Technical Service Training

SVT

Classroom Training

Student Reference Guide

FCS–13921–REF

SEPTEMBER, 2003

COURSE CODE: 30N04T0

TABLE OF CONTENTS

OBJECTIVES

- Describe the history of the Special Vehicle Team (SVT).
- Describe the SVT hallmarks.

CONTENTS

- History of the Special Vehicle Team (SVT)
- SVT hallmarks

INTRODUCTION

SVT is more than a product—it represents a complete ownership experience. SVT customers are deeply interested in the history, services and resources available to them as owners and drivers. Many times, this interest depends on technician knowledge and enthusiasm for the program which “polishes the Blue Oval.”

SVT HISTORY

SVTI006-A

The First Cobra (1993)

The Ford Special Vehicle Team (SVT) was established in 1991 to "Polish the Ford Oval" by creating low-volume, factory-produced vehicles designed for those select few whose idea of driving is a high-powered, passionate experience — not just a means of getting from point A to point B.

In a move to support this spirited enthusiasm, Ford Motor Company carefully integrated the wide array of talent in the company into a small, cross-functional group of engineers, product planners, and marketing people, housed under one roof with a common mission: to create vehicles specifically designed to meet the unique needs and desires of the knowledgeable driving enthusiast.

The engineers of the Special Vehicle Team brought the first SVT vehicles to market in the 1993 model year. The SVT Mustang Cobra and SVT F-150 Lightning were unveiled at the Chicago Auto show on February 6, 1992.

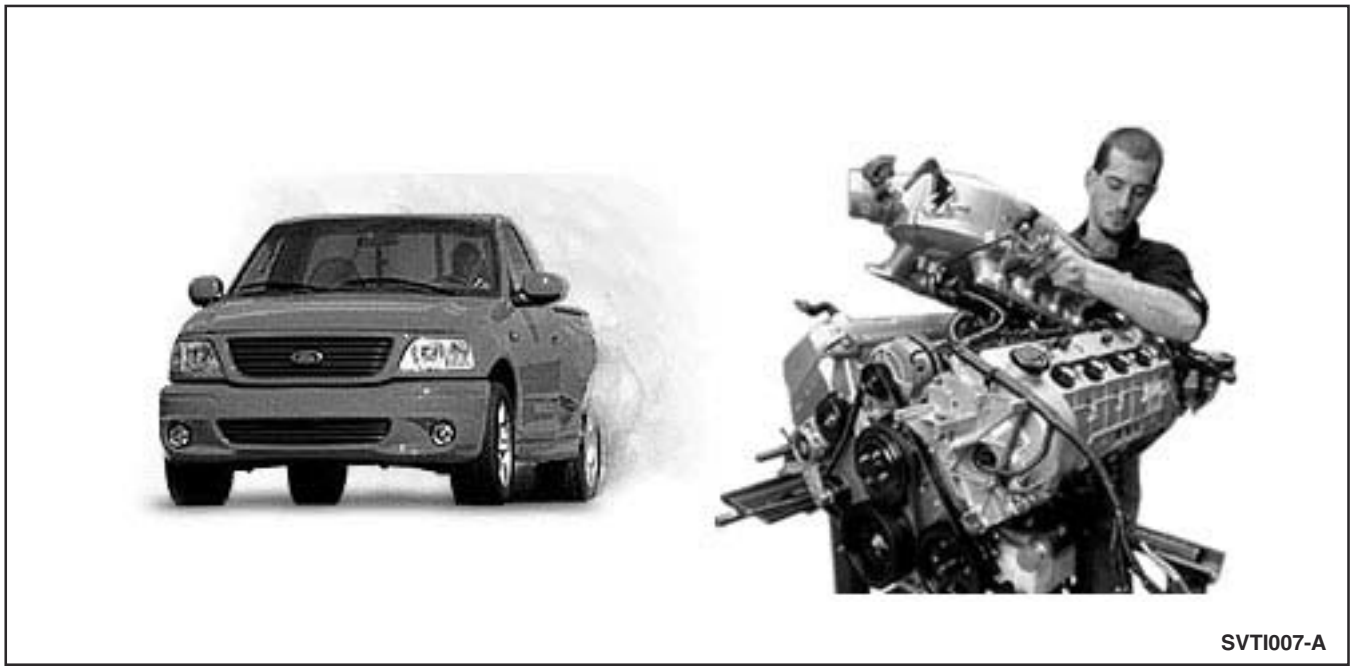
Although the Special Vehicle Team products are high-performance and limited-production vehicles, they are also affordable and well-balanced enough to be driven every day.

