Package) or \$200 at stocking dealer prices (for the Merchandiser Package). We think it's a value you can't afford to miss. To date, over 40,000 retailers have thought so, too!

FOR DETAILS ABOUT OUR OFFER...ASK AT OUR PARTS COUNTER

FIX TIP

When you're faced with the tough job of installing a new bypass hose for the cooling system on Ford engines with a front mounted distributor, you may think it is necessary to remove the water pump to get the job done. Here's a quick and sure way to do it without pulling the pump. Cut a 2¼-inch long section of ½-inch I.D. heater hose. Bend it end for end in a vise and wire it snug to hold it doubled. Place this bent hose on the bypass tubes then apply hand pressure on the folded section. As you're doing this, cut the wire and the hose will almost jump into place.

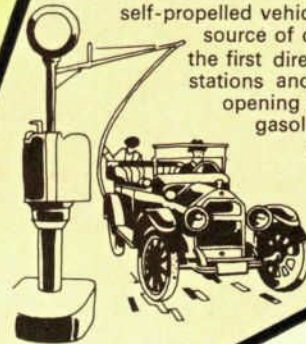


FACT OR FICTION

Here we have "Abe Lincoln's" old hat. The question is this: How much taller is the crown of the hat than the width of the brim? Answer on this page.

Motor Milestones

Spindletop . . . one of the nation's most spectacular and historic oil wells . . . came gushing from the Texas ground near Beaumont in 1901. This event tipped the source of automotive power away from steam and electricity, and made the gasoline-powered engine the front runner in the quest for self-propelled vehicles. The new source of oil helped establish the first direct-service gasoline stations and also triggered the opening of at least 190,000 gasoline service stations across the country.



THINGS YOU NEVER THOUGHT ABOUT

... and could easily forget
The strength of the adhesive on the antennae of a barnacle is stronger than any known adhesive . . . but it exists in such small quantities that scientists can't collect enough of the substance to test and reproduce it commercially.

DWELL POINTS

notes and quotes for the service world

OLD FRIENDS

The Ford Motor Company and the remanufacturing industry have been friends for a long time. In fact, Henry Ford established the first automotive remanufacturing program back in 1932.

Ford engines were remanufactured at the Rouge Plant in Dearborn, Michigan (just outside of Detroit) and Ford became the first vehicle for which a less expensive but totally acceptable replacement engine was made available.

NO PART-TIME JOB!

Water pumps for the cooling system of cars and trucks work every minute of engine operating time. And generally, they rotate faster than engine rpm. In doing so, they must prevent leakage of coolant . . . must run quietly . . . rotate without vibration . . . and operate at peak efficiency. All this during cold or high engine temperatures.

Ford Authorized Remanufactured water pumps meet that challenge! They are dependable because seals, bearings and gaskets are 100% new. Older model cast iron impellers are now replaced with ceramic impeller seats to provide better seating and longer life. Recommend and install Ford Authorized Remanufactured water pumps. That is . . . when you want to be known as a *professional* in the service trade.



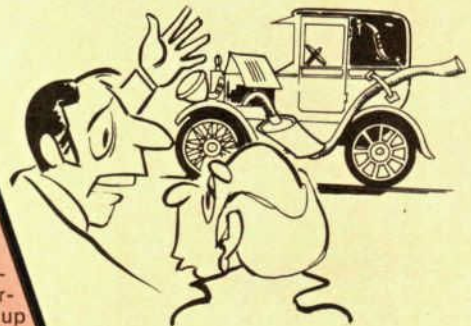
TAILOR EACH ENGINE JOB

Ford Authorized Remanufacturers have completely remanufactured **ROCKER ARM ASSEMBLIES** . . . **CRANKSHAFT ASSEMBLIES** . . . **SHORT BLOCKS** and of course **COMPLETE ENGINES** ■ Install only what you need ■ Each assembly is fully remanufactured to strict Ford Motor Company standards ■ Each assembly is warranted nationally. Read the warranty at the bottom of this page. It backs up the **QUALITY** built into our products. Quality you can count on.

We Stand Behind This All The Way!

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 4,000 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.

MECHANIC'S WORLD



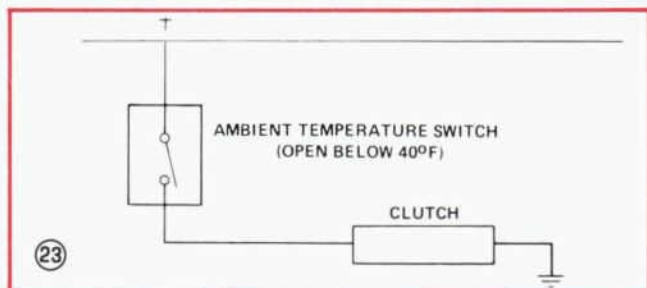
"There's one thing I'd like to know, Mr. Forfran, just how long have you been making these Do-It-Yourself repairs?"

