DECEMBER, 1964

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Technical parts and service information published by Ford Division to assist servicemen in Service Stations, Independent Garages and Fleets.

3 SPECIAL FEATURES !

ALSO . . .

Be sure to file this and future bulletins for ready reference. If you have any suggestions for additional information that you would like to see included in this publication please write to: Ford Division of Ford Motor Company, Parts and Service Promotion and Training Dept., P.O. Box 658, Dearborn, Michigan, 48121.

FoMoCo GENUINE PARTS

AUTOLITE

ROTUNDA

From Your Ford Dealer

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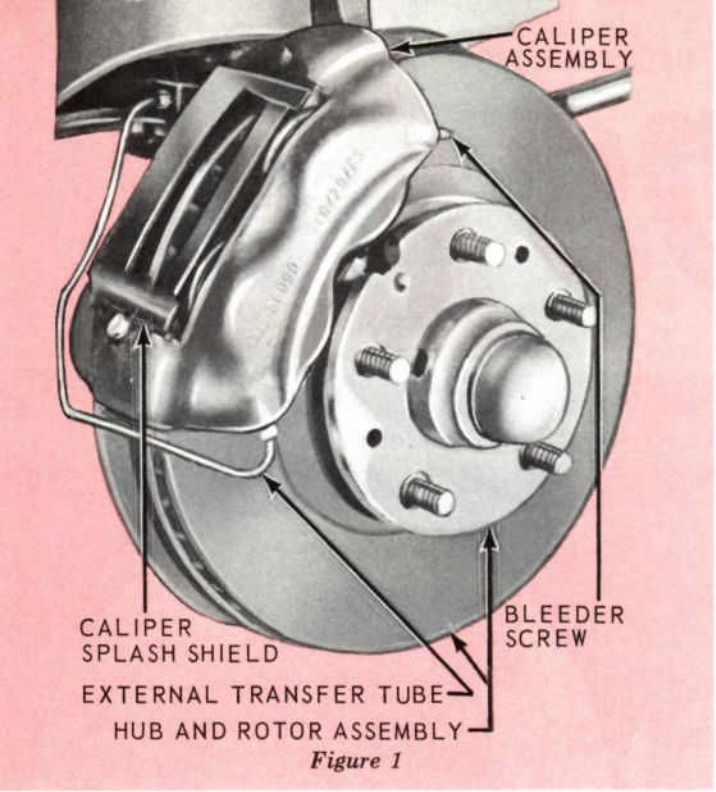


Figure 1

DISC BRAKES

Front wheel disc brakes—with all the benefits inherent in their design—are standard equipment on 1965 Thunderbirds and optional on Mustang models.

Instead of the traditional expanding brakes that press outward against a circular drum, this new system uses a cast iron disc with brake "pads" on either side. When the brakes are applied, the pads clamp equally on the disc for smooth, dependable stops —similar to the way you would squeeze a phonograph record between your fingers.

The disc is a one-piece casting *with radial ribs separating the two braking surfaces* to permit air to circulate between them for better cooling. This added cooling feature is not found even on many of the European sports cars that originally helped make solid disc brakes famous among sports car enthusiasts.

ADVANTAGES OF DISC BRAKES

- Because of their very nature, disc brakes heat up less and cool faster. They are much more resistant to "fade" after strenuous or repeated applications at high speed
- The brakes also are affected very little by water, since the disc throws off moisture through its natural centrifugal action.
- The equal clamping action of the brake pads produces more uniform straight-line stops.
- Other advantages include quieter operation, easier serviceability, automatic adjustment without the need for extra devices, and lining life equal to or better than regular drum-type brakes.

RELATION AND FUNCTION OF COMPONENT PARTS

The disc brake used on 1965 Thunderbirds and Mustangs is a fixed caliper, opposed piston, non-energized, ventilated disc type, actuated by a hydraulic system (see Figure 1). There is no lateral movement of either the disc (rotor) or the caliper.

The caliper assembly consists of two caliper housings bolted together with each half containing two cylinder bores of 1-15/16" diameter. Each cylinder bore contains a piston with an attached molded rubber dust boot to seal the cylinder bore from contamination (see Figure 2). The piston seals perform three important tasks:

1. They provide hydraulic sealing between the cylinders and pistons.
2. They return the pistons to released position when hydraulic pressure is released.
3. They maintain the shoes in correct adjustment at all times (comparable to the automatic adjusters in drum-type brakes).

The cylinders are connected hydraulically by means of internal passages in the caliper housing and an external transfer tube between the two halves of the caliper assembly. One bleeder screw and fluid inlet fitting is provided on each caliper assembly.

The shoe and lining assemblies are located in between parallel machined abutments within the caliper, and are supported radially by tabs on the outer ends of the shoe assemblies (see Figure 3). The shoes slide axially in the caliper abutments by means of the tabs which ride on machined ledges (bridges) when hydraulic pressure is applied to the piston. A shoe and lining assembly consists of friction material bonded to a metal plate called the shoe. It is replaced as a unit. Brake torque is absorbed by the mating of the shoe end against the caliper abutments (Figure 3). A splash shield is attached to the top of the caliper to retain the shoe and lining assemblies and reduce contamination.

The caliper assembly on Mustang models is mounted to a bracket located between the spindle and rotor splash shield, to the front of the wheel vertical centerline. On Thunderbirds, the caliper is mounted directly to the front wheel spindle to the rear of the wheel vertical centerline.

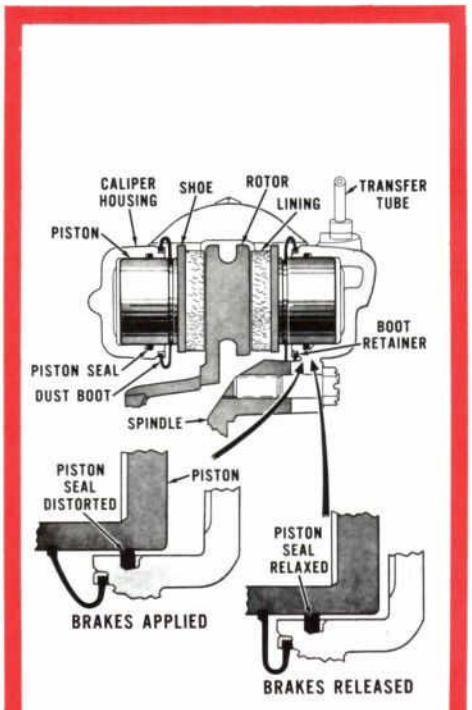


Figure 2

OPERATION

As the brake pedal is depressed, hydraulic pressure from the master cylinder forces the pistons out of the caliper bores against their respective shoe and lining assemblies. The shoe force of the pistons against the shoes moves the linings against both sides of the revolving rotor to effect braking action.

During brake application, the rubber seal on each piston stretches as the piston moves against the shoe (see Figure 2). When the hydraulic pressure against the piston is released, the seal relaxes or rolls back. This roll-back action pulls the piston away from the shoe approximately 0.005-inch to relieve the force of the lining against the rotor and, thereby, provide the required running clearance. Also, inherent rotor runout contributes to the maintenance of running clearance.

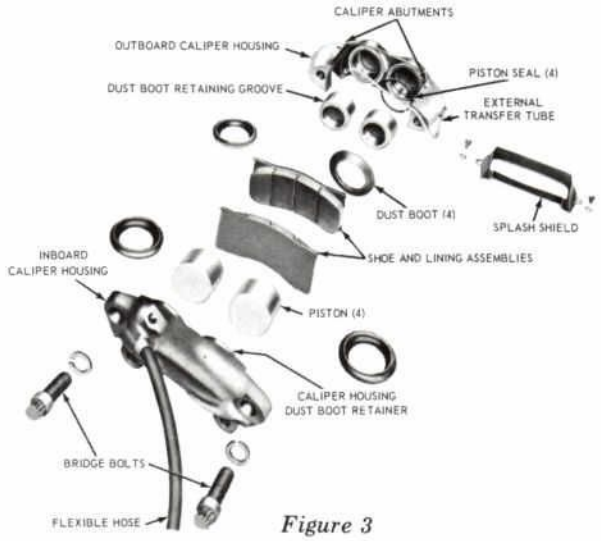


Figure 3

BRAKES ADJUST AUTOMATICALLY

Automatic adjustment is achieved by the pistons sliding in the seals outward from the cylinder bores. The piston gradually changes its position relative to the seal as the lining wears and thus maintains the correct adjustment location at all times.

When the brakes are in the unapplied position, there is no hydraulic pressure to the calipers because the fluid source at the master cylinder by-passes the residual check valve.

A warning sound feature is incorporated in the design of the brake shoes. Metal tabs on the ends of the shoes create an audible metallic, scraping noise, when the linings become worn enough to allow the tabs to contact the rotor. This metal-to-metal contact warns the driver that the shoes need replacing and is not detrimental to the function of the disc brake.

A proportioning valve located between the master cylinder and the rear brake wheel cylinders (see Figure 4) provides balanced braking action between the front and the rear brakes under a wide range of braking conditions. By regulating the hydraulic pressure applied to the rear wheel cylinders, the valve limits rear braking action when high pressures are required at the front brakes. In this manner, premature rear wheel skid is prevented. The proportioning valve is serviced as an assembly and is never adjusted or overhauled.