SVT HALLMARKS

The SVT hallmarks were created to guide product development with these objectives in mind:

- Performance
- Substance
- Exclusivity
- Value

Performance

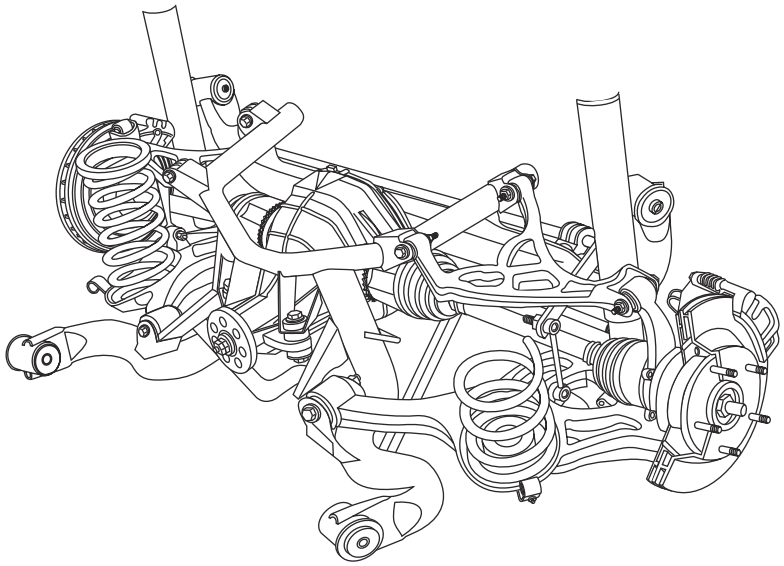


SVTI007-A

1999 Lightning

SVT builds vehicles that compete in different performance segments, against both domestic and foreign competitors. SVT performance begins with more powerful engines which produce quick acceleration and high top speed. However, SVT also focuses attention on other performance aspects of the vehicle, including handling and braking. The objective is a balanced performance vehicle that can stop and turn as well as it goes. SVT is committed to a continuing evolution of performance improvement in its vehicles. Over the years, SVT vehicles have become faster, better handling and more refined.

Substance



SVTI008-A

Cobra Independent Rear Suspension

Race track performance is not SVT's objective. SVT builds vehicles which have the handling characteristics and road finesse necessary for day-to-day driving, as well as deliver impressive performance. For SVT, "Substance" means a "form follows function" design philosophy. All features and systems of SVT vehicles are built with the driver and maximized driving enjoyment in mind. A well-balanced performance vehicle should include a tuned performance suspension and larger, more effective brakes, in addition to improved engine performance. SVT vehicles feature design enhancements that contribute to improved performance. SVT vehicles do not feature "add-on" modifications that do not provide a functional benefit.

Exclusivity

SVTI009-A

Cobra Convertible

Simply stated, SVT creates niche vehicles. SVT does not compromise the product in an effort to sell more—the product is designed with the knowledgeable performance enthusiast in mind. SVT products are uncompromised, more expensive, and by definition, more exclusive.

Periodically, SVT releases limited numbers of certain color and trim packages, which provide customers with a "one-of-a-kind" ownership experience. These packages are highly sought after by collectors. Examples include:

- 1995 Cobra hardtop convertible
- 1996 Cobra with Mystic paint
- 1993, 1995 and 2000 Cobra R models

Value

SVTF010-A

Cobra Convertible and Coupe

SVT vehicles provide a great overall value. They compete with some of the fastest performance vehicles on the road, yet are affordably priced.

OBJECTIVES

Describe the following unique features of the SVT F-150 Lightning:

- Body Options and Miscellaneous Equipment.
- Brake System
- Chassis
- 4R100 HD Transmission
- Exhaust System
- Axles
- Engine
- Engine Performance Features

CONTENTS

BODY COMPONENTS

SVTL001-A

Lightning on the Test Track

Body

The Lightning is a sophisticated sports vehicle whose bold styling captivates the heart of the sports vehicle enthusiast. The Lightning is based on the F-150 regular cab pickup truck. However, the painted fascia, painted outside mirrors, rocker sill extensions, the grill, and rear bumper provide a visual sensation that states that this is not an ordinary pickup truck.