The truth of the matter is that the crown is exactly as high as the brim is wide.

FORD'S NEW AIR CONDITIONING SYSTEM... SERVICE TIPS *Continued*

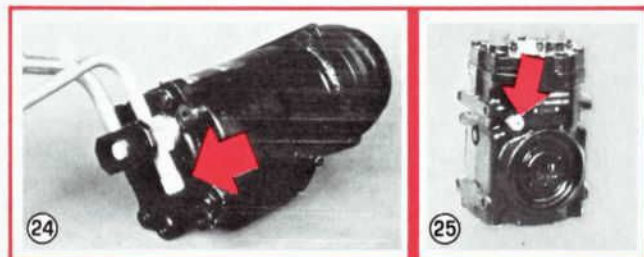
AMBIENT TEMPERATURE SWITCH

Now while the modified system doesn't use an icing switch, it does use an ambient temperature switch. See 23. The switch will open below temperatures of 40 degrees Fahrenheit and shut off the compressor. When the outside temperature rises to 55 degrees, the ambient switch closes engaging the clutch for normal A/C operation. This switch is located where it can sense the temperature of the incoming air into the A/C system.



HIGH PRESSURE RELIEF VALVE

The new six cylinder compressor requires the use of a high pressure relief valve in the discharge line. Under extreme heat conditions (pressures above 450 psig), the valve will open allowing refrigerant vapor to escape, preventing damage as a result of excessive pressure. See 24 for location.



This high pressure relief valve is also used on the two-cylinder compressor. It's mounted right on the compressor casting as shown in 25.

This high pressure relief valve can be replaced.

TESTING THE 1972 A/C SYSTEMS

CHECKING FOR LEAKS

Attach the manifold gauge set as shown in 26 or 27 depending on the type of compressor used in the system. Leave both manifold gauge valves at the maximum clockwise (closed) position. Both gauges should show approximately 60 to 80 pounds pressure at 75 degrees F. with the engine not running. If very little or no pressure is indicated, leave the vacuum pump valve closed, open the Refrigerant-12 tank valve, and set the low pressure (suction) manifold gauge valve to the counterclockwise position. This opens the system to tank pressure. Check all connections, and the compressor head gasket, oil filler plug, and shaft seal for leaks, using a flame-type leak detector.

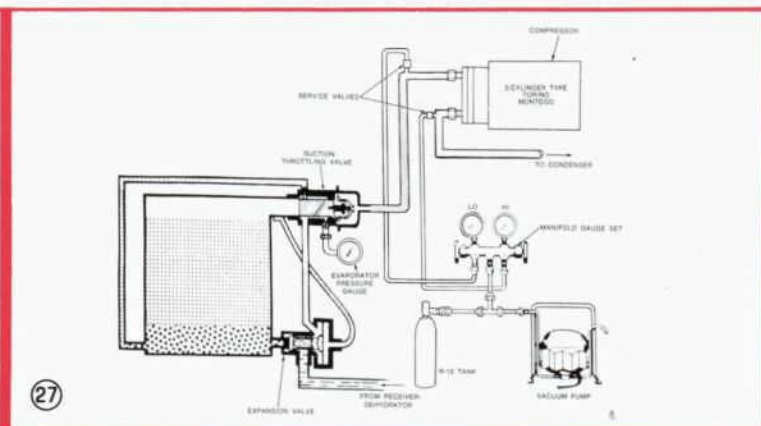
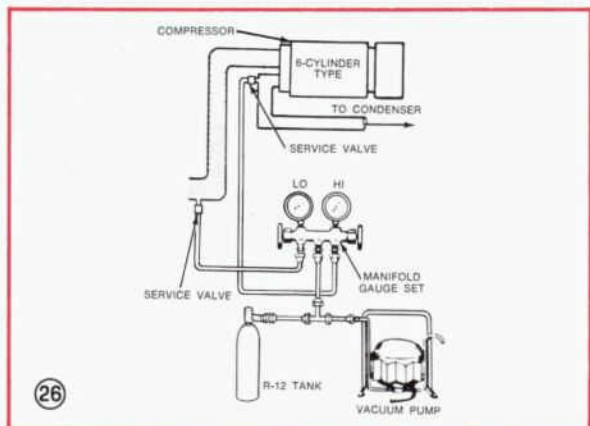
Follow the directions with the leak detector. If you have a flame-type leak detector, remember that the smaller the flame the more sensitive it is to leaks. Therefore, to insure accurate leak indication keep the flame as small as possible. The copper element must be red hot. If it is burned away, replace.