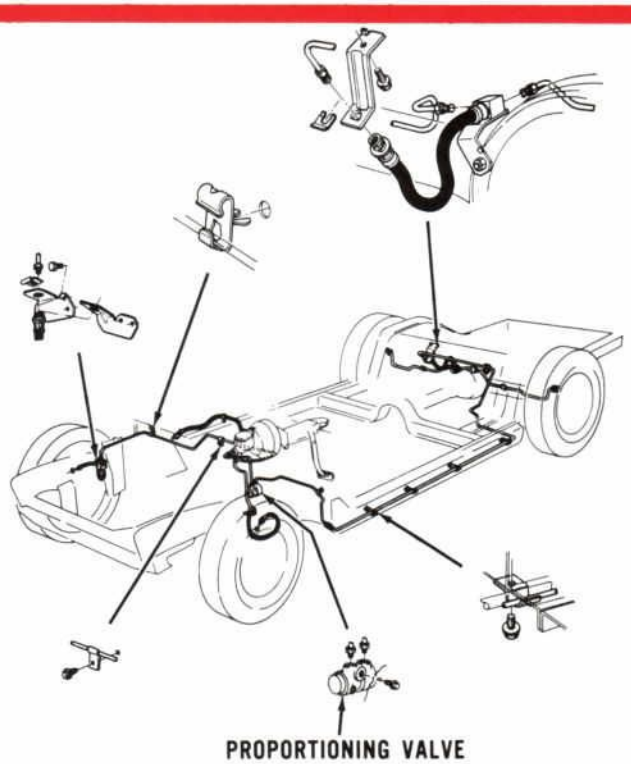


Figure 4

DISC BRAKES OPERATION, DIAGNOSIS

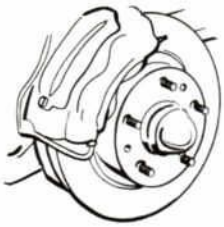
DIAGNOSIS OF DISC BRAKE PROBLEMS

Disc brake problems are similar to drum brake problems. Some of the problems which may be experienced – along with possible causes and corrections – are shown in the following chart:

TROUBLE SYMPTOM	POSSIBLE CAUSES	CORRECTION
EXCESSIVE PEDAL TRAVEL	Shoe and lining knock-back after violent cornering or traversing extremely rough road.	The driver will need to be informed that this type of operating action is to be expected and to adjust his driving habits to suit conditions. It may be necessary to apply the brakes once or twice to regain the normal short pedal travel.
	Piston and shoe and lining assembly not properly seated or positioned.	Remove the front wheel and tire assembly to inspect the caliper and linings. If the parts cannot be aligned for proper operation, the complete brake unit should be replaced.
	Air, leak, or insufficient fluid in the system or caliper.	Bleeding the system, correcting the leaks and adding sufficient fluid to fill the system to specifications (see page 9).
	Loose wheel bearing adjustment.	Adjust the wheel bearings to specifications. If the bearings cannot be adjusted, the bearings and races should be replaced.
	Damaged caliper piston seal. Brake fluid leakage around the brake piston is evidence of a leaking seal.	Examine the piston and the seal seat in the caliper for possible causes of seal damage. Correct the cause and replace the seal. If the cause of the seal damage cannot be determined, replace the caliper assembly.
	Improper booster push rod adjustment on the Thunderbird.	Adjust the push rod as required, or if satisfactory adjustment cannot be made, replace the push rod.
BRAKE ROUGHNESS OR CHATTER	Excessive lateral runout of the rotor or excessive out-of-parallelism of the rotor.	Since no repair or service operations are to be performed on the rotor, it must be replaced. The hub and rotor are replaced as a unit.
EXCESSIVE PEDAL EFFORT	Frozen or seized pistons may be caused by foreign material in the brake fluid.	If the piston and the caliper cannot be cleaned so that the piston operates properly, the caliper assembly must be replaced.
	Brake fluid, oil or grease on the linings.	If the brake lining has become contaminated with any type of foreign substance, the brake shoe should be replaced.
	Shoe and lining worn below .155″ on Mustang, .195″ on Thunderbird.	Replace the brake shoes.
	Proportioning valve malfunction.	Replace the proportioning valve.
	Booster inoperative.	Check the booster and perform the necessary corrective action.

and LIGHT REPAIR—continued

TROUBLE SYMPTOM	POSSIBLE CAUSES	CORRECTION
BRAKE OR WHEEL PULL	Hydraulic fluid, oil or grease on the linings may cause either a slippery brake or a sticky brake.	If the brake lining has become contaminated with any type of foreign substance, the brake shoe should be replaced.
	Misalignment of the caliper with the rotor.	Check and adjust the caliper alignment.
	Frozen or seized pistons.	Free the pistons and examine for any defect which would be the cause for replacement. Replace if necessary.
	Loose caliper attachments.	Check for loose attachments and torque the screws if necessary. If the caliper cannot be properly secured, replace the caliper or spindle as necessary.
NOISY BRAKE	Disc brakes may on occasion creak or groan when the brakes are released slowly.	This condition is in no way detrimental to the braking action and may be corrected by varying the speed of application or release of the brake pedal.
RATTLE	Brake noise or rattle may emanate from the brakes at low speed on rough roads. This may be caused by excessive clearance between the shoe and the caliper or between the shoe and the shield.	Check for worn linings or for a deformed splash shield.
BRAKES HEAT UP DURING DRIVING AND FAIL TO RELEASE	Abnormal heat can be caused by a frozen or seized piston.	Check the pistons and repair or replace as required.
LEAKY WHEEL CYLINDER	Usually caused by a damaged or worn piston seal or scores or corrosion on the piston surface. Inspection of these parts will reveal the cause of the leaks.	Regardless of whether the trouble is with the seal or the piston, the only solution is to replace the defective parts.
GRABBING OR UNEVEN BRAKING ACTION	The same causes for pulling brakes will cause grabbing. Uneven braking may be caused by a malfunctioning proportioning valve.	If the proportioning valve is the cause, replace the valve.
PEDAL ACTION BUT NO BRAKING EFFECT	Leak in the hydraulic system or calipers.	An inspection of the system and the calipers will reveal if leaks exist. Repair as necessary.
	Shoes and linings may not be properly aligned with the rotor.	Make necessary corrections.
	Air in the system or a bleeder screw still open.	Bleed the air from the system and tighten the bleeder screws securely.



DISC BRAKES OPERATION, DIAGNOSIS

IN-CAR ADJUSTMENTS AND REPAIRS

DISC BRAKE SERVICE PRECAUTIONS

1. Grease or any other foreign material must be kept off the caliper assembly, surfaces of the rotor and external surfaces of the hub during service operations. Handling of the rotor and caliper assemblies should be done in a way to avoid deformation of the brake rotor and nicking or scratching of brake linings.
2. If the square sectioned rubber piston seals are worn or damaged, they should be replaced immediately.
3. During removal and installation of a wheel and tire assembly, exercise care not to interfere with and damage the caliper splash shield, the bleeder screw fitting or the transfer tube.
4. Front wheel bearing end play is critical and must be within specification.
5. Insure vehicle is centered on hoist before servicing any front end components to avoid bending or damaging of the rotor splash shields on full right or left wheel turns.
6. Before vehicle is moved after any brake service work, obtain a firm brake pedal.
7. The bridge bolts retaining the two caliper housings should not be disturbed.
8. The proportioning valve or the delay valve should not be disassembled or adjustments attempted on them.
9. Riding of the brake pedal (common on left foot applications) should be avoided during vehicle operation.
10. The wheel and tire assembly mounted on the hub *cannot* be removed together as an assembly. The caliper assembly must be removed prior to removal of the hub and rotor assembly necessitating removal of the wheel and tire assembly from the hub.

CHECKING BRAKE LINES AND LININGS (36,000 MILES OR AS REQUIRED)

Raise all four wheels. Remove one of the front wheel and tire assemblies and inspect the rotor, caliper and linings. (The wheel bearings should be inspected at this time and repacked if necessary.) Do not get oil or grease on the rotor or the linings. If the linings are worn to within .030" of the surface of the shoe, replace both sets of shoe and lining assemblies (inboard and outboard) on the front wheels. It is recommended that both front wheel sets be replaced whenever a respective shoe and lining is worn or damaged.

If the rotor braking surface is excessively scored, warped, or shows runout over .002", it should be replaced. Do not attempt to repair or refinish the rotor.

If the caliper is cracked or fluid leakage is evident, it must be replaced as a unit. The bridge bolts retaining the two halves of the caliper assembly should not be disturbed.

CHECKING SHOE AND LINING WEAR

If a visual inspection does not adequately determine the condition of the lining, a physical check will be required.

To check the amount of lining wear, remove the wheel and tire assembly, caliper splash shield, and the shoe and lining assemblies. Three thickness measurements with a micrometer should be taken across the middle section on the shoe and lining; one reading at each side and one reading in the center. When an assembly has worn to a thickness of .155" on a Mustang or .195" on a Thunderbird at any location (lining material .030"), it should be replaced.