- Regular cab provides a lighter vehicle and the shorter wheelbase versus the extended cab or super crew providing better steering response.
- The only options available on the Lightning are a bedliner and soft tonneau cover.

Colors

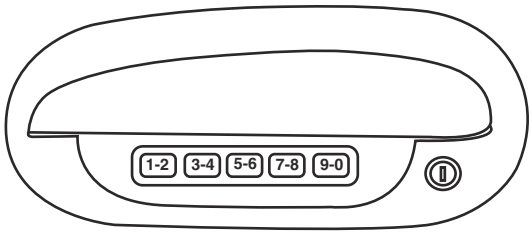
SVTL002-A

Lightning on the Test Track

The SVT F-150 Lightning is available in six exterior colors:

- Black Clearcoat
- Bright Red Clearcoat
- Silver Clearcoat
- Oxford White Clearcoat
- Dark Shadow Grey
- Sonic Blue

Keyless Entry System



SVTL003-A

Keyless Entry Keypad

- The driver door on the Lightning incorporates a keypad for unlocking the vehicle. The keypad is the same as found on the Expedition and Navigator models.
- The combination for the keypad is found in the WDS in the Generic Electronic Module (GEM).
- If there is a concern with the keypad, follow the WDS guided diagnostics and the workshop manual information for the repair procedures.

EXTERIOR

SVTL004-A

Lightning Exterior - Front and Rear 3/4 Views

Exterior appointments provide the Lightning with it unique “fast at the track” styling. Highlights include:

- Headlights, tailights, side markers, LED CHMSL.
- Fog lamps, ground effects, rims and tires.
- A class three trailer hitch and wiring package that became standard equipment in the 2000 model year.
- Dark tinted sliding rear window also became standard in the 2000 model year.
- 18x9.5 wheels and Goodyear Eagle F1-GS unidirectional tires (295/45 ZR-18).
- 14 mm (.55 in) wheel studs.
  - 2000 and newer model year wheels cannot be used on previous models due to lug size.
- Locking lug nuts are standard equipment on the Lightning starting in the 2002 model year.

Since many SVT customers treat their vehicles as prized possessions, rather than mere transportation, they can be more demanding than other Ford customers. Therefore, extra care must be taken when aligning body panels and when doing paint and finishing work.

INTERIOR

SVTL005-A

SVT Lightning Interior

- The Lightning interior is every bit as sporty as the stylish exterior.
- The interior is trimmed in a combination of Ebony textured leather and Medium Graphite cloth.
- Enhanced lateral bolstering on the bottom and backs of the two primary seats add support to offset cornering g-forces.
- The 40/60 split bench has six-way power for the drivers seat, and a center jump seat provides room for a third passenger. Flipped down, the jump seat becomes a convenient central armrest with storage bin and cup holders.
- The instrument cluster contains SVT-signature white-faced gauges, which are electroluminescent and at night change to a blue-green color with brilliant orange needles.
  - The electroluminescent instrument cluster is not seviceable and must be replaced as a unit.
- The cluster includes a boost gauge.

- Standard equipment includes:
  - a premium AM/FM stereo cassette with six-disc in-dash CD changer.
  - power side windows.
  - power door locks.
  - air conditioning.
  - speed control with instrument cluster cruise on indicator.
  - remote keyless entry.
  - SecuriLock passive anti-theft system.
  - overhead console with compass and outside temperature display.
  - autolamps.
- Dual visors and the second grab handle were deleted in the 2002 model year.
- In 2003 the interior was updated to include:
  - New A-pillar handles
  - Satin finish on the door handles
  - New steering wheel wrap
  - High density carpet