Hold the open end of the hose just below each suspected leak point for two or three seconds. The flame will normally be almost colorless. The slightest leak will be indicated by a bright green-blue color to the flame. Be sure to check the manifold gauge set and hoses for leaks as well as the rest of the system.

NOTE: Many A/C service technicians prefer the electronic-type leak detector. This type of "sniffer" is much more sensitive to extremely small leakage conditions of R-12 and can be used inside the passenger compartment near the evaporator area without fear of melting wiring or burning materials or paint.

NOTE: If the surrounding air is contaminated with refrigerant gas, the leak detector will indicate this gas all the time. Good ventilation is necessary to prevent this situation. A fan, even in a well ventilated area, is very helpful in removing small traces of refrigerant vapor.

TESTING—EVACUATING—CHARGING THE REFRIGERANT SYSTEM



FORD'S NEW AIR CONDITIONING

CHECKING SIGHT GLASS

The liquid sight glass is mounted in the high pressure refrigerant line between the receiver and the expansion valve.

Clean the sight glass before checking for a proper charge of refrigerant. Then, observe the sight glass for bubbles with the engine running at 1500 rpm and the A/C controls set at maximum cooling. Test at a high blower speed and lower compressor speed. A continuous or large amount of bubbles in the sight glass indicate an undercharge of refrigerant or the evaporator pressure is 30 psig and the suction throttling valve is controlling. If an undercharge of refrigerant is found, check the system for leaks. Repair any leaks, evacuate the system with a good vacuum pump, and charge the system with the proper amount of Refrigerant-12 by weight. Refer to the sticker located on the fan shroud and near the compressor.

While observing the sight glass, cycle the magnetic clutch off and on, with the engine running at 1500 rpm. If refrigerant is in the system, bubbles will appear while the clutch is being cycled on and off and disappear when the clutch is engaged. If no bubbles appear during the on and off cycle of the magnetic clutch, there is no refrigerant in the system. If there is no refrigerant in the system, it will be necessary to partially charge the system to make a leak test. Then, repair the system as required, and fully charge the system. *Under conditions of extremely high temperatures, occasional foam or bubbles may appear in the sight glass.*

ATTACHING THE MANIFOLD GAUGE SET

When performing any of the various tests, test equipment must be connected to the system. If a charging station type of equipment is used, follow the instructions of the manufacturer.

To attach a manifold gauge set to the A/C system proceed as follows:

1. Remove the caps from the high and low pressure charging (Schrader) valves in the high and low pressure lines at the compressor as shown in 26 or 27.
2. Turn both manifold gauge valves fully clockwise to close the gauge set to the center outlet hoses.
3. If the gauge hoses do not have the valve opening pins in them, install fitting adapters on the manifold gauge low and high pressure hoses.
4. Connect the high and low pressure gauge hoses with adapters, to the respective high and low pressure service valves at the compressor as illustrated in either 26 or 27.
5. Connect a separate pressure gauge to the evaporator gauge connection on the suction throttling valve.

SAFETY INFORMATION ON AIR CONDITIONING REFRIGERANT

REFRIGERANT-12 is a relatively safe refrigerant and is used in all Ford, Mercury and Lincoln air conditioning systems. It operates at low pressure and condenses easily in the temperature ranges found in automotive condensers. A list of advantages include these qualities:

- Odorless
- Colorless
- Tasteless
- Non-Corrosive
- Non-Toxic
- Non-Inflammable
- Has a high affinity for oil
- Has the ability to absorb great quantities of heat
- Readily changes state
- Low boiling point

However, Refrigerant-12 is used under pressure and its low boiling point (minus 21.7°F.) combined with its chemical change when exposed to flame requires certain handling precautions for personal safety.

NEVER TOUCH LIQUID ▪ Liquid Refrigerant-12 vaporizes so quickly and takes on so much latent heat in the process that even a drop on your skin will cause severe and painful frostbite. Therefore, open fittings carefully and slowly to release pressure inside the system.

If skin areas are exposed to Refrigerant-12, treat as you would for frostbite and consult a physician.

ALWAYS WEAR SAFETY GOGGLES ▪ When performing any type of service around an air conditioning system it is vital that you wear safety goggles. Liquid refrigerant in your eyes could cause blindness. If you should get any near your eyes, rinse them immediately with mineral oil to absorb the

refrigerant. Follow by flooding your eyes with clear water and contact a doctor immediately.

AVOID HEAT ▪ Store refrigerant containers upright out of the sun and away from building heat outlets. Pressure in a container will rise with heat.