CHECKING RUNNING CLEARANCE

To check the shoe and lining assembly to rotor clearance, remove the wheel and tire assembly and the caliper splash shield. Insert a feeler guage between the lining and rotor. Ordinarily, the clearance should be .003" to .006". However, if the vehicle was stopped by a brake application just prior to checking the clearance, it is considered normal for the brakes to drag slightly.

CHECKING ROTOR ASSEMBLY—RUN-OUT

Excessive lateral run-out of the rotors will cause knocking back of the pistons which creates increased pedal travel and vibration when the brakes are applied.

Before checking the run-out, the bearing end play should be eliminated by tightening the adjusting nut. *Readjustment will be required at the completion of the test to prevent bearing failure.* After tightening the nut, check that the hub and rotor can still be rotated.

A dial indicator should be clamped to the caliper housing so that the stylus contacts the rotor at a point approximately 1" from the outer edge. Rotate the rotor and check the indicator reading. The maximum total indicator reading on the gauge should not exceed .002". If the reading exceeds this specification, the rotor should be replaced. Do not attempt to refinish a rotor that indicates run-out in excess of the specification.

DISC BRAKE SHOE AND LINING REPLACEMENT

REMOVAL

1. Remove the wheel and tire assembly from the hub and rotor assembly. *Be careful to avoid damage or interference with the caliper splash shield, bleeder screw fitting or transfer tube.*

2. Remove the two bolts that retain the caliper splash shield, and remove the shield (Figure 5).

3. To facilitate removal and installation of the shoe and lining assemblies, the pistons must be pushed into their bores. Apply a steady inward pressure against each shoe and lining assembly toward its respective caliper housing on each side of the rotor (Figure 6). Maintain the pressure for at least a minute. If the pistons will not go in easily, force them in with water pump pliers.

4. Grasp the metal flange on the outer end of the shoe with two pairs of pliers and pull the shoe out of the caliper (Figure 7).

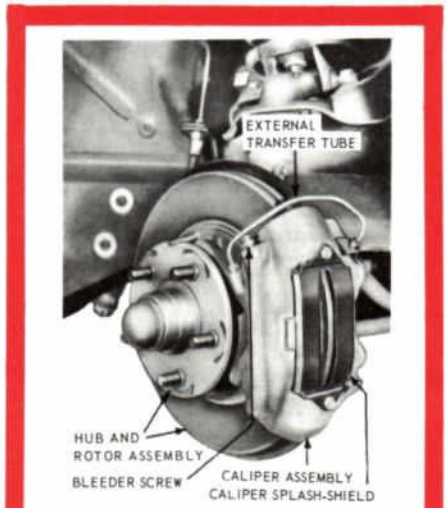


Figure 5

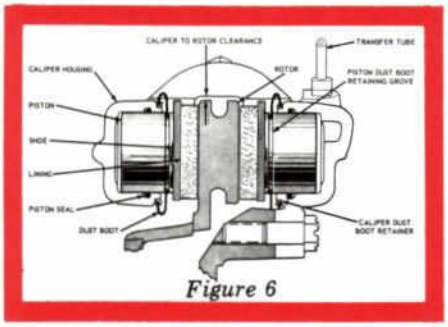


Figure 6

CLEANING AND INSPECTION

When the shoe and lining assemblies are replaced, remove the dust boots from the pistons. Check the condition of the boots, and inspect each piston surface for damage or corrosion. Thoroughly clean each dust boot and surrounding area before installing.

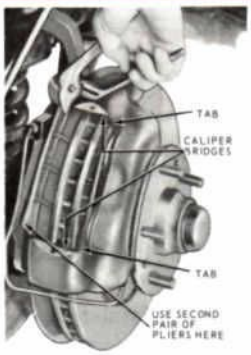


Figure 7

INSTALLATION

1. Position a new shoe and lining assembly on each side of the rotor so that the lining faces the rotor. Be sure that the tabs on the shoe flanges seat fully against the caliper bridges (Figure 7).

2. Install the caliper splash shield and secure the shield to the caliper with two retaining bolts (Figure 5).

3. Pump the brake pedal several times until a firm pedal is obtained and the shoe and lining assemblies are properly seated.

4. Install the wheel and tire assembly on the hub and rotor assembly.

5. Check and refill the master cylinder reservoir with Rotunda Heavy Duty Brake Fluid, Ford Part Number B7AZ-19542-A, as required.

6. Road test the car.

It should not be necessary to bleed the system after a shoe and lining replacement.

DISC BRAKE CALIPER ASSEMBLY

REMOVAL

1. Remove the wheel and tire assembly from the hub and rotor assembly. *Be careful to avoid damage or interference with the caliper splash shield, bleeder screw fitting or transfer tube.*

2. Disconnect the front brake flexible hose from the brake tube at the bracket on the frame.

3. Remove the two bolts retaining the caliper to the mounting bracket on Mustang vehicles or to the spindle on Thunderbirds. *Take care to avoid loosening the bridge bolts that hold the two halves of the caliper together.*

4. Lift the caliper assembly off the rotor.

INSTALLATION

1. Position the caliper assembly on the rotor, and mate the mounting bolt holes in the caliper with those in the spindle. It may be necessary to push the caliper pistons into the cylinder bores to obtain clearance between the shoe and lining assembly and the rotor. The shoe and lining assemblies should be seated properly on the bridges.

2. Install the caliper to mounting bracket retaining bolts and torque to specification (see page 9). Check to insure that the rotor runs squarely and centrally between the two halves of the caliper. There should be approximately .090"-.120" clearance between the caliper and the rotor outside diameter (Figure 6).

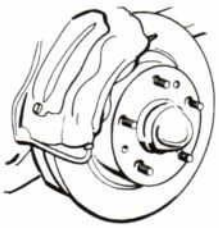
3. Connect the front wheel brake flexible hose to the brake tube at the bracket on the frame. The hose should be checked for correct routing.

4. Bleed the brake system and check the master cylinder fluid level, adding Rotunda Heavy Duty Brake Fluid, Ford Part Number B7AZ-19542-A, as required.

5. *Pump the brake pedal several times to actuate the piston seals and to position the shoe and lining assemblies.*

6. Install the wheel and tire assembly.

7. Road test the car.



DISC BRAKES OPERATION, DIAGNOSIS

HUB AND ROTOR ASSEMBLY

REMOVAL

1. Remove the wheel and tire assembly from the hub and rotor assembly (Figure 8). *Be careful to avoid damage or interference with the caliper splash shield, bleeder screw fitting or transfer tube.*

2. Remove the caliper assembly from the spindle and the rotor. If the caliper does not require servicing, it is not necessary to disconnect the brake hose or remove the caliper from the car. Position the caliper out of the way, and support it with a wire to avoid damaging the caliper or stretching the hose. Insert a *clean* cardboard spacer between the linings to prevent the pistons from coming out of the cylinder bores while the caliper is removed.

Handle the rotor and caliper assemblies in such a way as to avoid deformation of the rotor and nicking or scratching of the brake linings.

3. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle. Remove the outer bearing cone and roller assembly.

4. Remove the hub and rotor assembly from the spindle.

INSTALLATION

1. If the rotor is being replaced, remove the protective coating from the new rotor with carburetor degreaser. Pack a new set of bearings with the proper grease, and install the inner bearing cone and roller assembly in the inner cup. Pack grease lightly between the lips of a new grease retainer and install the retainer (Figure 8).

If the original rotor is being installed, make sure that the grease in the hub is clean and adequate, that the inner bearing and grease retainer are lubricated and in good condition, and that the rotor braking surfaces are clean.

2. Install the hub and rotor assembly on the spindle.

3. Lubricate and install the outer wheel bearing, washer and adjusting nut.

4. Adjust the wheel bearings to specification, and then install the nut lock, cotter pin, and grease cap. *The wheel bearing adjustment is especially important with disc brakes.*

5. Mount the caliper assembly on the mounting bracket and torque the two mounting bolts to specification (see page 9). If necessary, push the caliper pistons into the cylinder bores to obtain clearance between the shoe and lining assemblies and the rotor. Be sure that the shoe and lining assemblies are seated on the bridges. Check the flexible hose for correct routing.

6. Install the wheel and tire on the hub and rotor assembly.

ROTOR SPLASH SHIELD

REMOVAL

1. Remove the caliper and the hub and rotor assembly as outlined under "REMOVAL" in the foregoing procedure.

2. Remove the four nuts (Mustang) or three nuts (Thunderbird) that retain the splash shield to the mounting bracket and remove the shield (Figure 8). On Thunderbirds, a gasket is located between the spindle and the shield.

3. Remove the gasket.

INSTALLATION

1. Install the gasket.

2. If the shield is bent, straighten it out before installation. Position the shield to the mounting bracket (Figure 8), install the retaining nuts, and torque to specification (see page 9).

3. Install the hub and rotor assembly and the caliper as outlined under "INSTALLATION" in the foregoing procedure.

PROPORTIONING VALVE

The proportioning valve is serviced as an assembly and is never adjusted or overhauled.