BRAKES

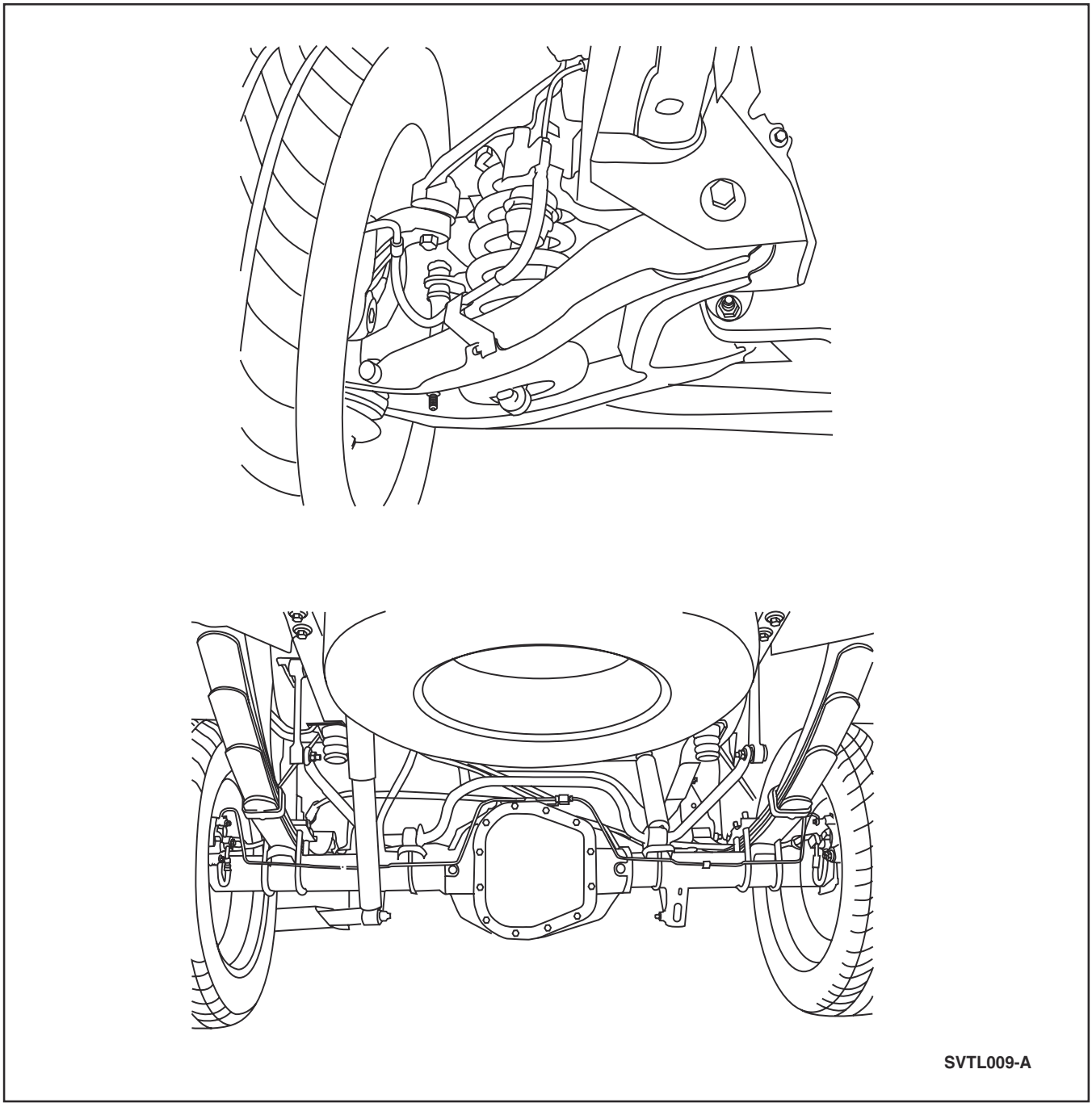
TAW046-A

Lightning Front Brakes

- SVT uses F-250 Super Duty/Expedition brakes as the starting point for the Lightning's four wheel disc system.
- The stronger vacuum brake booster and master cylinder provide excellent feel while creating the power necessary to bring the Lightning's awesome power to a smooth, safe stop.
- The Lightning rotors are 4.0 mm thicker than the rotors on the mainstream F-150.
- When the twin pistons clamp down on the 12.1 inch front rotors, the rotor's internal veins rapidly and effectively dissipate heat that builds up under hard braking.
- The rear rotors are 13.1 inches in diameter and are fitted with single-piston calipers.
- Standard 3-channel 4-wheel Anti-Lock brakes allow the Lightning to stop from 60 mph in just 137 feet.