Always discharge the refrigerant from the system if the car is going into a paint drying oven, or if welding or steam cleaning jobs are to be done near the system. Also, watch the temperature and pressure when testing the system. It may be necessary to direct the flow of air from a large fan through the front grille to avoid overheating.

It is common practice to put a refrigerant container (can or drum) in a pan of warm water to raise the pressure and thus speed up the charging operation . . . but never heat the containers with an open flame or exceed water temperature of 150°F. to make charging occur faster. *The pressure rise may happen so fast that the containers may explode.*

VENTILATION ▪ Proper ventilation in the area of air conditioning work is essential. Although R-12 is non-toxic, too much in a confined space can be suffocating as it doesn't contain the oxygen we need to breathe. Therefore, always discharge the refrigeration system into an exhaust fan or through an open window or doorway.

AVOID FLAME ▪ At all normal temperatures R-12 is non-toxic. But, in contact with an open flame, it forms phosgene gas, which can be extremely harmful. Never discharge a system near an open flame. When the flame type leak detector is used to check for leaks, never breathe the fumes.

PERFORMANCE TEST

The pressures developed on the high pressure (discharge) and low pressure (suction) side of the compressor indicate whether or not the system is operating properly.

Attach the manifold gauge set as described earlier. Set both manifold gauge valves at the maximum clockwise, or closed, position.

Check the system pressures with the engine running at 1500 rpm, all controls set for maximum cooling, and the front of the car at least 5 feet from any wall.

The actual pressure indicated on the gauges will depend on the temperature of the surrounding air and the humidity. Higher air temperatures, along with high humidity, will give higher system pressures.

At idle speed and a surrounding air temperature of 100-110 degrees F., the high pressure may go as high as 300 pounds or more. If it becomes necessary to operate the air conditioner under these conditions, keep the high pressure down with a fan directed at the condenser and radiator.

Correct pressures for a normal operating system are as follows: The *low pressure* (suction) gauge should indicate 4 to 25 psi, while the *high pressure* (discharge) gauge should indicate 120 to 170 psi.

Evaporator gauge (low pressure), readings require you to refer to the Pressure/Altitude Chart shown on this page.

SUCTION THROTTLING VALVE TEST

1. With the manifold gauge set connected into the system as described earlier, connect a separate pressure gauge to the evaporator gauge connection on the suction throttling valve. See 21 and 27.
2. Perform the air conditioner performance test as outlined earlier. Make any repairs indicated by the test.
3. After operating the system for 10 to 15 minutes, be sure that normal operating pressures are indicating on the manifold gauge set (low pressure gauge 4-25 psi and high pressure gauge 120-170 psi). Then check the reading on the evaporator gauge.
4. Any gauge used to check the evaporator pressure at the suction throttling valve will be affected by atmospheric pressure, whereas the pressure within the valve itself remains unaffected. To compensate for this, use of the pressure-altitude chart, see 28, will give the required gauge reading for correct evaporator pressure at a given altitude.
5. If there are indications of ice forming on the evaporator tube, replace the STV. Otherwise, check your gauges.

PRESSURE/ALTITUDE CORRECTION

The evaporator pressure gauge reading will vary, depending on your particular elevation above sea level. Be sure and check the elevation of your local area and then use the

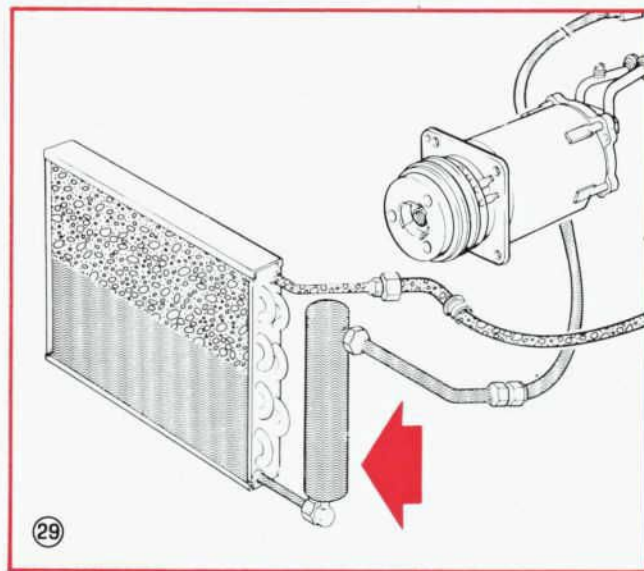
pressure-elevation chart. For example: With an elevation of ten feet above sea level, you can expect a constant evaporator pressure reading of about 28½ pounds. But, if your elevation is sixty-nine hundred and fifty feet your constant evaporator pressure should read a little less than 32 pounds. A low evaporator pressure reading of 28½ pounds in a high elevation area could very easily cause the evaporator to ice up.