REMOVAL

1. Disconnect and remove the master cylinder-to-proportioning valve brake tube (see Figure 4, page 3).

2. Disconnect the front-to-rear brake tube from the proportioning valve.

3. Working underneath the left fender, remove the bolt that retains the proportioning valve to the fender apron and remove the valve through the access hole (Figure 9).

INSTALLATION

1. From underneath the left fender, install the proportioning valve through the access hole in the fender apron. Position the valve to the apron so that the mounting tang extends through the hole in the fender apron as shown in Figure 9. Install the retaining bolt.

2. Connect the front-to-rear brake tube to the valve.

3. Position and connect the master cylinder-to-proportioning valve brake tube.

4. Bleed the brake system.

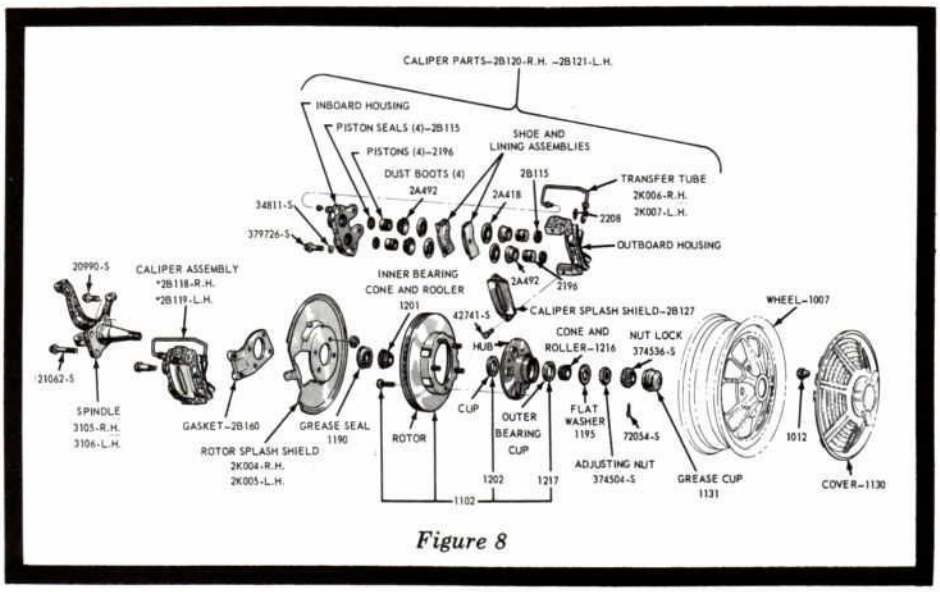


Figure 8

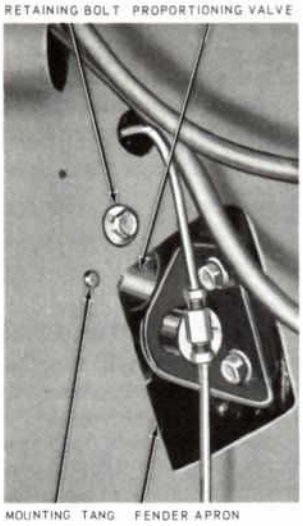


Figure 9

HYDRAULIC SYSTEM BLEEDING

Bleeding operations for disc brakes will be similar to current practices on drum brakes with a few exceptions and precautions. To bleed a disc brake assembly, the wheel and tire assembly must be removed to gain access to the bleeder fitting on the caliper. Manual bleeding of the system will require more "pumping" of the brake pedal than currently required because of the increased fluid requirements of the disc brake system. It may be necessary to check and add brake fluid to the master cylinder more frequently during bleeding operations. *Care should be exercised to avoid getting brake fluid on the rotor.*

Before the vehicle is moved, the pistons must be returned to their normal position, and the shoe and lining assemblies properly seated.

It is *mandatory* that the brakes be functionally checked and a firm pedal obtained when the pedal is depressed after bleeding and before the vehicle is driven.

Pressure bleeding operations remain unchanged. However, the adapter cover must be securely attached to the master cylinder to preclude leakage.

DISC BRAKE SPECIFICATIONS

BRAKE SHOE AND LINING DIMENSIONS

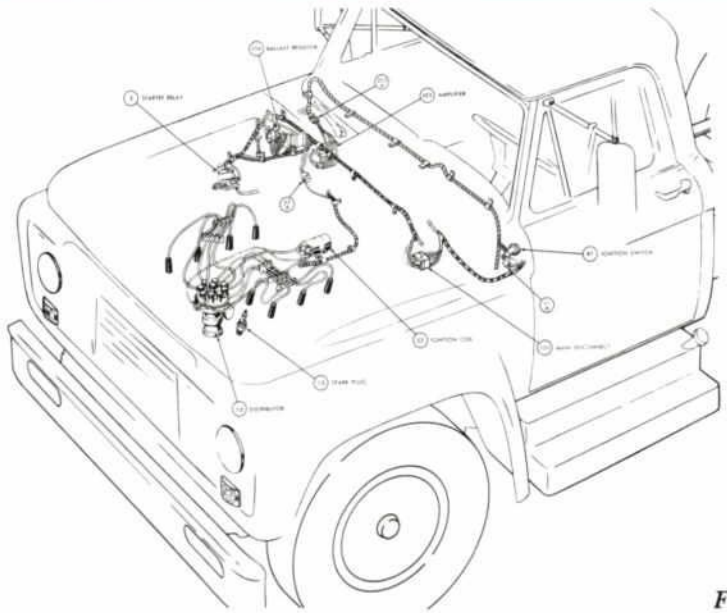
	THUNDERBIRD	MUSTANG
Lining Material	Bonded FoMoCo C5SZ-2001-A	Bonded FoMoCo C5ZZ-2001-A
Lining Size	5.36″ x 1.90″	4.82″ x 1.84″
Lining Area	10.03 sq. in./segment	8.50 sq. in./segment
Shoe and Lining Thickness	0.600″ nominal	0.525″ nominal
Lining Thickness	0.436″ nominal	0.400″ nominal
Shoe and Lining Maximum Wear Limit	0.195″	0.155″
Lining Maximum Wear Limit (from surface of shoe)	0.030″	0.030″
Lining to Rotor Clearance (brakes released)	0.002″-0.010″	0.003″-0.006″
Proportioning Valve	450 PSI cut in (43½% reduction in rear line pressure over 450 PSI)	300 PSI cut in (50% reduction in rear line pressure over 300 PSI)

TORQUE SPECIFICATIONS

	THUNDERBIRD (Ft-Lbs)	MUSTANG (Ft-Lbs)
Caliper Assembly to Mounting Bracket	not applicable	45-60
Mounting Bracket to Spindle	not applicable	35-45
Caliper Assembly to Spindle	75-100	not applicable
Caliper Bleeder Screw	10 (120 in-lbs)—Maximum—must be leakproof	10 (120 in-lbs)—Maximum—must be leakproof
Caliper Splash Shield	7-9	7-9
Caliper Bridge Bolts	65-75	65-75
Rotor Splash Shield to Spindle	10-20	10-20
Brake Tube Fitting Nuts to Proportioning Valve	70 In.-Lbs.—Maximum—must be leakproof	70 In.-Lbs.—Maximum—must be leakproof
Hub and Rotor Assembly to Front Wheel Spindle	17-25—Rotate rotor while torqueing*	17-25—Rotate rotor while torqueing*
Wheel Assembly to Front Wheel Hub and Rotor Assembly	75-110	75-110

**.0005″ to .0065″ maximum bearing end play with torque specification of 17-25 Ft-Lbs*

FORD TRUCK TRANSISTOR IGNITION SYSTEM...



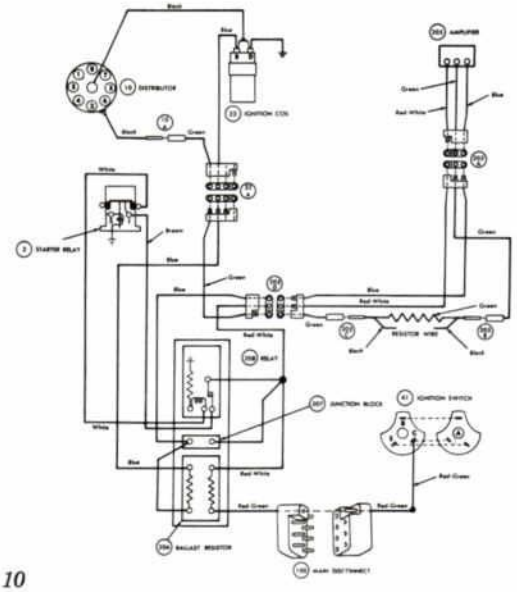


Figure 10

OPERATION

In addition to 1965 Thunderbird and Ford 390 Police Interceptor and 427 High Performance engines, a permatuned transistor ignition system is available on 1965 Ford truck 330, 361, 391, 401, 477 and 534 V-8 engines. Figure 10 shows a typical truck transistor ignition system.

The ignition coil primary in the transistor system is designed to draw a normal 12 ampere peak current, or approximately 5.5 amperes average current as indicated on an ammeter, in order to provide high spark plug voltage at the higher engine speeds.

The transistor in the system acts as a switch or relay. It is similar in action to a horn relay, except that it has no moving parts, and thus acts with very little time lag. The transistor is connected between the battery and the coil and is used to make and break the coil primary circuit.