NOTES

CHASSIS



SVT Lightning Front and Rear Suspension

- The shock and spring rates (front and rear) on the Lightning are higher than the rates on the mainstream F-150 to provide better ride and handling.
- The Lightning is equipped with premium Bilstein gas-filled, monotube shocks.
  - These shocks incorporate a larger shaft.
  - Monotube shocks provide more consistent ride quality over low amplitude road variations because they dissipate heat more efficiently than standard shock absorbers.
- The rear shocks mount on opposite sides of the Lightning's rear axle.
  - Mounting the right side shock to the front of the vehicle limits axle tramp under full throttle acceleration.
  - On the mainstream F-150 the rear shocks are both mounted to the axle from the rear of the vehicle.
- The 23mm solid stabilizer bar in the rear limits body lean and helps balance and traction during cornering.
- The ride height for the Lightning is lower in the front and the rear than the mainstream F-150 for improved handling characteristics.
- The wide tires and the sport suspension on the Lightning provide a responsive sporty feel but also make correct alignment even more critical than on mainstream vehicles.
- A larger steering stop is welded to each lower control arm to prevent the wider front tires from contacting the tire well.

LIGHTNING ALIGNMENT SPECIFICATIONS

ITEM	LH	RH	SPLIT
CASTER	6.7°	7.2°	-0.5 +/- 0.7°
CAMBER	-0.5°	-0.5°	0° +/1 0.7°
TOE*	-0.05° +/- 0.15°	-0.05° +/- 0.15°	-0.10° +/- 0.25°

DOGTRACKING Maximum of 30mm (1.2")**

* Positive value is toe in, negative value is toe out.

** Centerline of front tires compared to centerline of rear tires.

These alignment specifications are specific to the Lighting. If a Lightning is aligned using F-150 specifications, the vehicle will pull to one side.

Road Crown

Roads are built so that the center part of the road is higher than the shoulders of the road. This is called the "Road Crown" and prevents water from pooling on the road. Road crown can make a vehicle that is aligned properly seem to pull to one side. The Lightning is especially sensitive to road crown. Always road test the vehicle to ensure that road crown is not mistaken for improper alignment.

Dog Tracking

Dog Tracking is when the rear wheels do not follow exactly in the path of the front wheels.

STEERING GEAR

- The steering gear was redesigned in 2003 to reduce drift and pull concerns.
  - The steering gear uses a different spline pattern than previous Lightnings or on the mainstream F-150.

Handling Characteristics Note

The following wording is included on a sticker with the SVT Lighthing to provide the customer with information regarding the handling charteristics of a vehicle with low-profile, high-performance tires:

NOTICE:
THIS VEHICLE IS EQUIPPED WITH HIGH-PERFORMANCE TIRES
RIDE, STEERING and TRACKING MAY BE DIFFERENT THAN EXPECTED

Ford Special Vehicle Team engineers have specified a low-profile, high-performance tire for use on your SVT vehicle to deliver the kind of driving dynamics that performance enthusiasts expect. Wide performance tires help put the engine's power to the pavement in the form of traction during straight-line acceleration, and provide for improved handling and roadholding ability during hard cornering. You should know that, while wide-tread, low-profile tires greatly improve the overall performance capability of your vehicle, they also might exhibit certain ride, steering and tracking characteristics that may be noticeably different than standard vehicles.