SUCTION THROTTLE VALVE PRESSURE/ALTITUDE CHART

| ALTITUDE OF TEST SITE (FEET) | REQUIRED GAUGE READING ±1 psi |
|------------------------------|-------------------------------|
| 0 FEET (Sea Level) | 28.5 |
| 1000 FEET | 29.0 |
| 2000 FEET | 29.5 |
| 3000 FEET | 30.0 |
| 4000 FEET | 30.5 |
| 5000 FEET | 31.0 |
| 6000 FEET | 31.4 |
| 7000 FEET | 31.8 |
| 8000 FEET | 32.3 |
| 9000 FEET | 32.7 |
| 10,000 FEET | 33.2 |

RECEIVER-DRYER TEST

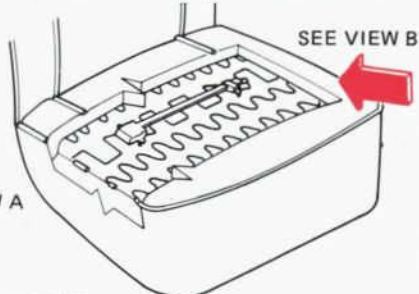
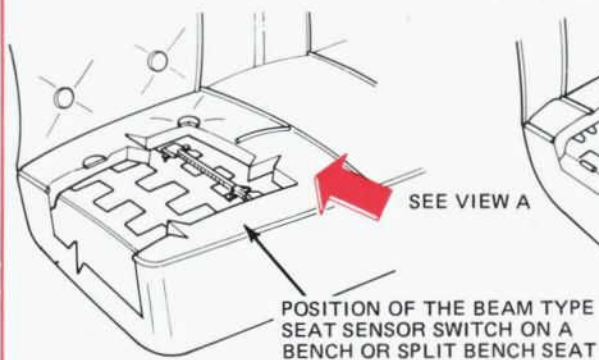
Operate the air conditioner for about five minutes; then, slowly move your hand across the length of the receiver-dryer from one end to the other. There should be no noticeable difference in temperature. If cold spots are felt, it indicates that the unit is restricting the refrigerant flow, and the receiver-dryer must be replaced. See 29.



MAGNETIC CLUTCH TEST

Disconnect the magnetic clutch wire at the bullet connector, and connect it to a suitable jumper lead. Touch the other end of the jumper lead to the battery positive terminal. The magnetic clutch should pull in with a distinct click. Repeat this check a few times to insure clutch action is correct.

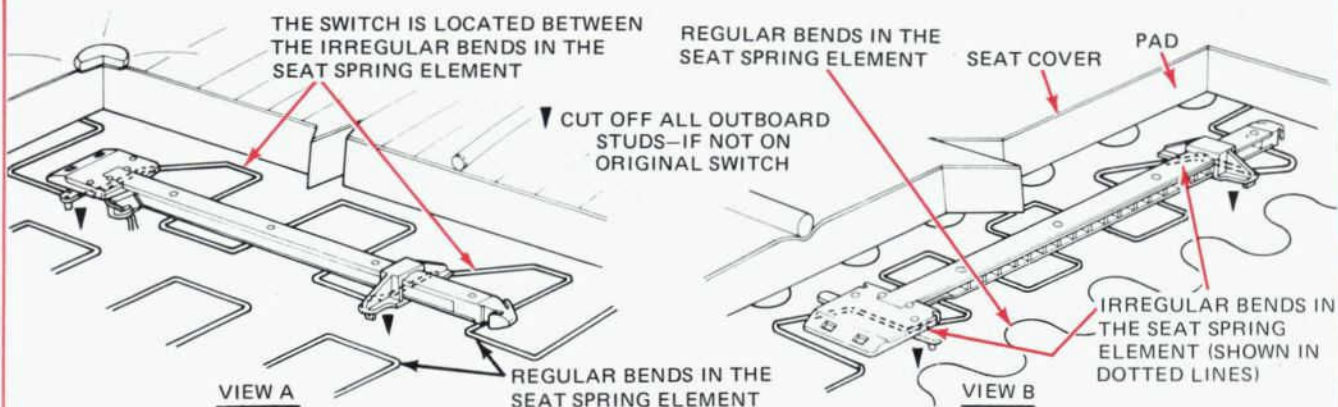
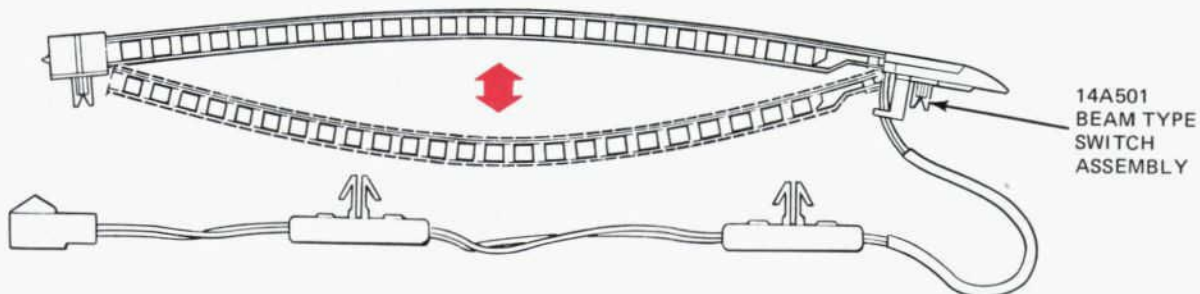
THE BEAM TYPE SEAT SENSOR SWITCH WILL BE USED ON ALL MODELS EXCEPT THUNDERBIRD, TORINO AND MONTEGO EQUIPPED WITH BUCKET SEATS.