The distributor controls the transistor. The 8-ohm resistor, connected between the distributor and the transistor (in the wiring harness), limits the transistor control current (and distributor point current) to 0.5 ampere. The low distributor point current eliminates pitting and gives long distributor point life.

The distributor condenser has been increased in value to 2 mfd and is located in the amplifier assembly. As in the standard ignition circuit, it absorbs high inductive energy during initial distributor point opening. However, it no longer has any effect on the distributor points as the transistor effectively isolates the points from the coil.

The amplifier assembly (Fig. 11) is mounted under the instrument panel to protect the parts from engine heat.

A ceramic ballast resistor block, a tachometer connector block and a cold start relay are mounted on a plate in the engine compartment (Fig. 12). A fiber cover encloses the resistor block, tachometer block and cold start relay.

Figure 11

A 2-ampere fuse between the black (large) terminal of the tach block and the coil primary circuit prevents the transistor from being damaged by the application of external devices other than normal testing equipment.

The cold start relay contacts are normally closed and they are connected into the circuit only during the start cycle. When the starter relay is closed, the cold start relay is actuated and opens its contacts. If, during starting, the available voltage drops below 10.5 volts, the relay contacts close, thus bypassing the 0.33-ohm resistor in the ballast resistor block, and applying full available voltage to the system.

The tachometer block is used to connect a tachometer or other test equipment into the circuit. Do not connect test equipment into the circuit in any other manner, or readings will be inaccurate and damage may occur to the transistor, or change its operating characteristics.

Connect the tachometer red lead to the tachometer block small terminal and black lead to the large terminal.

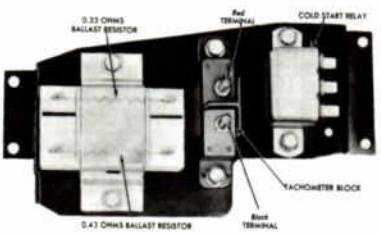


Figure 12

Operation and Diagnosis

DIAGNOSIS

Ignition troubles are caused by a failure in the primary or secondary circuit, or incorrect ignition timing. Isolate the trouble as follows:

1. Remove the coil high tension lead from the distributor cap.

2. Disconnect the brown wire from the starter relay "I" terminal and the red and blue wire from the starter relay "S" terminal.

3. Turn the ignition switch on.

4. While holding the high tension lead approximately ¼ inch from the cylinder head, crank the engine by using an auxiliary starter switch between the starter relay battery and "S" terminals.

If the spark is good, the trouble lies in the secondary (high voltage) circuit. If there is no spark or a weak spark, the trouble is in the primary (low voltage) circuit.

Primary Circuit. A breakdown or energy loss in the primary circuit can be caused by:

1. Defective primary wiring.
2. Improperly adjusted, contaminated or defective distributor points.
3. Defective amplifier assembly.

The trouble can be isolated by performing a primary circuit test.

Secondary Circuit. A breakdown or energy loss in the secondary circuit can be caused by:

1. Fouled or improperly adjusted spark plugs.
2. Defective high voltage wiring.
3. High voltage leakage across the coil, distributor cap or rotor.

To isolate a trouble in the secondary circuit, turn the ignition switch off, remove the auxiliary starter switch from the starter relay, install the coil high tension lead in the distributor cap, the red and blue wire to the starter relay (this goes on the "S" terminal) and the brown wire to the starter relay (this goes on the "I" terminal) and perform a secondary circuit test.

PRIMARY CIRCUIT TESTS

When diagnosis procedures isolate trouble to the primary circuit, make the following tests to locate the defective item. Do not use any other procedure, conventional short cut, or connect test equipment in any other manner than that described, or extensive damage can be caused to the transistor ignition system. Figure 13 shows the transistor ignition system tests in outline form.

Connect a dwell meter to the tachometer block (Fig. 12). Connect the black lead to the black (large) terminal and the red lead to the red (small) terminal. Turn the ignition on and crank the engine. Observe the dwell reading.

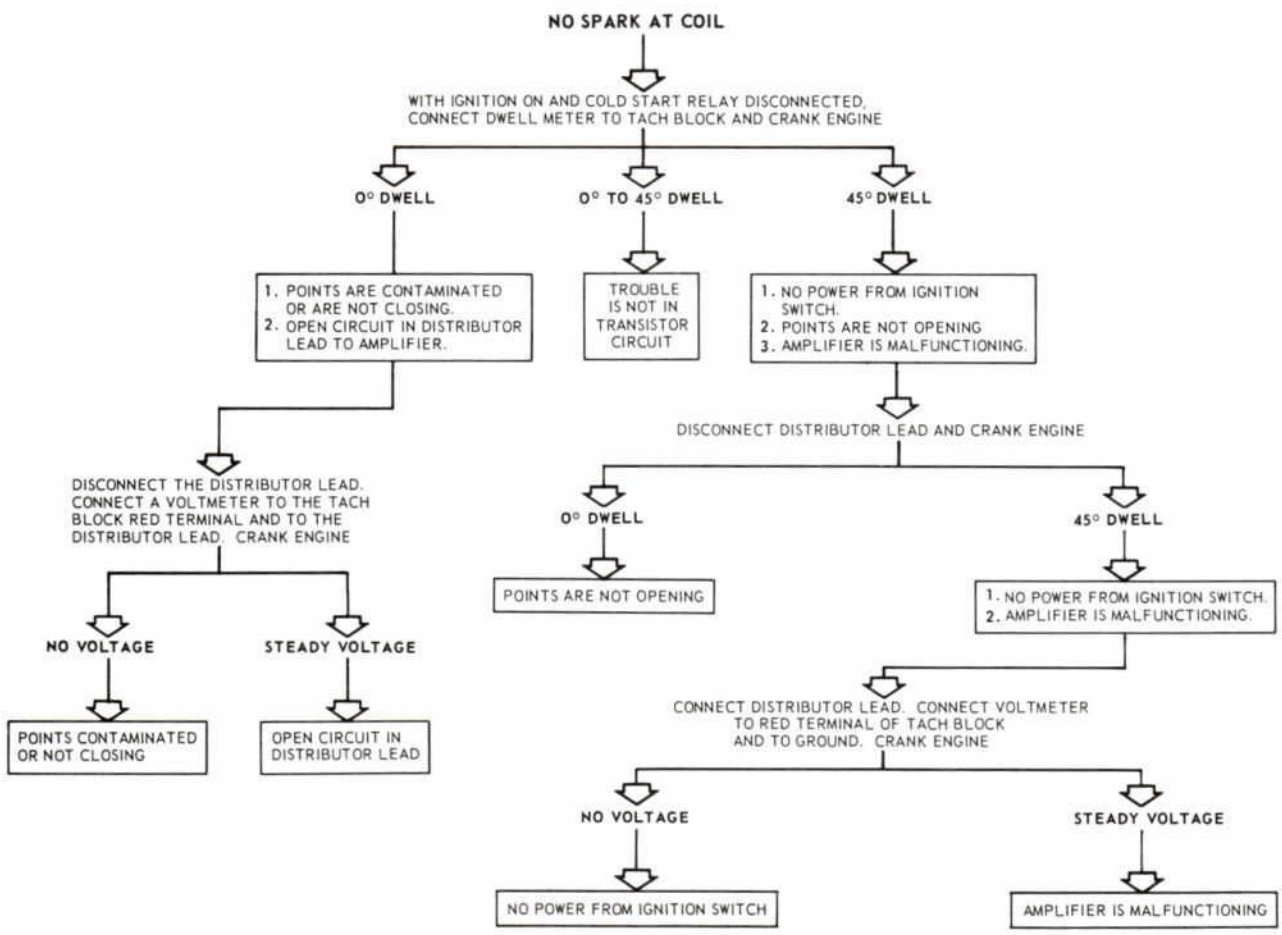


Figure 13

0° Dwell. A dwell reading of 0° indicates:

1. The distributor points are contaminated or are not closing.

2. An open circuit in the distributor lead to the amplifier.

To determine which item listed is causing the trouble, proceed as follows:

Disconnect the distributor lead at the bullet connector and connect a voltmeter red lead to the red tach block terminal (red-white striped lead) and the voltmeter black lead to the distributor lead from the distributor. Do not connect the voltmeter to the lead from the amplifier. Crank the engine and note the voltmeter reading.

If a steady indication of voltage is obtained, the trouble is in the distributor lead to the amplifier. Absence of any voltage indication on the voltmeter shows that there is an open circuit between the distributor lead and the breaker point ground.

0° to 45° Dwell. A dwell reading between 0° and 45° indicates:

1. The transistor and the primary circuit are functioning properly.

2. The trouble could be in the secondary circuit.

45° Dwell. A dwell reading of 45° indicates:

1. No power from the ignition switch.

2. The distributor points are closed and not opening.

3. Defective amplifier assembly.

To determine which of the three items listed are causing the trouble, proceed as follows:

Disconnect the distributor lead at the bullet connector, and crank the engine. If the dwell meter indicates 0° dwell, the distributor points are not opening. If 45° dwell is indicated, the amplifier is malfunctioning or there is no power from the ignition switch.