SERVICE ON THE BEAM TYPE SENSOR SWITCH CAN BE PERFORMED BY REACHING UNDER THE SEAT, SEPARATING THE SWITCH WIRING CONNECTORS, PUSHING UP ON THE SEAT PAD AND REMOVING THE SWITCH. NOTICE THAT THE SWITCH IS MOUNTED ON TWO IRREGULAR BENDS IN THE SEAT SPRING ELEMENTS BECAUSE THE REPLACEMENT SWITCH MUST BE INSTALLED ON THE SAME TWO IRREGULAR ELEMENTS.

NOTE:

RESET THE SWITCH BY DEFLECTING THE SWITCH DOWN AS SHOWN AND THEN ALLOWING THE SWITCH TO RETURN TO NORMAL POSITION

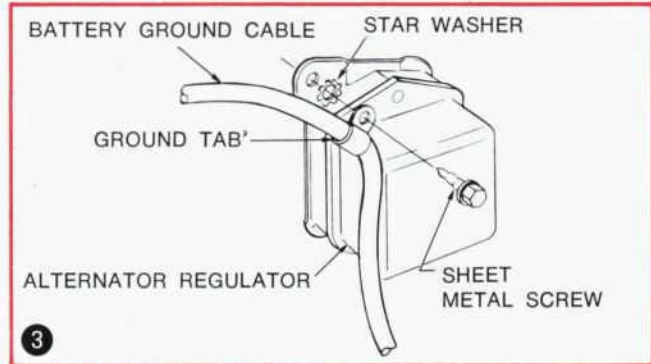


TEMPERATURE AND/OR OIL GAUGES READ HIGH —1971/1972 COUGAR/MUSTANG VEHICLES

Excessively high-reading temperature and/or oil gauges, especially with headlamps or A/C turned on, have been traced to a loose and/or corroded body ground at the alternator regulator base.

Body grounding is provided by a tab attached to the negative battery cable; the tab is secured to the mounting base of the alternator regulator located on the fender apron by means of a sheet metal screw.

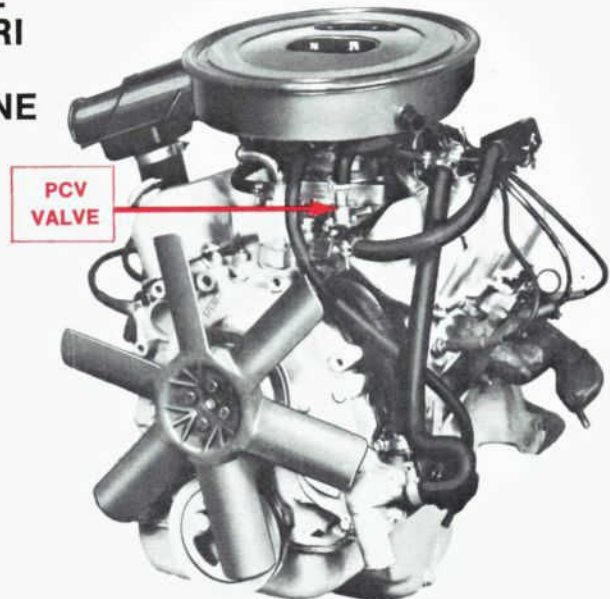
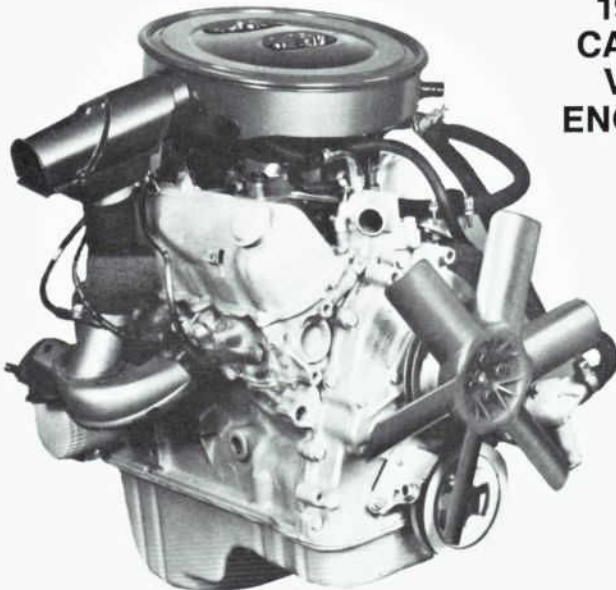
If a problem of high temperature gauge and/or oil gauge reading is experienced, remove and clean the grounding tab sheet metal screw and install a star washer *between* the negative cable grounding tab and the alternator regulator base. Tighten the screw to 24-36 lb.-in.



FAST MOVING AUTOLITE/MOTORCRAFT PARTS FOR THE 1972 CAPRI V-6 ENGINE

| PART NAME | FORD PART NUMBER | AUTOLITE/ MOTORCRAFT PART NUMBER | PART NAME | FORD PART NUMBER | AUTOLITE/ MOTORCRAFT PART NUMBER |
|--------------------------|-----------------------------|--|---------------------------|-------------------|--|
| AIR CLEANER ELEMENT..... | C8TZ-9601-A..... | FA-52 | OIL FILTER..... | C1AZ-6731-A..... | FL-1 |
| CARBURETOR..... | D2RY-9510-A Std Trans..... | CA-965 | PCV VALVE..... | D2RY-6A666-A..... | EV-66 |
| | D2RY-9510-B Auto Trans..... | CA-966 | DISTRIBUTOR POINTS..... | D2RY-12171-A..... | DPE-224 |
| IGNITION COIL..... | D1RY-12029-A..... | DGE-49 | ALTERNATOR REGULATOR..... | D1RY-10316-C..... | GRE-388-A |
| IGNITION CONDENSER..... | D2RY-12300-B..... | DC-261 | DISTRIBUTOR ROTOR..... | D2RY-12200-A..... | DRE-103 |
| FUEL PUMP..... | D2RY-9350-A..... | — | SPARK PLUG..... | D2RY-12405-B..... | AGR-32 |

1972
CAPRI
V-6
ENGINE



4

HOW TO BOND WINDSHIELD-MOUNTED MIRRORS IN SECONDS

The problem of installing rear-view mirrors on windshields is solved by the use of Ford Loctite Minute-Bond Adhesive 312.

Ford Loctite Minute-Bond Adhesive 312, a super-fast, high-strength, multi-purpose adhesive, can be used to fixture parts immediately and bond parts permanently. This adhesive, suitable for bonding most close-mated, smooth-surface materials offers exceptional performance. Fixtures in 10 seconds . . . reaches 60% of full strength in 2 minutes . . . ultimate strength up to 3000 psi.

Ford's Glass Division, in collaboration with the Body Engineering Office, has developed this solution for instant field installation or repair of these inside rear-view mirrors. The photos below depict the ease with which this adhesive can be used in solving this bonding problem and providing you with another satisfied customer.

Part Numbers

DOAZ-19554-A (complete kit)

DOAZ-19554-B (accelerator only)



Ford Loctite Minute-Bond Adhesive 312 Kit (DOAZ-19554-A). Kit contains 50cc Minute-Bond Adhesive 312 and 6 oz. Accelerator for Minute-Bond Adhesive 312 (DOAZ-19554-B). Detailed instructions are included in kit.



Spray bond area of windshield and bracket with Ford Loctite Minute-Bond Accelerator. Allow one minute to dry.



Apply Ford Loctite Minute-Bond Adhesive 312 evenly to rear-view mirror mounting bracket.