Use a voltmeter or test light to determine if the transistor (amplifier assembly) is at fault. Connect the voltmeter to the red-green lead terminal of the ballast resistor and to ground. Crank the engine.

If a steady indication of voltage is obtained, the trouble is in the amplifier. Absence of any voltage indication on the voltmeter shows there is an open circuit, or no power between the ignition switch and the amplifier. The ballast resistor could be defective. Replace it with a known good ballast resistor, and repeat the test.

If the test procedure indicates a defective amplifier, replace it with a known good amplifier, and proceed as follows:

Connect the distributor high tension lead at the bullet connector. Then, with the cold start relay disconnected and the dwell meter connected to the tachometer block, crank the engine and observe the indicated dwell. Zero to 45° indicates satisfactory ignition; thus, the amplifier is at fault.

If the dwell reading is still 45°, the wiring from the amplifier through the ballast resistor to the coil is defective. Replace the defective item.

After a repair has been made, run through the test again to check for any other malfunctions.

TRANSISTOR IGNITION SYSTEM SERVICE PARTS

Following is a list of service parts for Ford truck transistor ignition systems. You can obtain these parts from your local Ford dealer. See Figure 14.

PART NUMBER	DESCRIPTION
C3AZ-12239-A	Breaker Point Dust Cover 330 MD Engine
B8Q-12239-A	Breaker Point Dust Cover All Other Engines
C3TZ-12A027-A	Amplifier Assembly
C3TZ-12029-A	Coil Assembly
C3TZ-12A042-B	Cold Start Relay
C3TZ-12A046-A	Ballast Resistor
C3AZ-12250-A	Ignition Resistor Wire
C3TZ-14A275-A	Plate Assembly—Ballast Resistor Mounting—for Models F-N-NT-T 850/1100
C3TZ-14A275-B	Plate Assembly—Ballast Resistor Mounting—for Models C-CT-H-HT 850/1100
C3TZ-14A276-A	Cover—Ballast Resistor Mounting
Basic Numbers 14A273, 14289, 14398, 14401	Wiring Loom Assembly
C4TZ-14A274-B	Resistor Mounting Plate
B6A-14296-C	Wire—Coil Ground (cut to length)
C3TZ-14303-B	Cable—Ground (F Series only)
C3TZ-1448-A	Tach Block

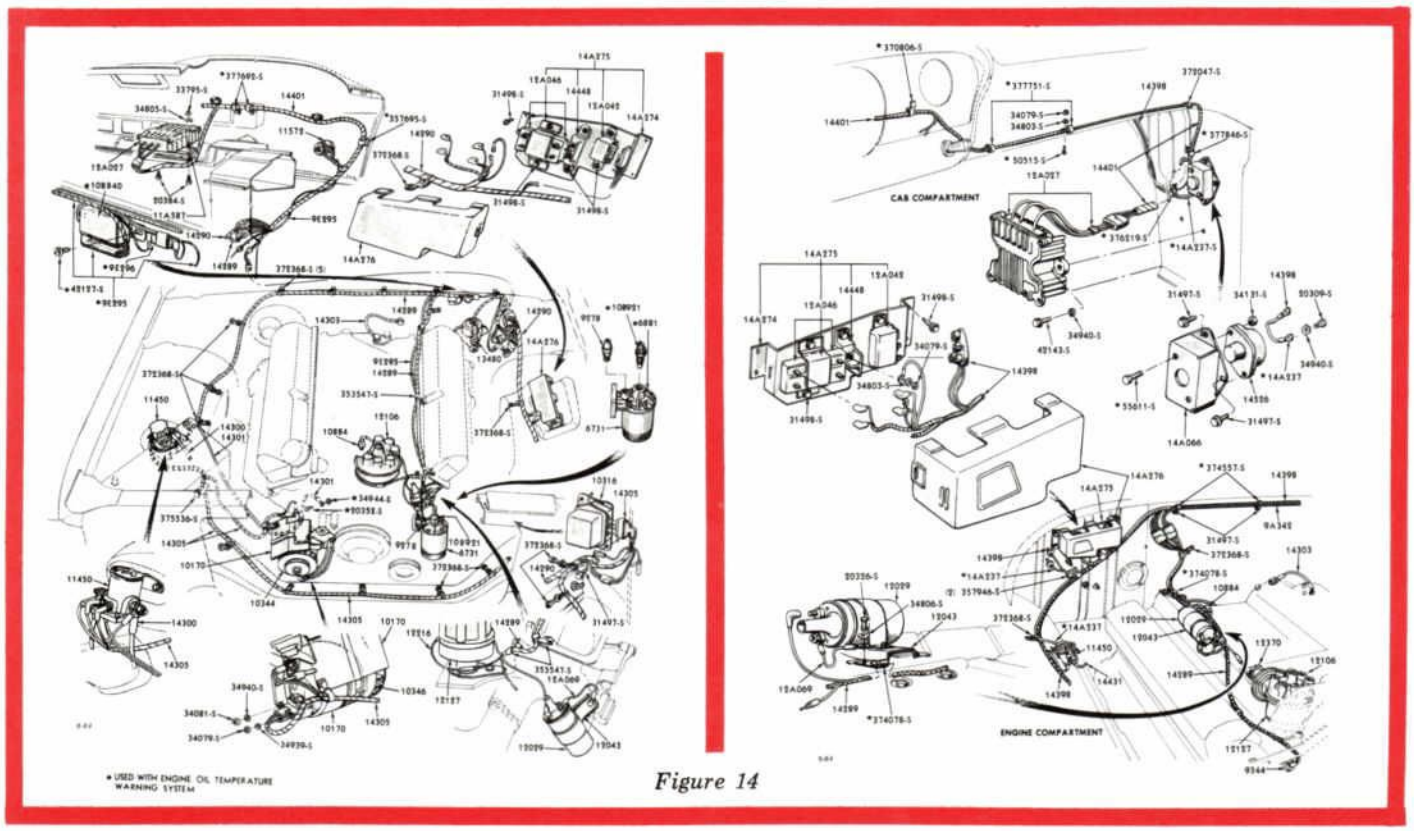


Figure 14

1965 POSITIVE CRANKCASE VENTILATION SYSTEMS

All 1965 Ford-built cars are equipped with a crankcase ventilation system. New York and California require a special type of system that limits the emission of unburned hydrocarbons into the atmosphere. Cars manufactured or sold in these two states must have a system that reburns crankcase fumes through the fuel induction system of the engine. The 240 C.I.D. 6-cylinder engine and 390 and 427 C.I.D. V-8 engines are equipped with the New York-type open system in all states. All other engines are equipped with the open-type system in New York and the closed system in California. Where no special system is used, the engines are equipped with a road draft tube to ventilate the crankcase.

With the open-type system, a jiggle-pin-type emission control valve is used and must be replaced every 12,000 miles. The closed system uses, in addition to the "jiggle-pin" valve, a polyurethane air cleaner filter that must also be replaced every 12,000 miles.

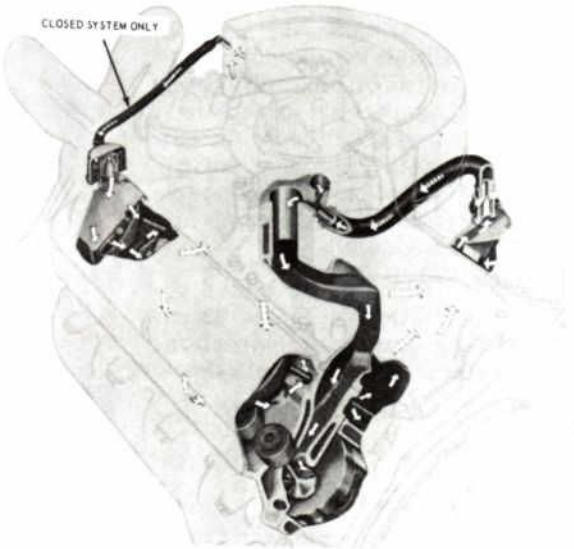


Figure 15

OPERATION

OPEN VENTILATION SYSTEM

The air flow in the positive crankcase ventilation system is shown in Figure 15.

Ventilating air enters the engine through the oil filler cap, which contains a filtering element which filters the incoming air.

From the oil filler cap, the air flows into the front section of the valve rocker arm chamber. The ventilating air moves down past the push rods into the front of the lower crankcase and into the timing chain chamber.

The rotating action of the crankshaft causes the air to flow towards the rear of the crankcase and up into the rear section of the right valve rocker arm cover. The air then enters a spring-loaded regulator valve that regulates the amount of air to meet changing operating conditions. The air is then directed to the intake manifold through the crankcase vent hose. During idle, intake manifold vacuum is high. The high vacuum overcomes the tension of the spring pressure and moves the valve to the "Low Speed Operation" position (Figure 16). With the valve in this position, the ventilating air passes between the valve (jiggle pin) and the outlet port, and there is minimum ventilation.

As engine speed increases and manifold vacuum decreases, the spring forces the valve to the full open position (Figure 16). This increases the flow of ventilating air.