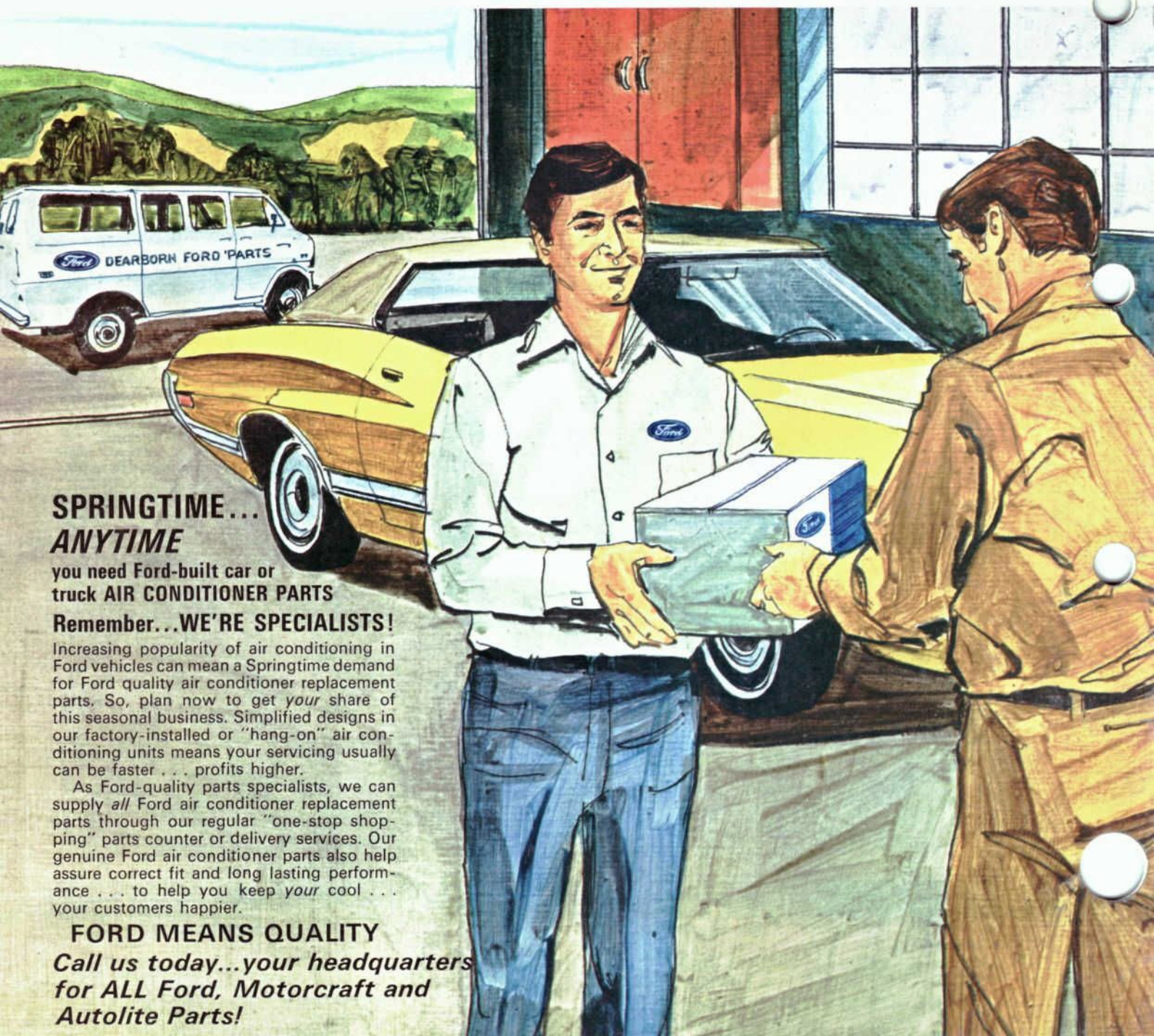


To fixture, press bracket onto windshield and hold firmly for one minute.



After 5 minutes, secure mirror to mounting bracket. Ultimate strength develops in 24 hours.

YOUR SOURCE FOR GENUINE FORD, MOTORCRAFT AND AUTOLITE ORIGINAL EQUIPMENT PARTS



**SPRINGTIME...
ANYTIME**

you need Ford-built car or
truck AIR CONDITIONER PARTS

Remember...WE'RE SPECIALISTS!

Increasing popularity of air conditioning in Ford vehicles can mean a Springtime demand for Ford quality air conditioner replacement parts. So, plan now to get *your* share of this seasonal business. Simplified designs in our factory-installed or "hang-on" air conditioning units means your servicing usually can be faster . . . profits higher.

As Ford-quality parts specialists, we can supply *all* Ford air conditioner replacement parts through our regular "one-stop shopping" parts counter or delivery services. Our genuine Ford air conditioner parts also help assure correct fit and long lasting performance . . . to help you keep *your* cool . . . your customers happier.

FORD MEANS QUALITY

**Call us today...your headquarters
for ALL Ford, Motorcraft and
Autolite Parts!**