CLOSED VENTILATION SYSTEM

The closed ventilation system is the same as the open ventilation system except that the breather cap is sealed and connected to the air cleaner by a hose (see Figure 15). Thus, the crankcase receives air from the air cleaner. If the system becomes restricted, a back-flow condition will occur, thereby venting the crankcase gases into the air cleaner silencing chamber.

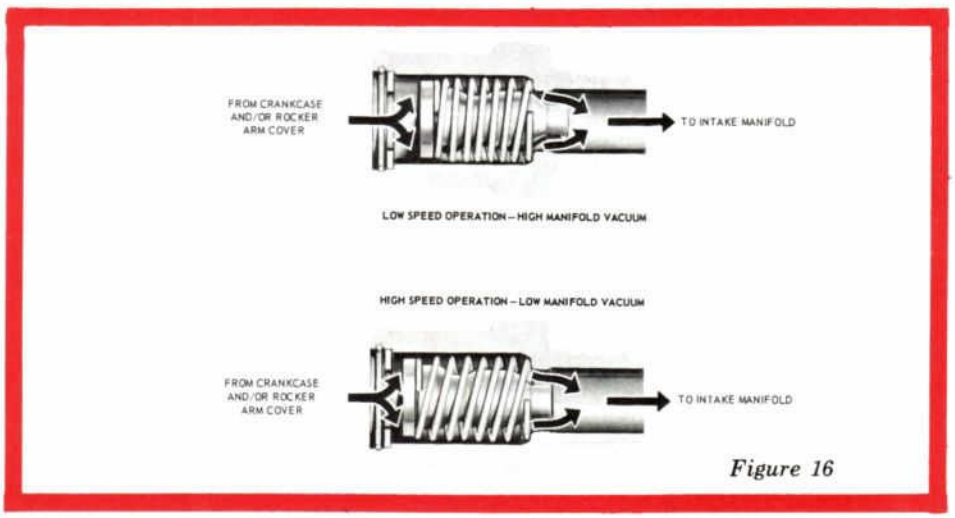


Figure 16

1965 POSITIVE CRANKCASE VENTILATION SYSTEMS, continued

TESTING PROCEDURE

A malfunctioning positive crankcase ventilation system may be indicated by loping or rough engine idle. Do not attempt to compensate for this poor idle condition by disconnecting the crankcase ventilation system and/or making carburetor adjustments. The removal of the crankcase ventilation system from the engine will adversely affect the fuel economy and engine ventilation with resultant shortening of engine life.

To determine whether the loping or rough idle condition is caused by a malfunctioning crankcase ventilation system, perform either of the following tests.

REGULATOR VALVE TEST

Install a known good regulator valve in the crankcase ventilation system.

Start the engine and compare the engine idle condition to the prior idle condition.

If the loping or rough idle condition remains when the good regulator valve is installed, the crankcase ventilation system is not at fault. Further engine component diagnosis will have to be conducted to find the malfunction.

If the idle condition is found to be satisfactory, replace the regulator valve and clean the hoses, fittings, etc.

AIR INTAKE TEST

The PCV System works well only if properly maintained. In order to test its efficiency the AC Tester CT-1 can be used. See Figure 17. This tester will give an accurate visual indication of the need for service.

The tester will check the PCV System used on all Ford engines as well as other make vehicles. Set the tester to number 2 for all Ford engines except 144 and 170 C.I.D. engines, which require a number 4 setting. The tester will let the customer see for himself if he needs emission service. With the exception of the tester setting for Ford engines given above, complete operating instructions are provided with the tester.

Figure 17

CLEANING AND INSPECTION

Do not attempt to clean the crankcase ventilation regulator valve. The oil filler tube breather cap, located on the valve rocker arm cover should be cleaned at the proper mileage interval. On a closed crankcase ventilation system, the oil filler tube cap is not cleanable. Remove the cap and wash it in a low-volatility, petroleum-base solvent. Probe the breather hole(s) to assure removal of any accumulated deposits. Shake the cap dry and install it. Do not dry with compressed air as air pressure may damage the filter element.

Clean the crankcase ventilation system connection on the carburetor spacer or intake manifold (240 Six) by probing the inlet nipple with a flexible wire or bottle brush. Clean the rubber hoses with a low-volatility, petroleum-base solvent and dry with compressed air.

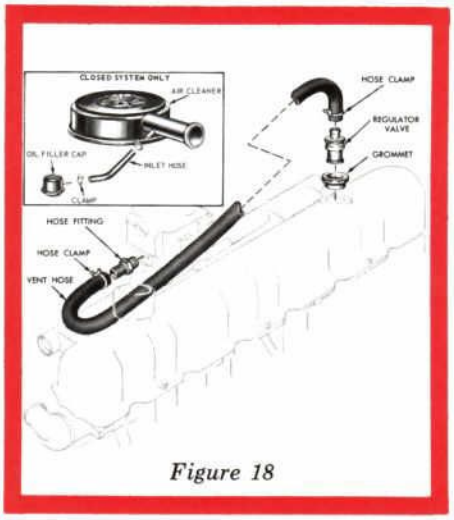


Figure 18

170 & 200 C.I.D. Six Cylinder Engines

The positive crankcase ventilation system components for the 170 and 200 C.I.D. Six-Cylinder Engines are shown in Figure 18.

REMOVAL

1. On a closed ventilation system, remove the inlet hose from the air cleaner and the oil filler cap.
2. Remove the air cleaner.
3. Grasp the crankcase vent hose near the rocker arm cover grommet and pull to remove the regulator valve from the rocker arm cover.
4. Using hose clamp pliers, slide both hose clamps towards the center of the vent hose. Remove the regulator valve from the vent hose and remove the vent hose from the hose fitting in the intake manifold.
5. Remove the vent hose fitting from the intake manifold.

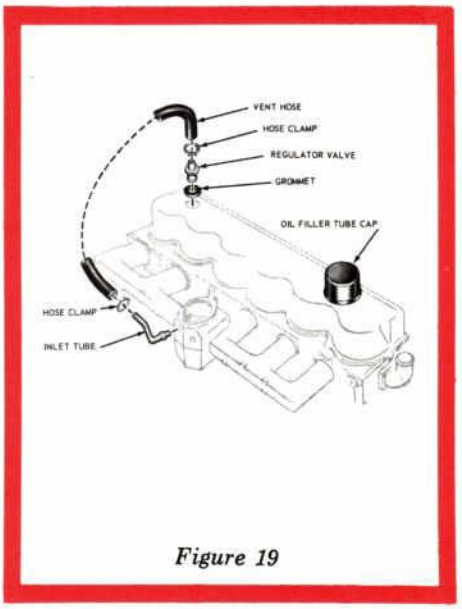


Figure 19

INSTALLATION

1. Install the vent hose fitting in the intake manifold.
2. Position the hose clamps on the vent hose. Install the hose on the fitting in the intake manifold and the

regulator valve in the hose. Using hose clamp pliers, slide the clamps into position.

3. Insert the regulator valve into the rocker arm cover mounting grommet.

4. Install the air cleaner.

5. On a closed ventilation system, connect the inlet hose to the air cleaner and the oil filler cap.

6. Operate the engine and check for leaks.

REMOVAL AND INSTALLATION

240 C.I.D. Six Cylinder Engine

REMOVAL

1. Remove the air cleaner.

2. Grasp the crankcase ventilation regulator valve and pull upwards to remove it from the rocker arm cover.

3. Using hose clamp pliers, slide both hose clamps toward the center of the vent hose. Remove the regulator valve from the vent hose and remove the vent hose from the inlet tube in the intake manifold.

4. Remove the inlet tube from the intake manifold.

INSTALLATION

1. Install the inlet tube in the intake manifold.

2. Position the hose clamps on the vent hose. Install the hose on the inlet tube in the intake manifold. Install the regulator valve in the hose. Using hose clamp pliers, slide the clamps into position.

3. Insert the regulator valve into the rocker arm cover mounting grommet.

4. Install the air cleaner. Operate the engine and check for leaks.

The positive crankcase ventilation system components for the 240 C.I.D. Six Cylinder Engine are shown in Figure 19.

260 & 289 C.I.D. Engines

The positive crankcase ventilation system components for the 260 and 289 C.I.D. V-8's are shown in Figure 20.

REMOVAL

1. Disconnect the automatic choke heat chamber air inlet hose at the inlet tube near the right valve rocker arm cover. Do not remove the choke heat chamber air inlet hose at the air cleaner. On a closed ventilation system, remove the ventilation system air intake hose from the air cleaner and the oil filler cap.

2. Remove the air cleaner and intake duct assembly.

3. Using hose clamp pliers, slide both crankcase vent hose clamps towards the center of the vent hose. Slide the vent hose clamps away from the hot idle compensator (if so equipped). Disconnect the crankcase vent hose at the carburetor spacer, regulator valve and hot idle compensator (if so equipped).

4. Pull the regulator valve and fitting (elbow) out of the valve rocker arm cover mounting grommet.

INSTALLATION

1. Insert the regulator valve and fitting (elbow) into the valve rocker arm cover mounting grommet.

2. Position the hose clamps on the vent hose. Connect the vent hose to the carburetor spacer regulator valve and hot idle compensator (if so equipped). Using hose clamp pliers, slide the clamps into position.

3. Install the air cleaner and intake duct assembly.

4. Connect the automatic choke heat chamber air inlet hose. On a closed ventilation system, install the ventilation system air intake hose to the air cleaner and the oil filler cap.

5. Operate the engine and check for leaks.

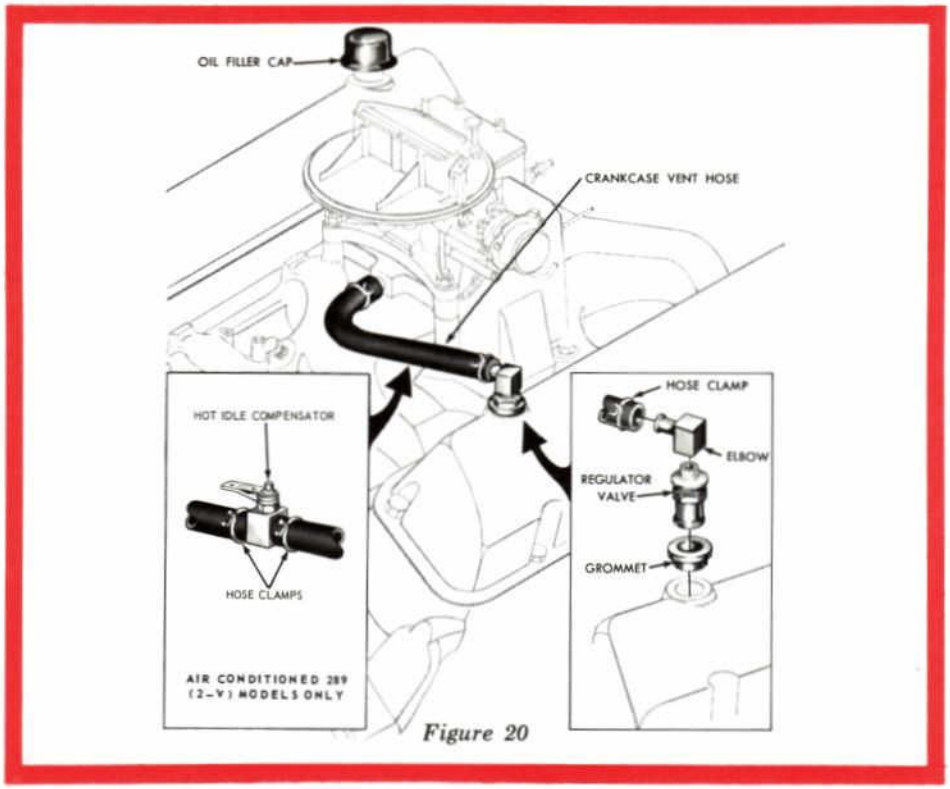


Figure 20

352, 390 & 427 V-8 Engines

REMOVAL

1. Loosen or remove the hose clamps, and remove the vent hose (closed system only) from the air cleaner and/or oil filler tube breather (Figure 15, Page 13). Remove the carburetor air cleaner.

2. Grasp the crankcase ventilation regulator valve and pull it straight upwards and out of the grommet in the right valve rocker arm cover.

3. Use a hose clamp tool to slide both hose clamps off the ends of the regulator valve inlet hose. Remove the inlet hose from the carburetor spacer, and separate the hose from the regulator valve.

INSTALLATION

1. Install the inlet hose and hose clamp on the regulator valve. Install the inlet hose and hose clamp on the carburetor spacer inlet nipple. Position the hose clamps.

2. Install the crankcase ventilation regulator valve in the right valve rocker arm cover (Figure 15). Be sure the grommet is properly seated around the regulator valve and valve rocker arm cover.

3. Install the air cleaner. Install the breather cap vent hose, and tighten or position the hose clamps.

DISTRIBUTOR CAM LUBRICANT

Unsatisfactory operation of ignition contact sets (points) can be attributed to the use of distributor cam lubricant in excessive or insufficient quantities. If excessive amounts of lubricant are applied, this lubricant gets slung off or melts and runs down the channel of the movable point arm to the contact area, where it burns. If insufficient amounts are applied, the rubbing block squeaks and wears rapidly. In either case, point replacement is frequently considered necessary.

To remedy this, Rotunda Cam Lubricant (Ford part number C4AZ-19D530-A) is now available in a convenient 1½ ounce tube. This is a new, improved, high-temperature-resistant lubricant which meets Ford engineering specifications for this purpose.

Application of an even film of this lubricant to the distributor cam is recommended whenever the distributor cap is removed, and in such quantities that *a bead no larger than the head of a match* builds up on the rubbing block after one revolution.

CORRECT METHOD OF RAISING THE ECONOLINE FRONT END

Reports have been received which indicate that 1961-65 Econoline, Station Bus and Club Wagons are being raised with a chain fall attached to the front bumper.

This procedure results in damage to the front bumper arms and face bar, and can contribute to steering gear misalignment.

Please note that these vehicles should always be raised by the axles.

CONVERTING NON-ADJUSTABLE TYPE MUSTANG SEAT TO THE ADJUSTABLE TYPE

An adjustable-type passenger seat was incorporated in Mustang production in May, 1964. Since some owners of Mustangs built prior to that date have requested an adjustable-type passenger seat, an Adjustable Seat Kit has been devised and is available through Ford dealers under Ford part number C5ZZ-6561700-A.

NEW CYLINDER HEAD GASKET—1954-64 239, 256, 272, 292 and 312 C.I.D. Car and Truck Engines

A new rubber composition cylinder head gasket, Ford Part Number C3TZ-6051-G, has been released for the above engines to provide better sealing and to minimize head gasket coolant leaks. This new gasket should be installed without a sealer. Torque and torqueing sequences are the same.

EXCESSIVE BRAKE PEDAL TRAVEL—All Car Lines with Self-Adjusting Brakes

Excessive brake pedal travel on passenger cars with self-adjusting brakes has been found to be the result of one or more of the brake adjuster screw assemblies seizing and failing to operate. To alleviate excessive pedal travel caused by this condition, the following corrective procedure is recommended:

1. Remove all four brake drums.
2. Disconnect the adjusting lever from the secondary shoe and remove the adjuster screw and nut assembly.
3. Disassemble and clean the adjuster screw and nut assembly.
4. Apply a thin, uniform coating of Brake Self-Adjusting Screw Grease (Ford part number C4AZ-19590-A) to the threads of the adjuster screw and reassemble the adjuster screw and nut.
5. Install the adjuster screw and nut assembly to the brake shoes and connect the adjuster lever.

NOTE: As the adjusting screw and nut assemblies are right and left-handed, and interchanging the assemblies from one side of the vehicle to the other will cause the brake shoes to retract rather than expand upon action of the adjuster lever, each assembly should be cleaned and lubricated completely before proceeding to the next assembly.

6. Repeat Steps 3 through 5 for each remaining assembly.
7. Install all drums and adjust brakes.
8. Check brake operation.

HESITATION AND ROUGH IDLE—1963-64 Econoline

Under unusual operating conditions, sand and gravel may enter the carburetor fuel bowl through the vent tube on 1963 and 1964 Econoline models. This dirt can then lodge in idle passages and accelerator pump circuits.

If this condition is encountered, a satisfactory repair can be made by thoroughly cleaning the carburetor and installing an Inline Fuel Filter, Ford part number C2RZ-9155-A, in the vent tube.

Installation procedure is:

1. Remove 7½" from the carburetor end of that portion of the vent tube which routes to the transmission.
2. Connect a 5½" piece of $\frac{5}{16}$ I.D. rubber tube to that part of the vent tube which is attached to the carburetor.
3. Install the outlet side of the inline filter to this $\frac{5}{16}$ I.D. hose.
4. Connect the inlet side of the inline filter to the end of the tube which was shortened in Step 1 with the $\frac{5}{16}$ I.D. hose supplied with the filter.
5. Position tube and inline filter by binding the tubing to prevent interference with the choke and air cleaner.

HESITATION ON ACCELERATION—"ELASTOMETER" VALVE ACCELERATOR CARBURETORS

There have been instances reported where the return spring on the "elastometer" valve accelerator pump has been installed improperly (Ford 2 and 4-venturi carburetors). When this occurs, the valve will not unseat and allow fuel to fill the accelerator pump cavity. Consequently, when accelerating, additional fuel will not be supplied for proper engine operation.

On complaints of hesitation on acceleration, the accelerator pump should be checked for fuel discharge at the pump nozzle. If little or no fuel is being discharged, remove the accelerator pump cover and diaphragm. Inspect the diaphragm return spring for proper installation (see Figure 21). Correct if necessary. Reinstall the diaphragm and cover.

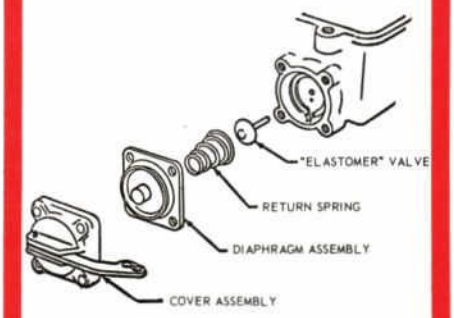


Figure 21