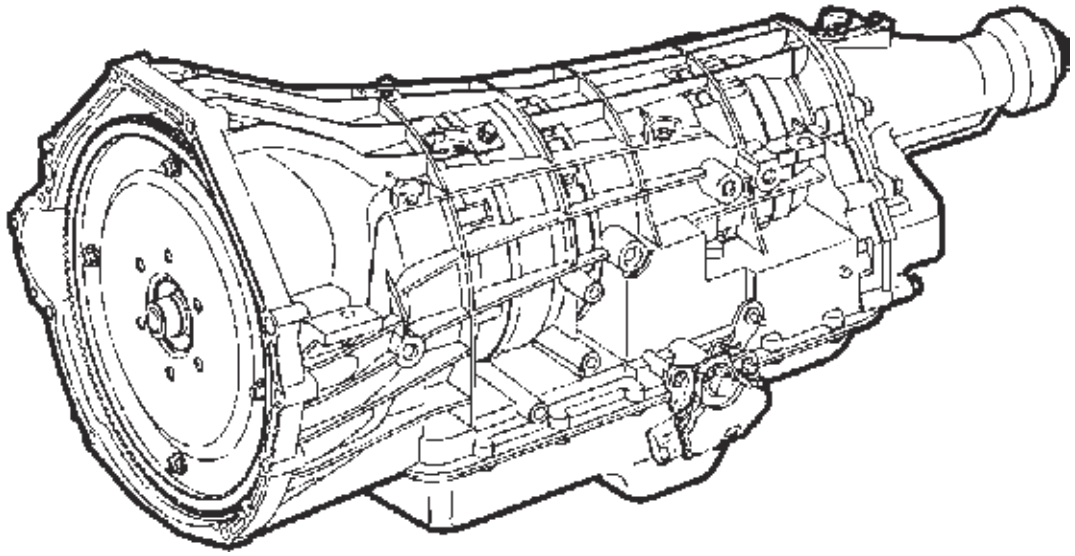
Be advised that you may encounter some steering-wheel feedback while driving on uneven, rutted or grooved pavement. Such left-right dartiness fed back through the steering wheel is a common side-effect from the use of wide-tread, low-profile, high-performance tires and does not necessarily indicate a problem with the vehicle's tires, wheels, steering or suspension.

Should you have any questions or concerns regarding the ride, steering or tracking characteristics of your SVT vehicle, please consult your SVT-certified dealership's service department, or contact the SVT Info Center directly at 800-FORD-SVT (800-367-3788) from 8:30 a.m. to 6 p.m. EST Monday through Friday.

Ford SVT takes pride in its vehicles and strives to maintain a close relationship with our customers. To that end, we make every effort to keep SVT enthusiast owners well-informed and encourage communication with us. The way we see it, the more you know about an SVT vehicle, the more you'll appreciate the SVT hallmarks of performance, substance, exclusivity and value. Enjoy the high-performance qualities of your SVT vehicle!

TO BE REMOVED BY CUSTOMER ONLY!

4R100 HEAVY DUTY TRANSMISSION

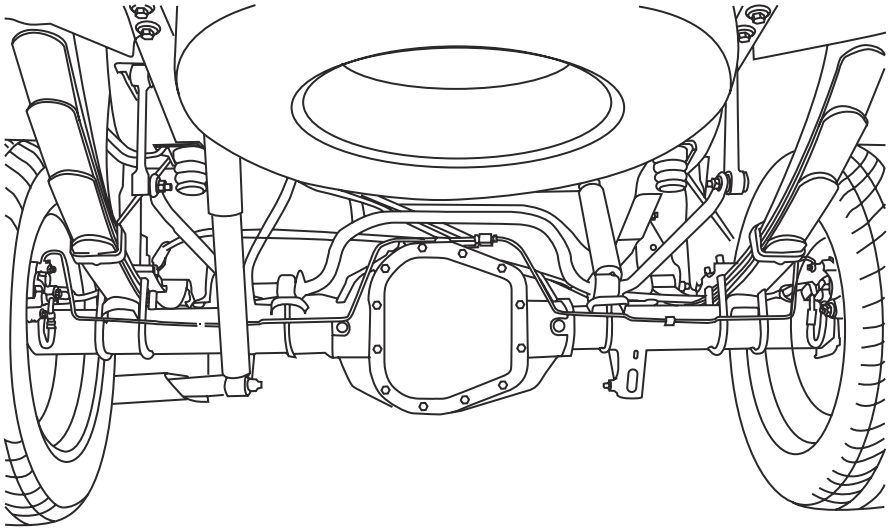


SVTL027-A

- The SVT F-150 Lightning is equipped with a unique 4R100 transmission.
- The external case is the same as the 4R100 on the F-150. However, some of the internal components are from the F-250 7.3L DIT Powerstroke diesel version of the 4R100 transmission to handle the added torque, including:
  - dual plate torque converter
  - clutch packs
  - output shaft
    - These components are more directly affected by the increased torque of the Lightning engine.
- The Lightning is equipped with an Auxiliary Transmission Cooler package, which helps maintain the condition of the transmission fluid.
- As a finishing touch of strength, the slip yoke on the driveshaft is similar to the slip yoke used on the F-250 Powerstroke diesel.

NOTE: Refer to the F-Super Duty Workshop Manual for any diagnosis or repair procedures.

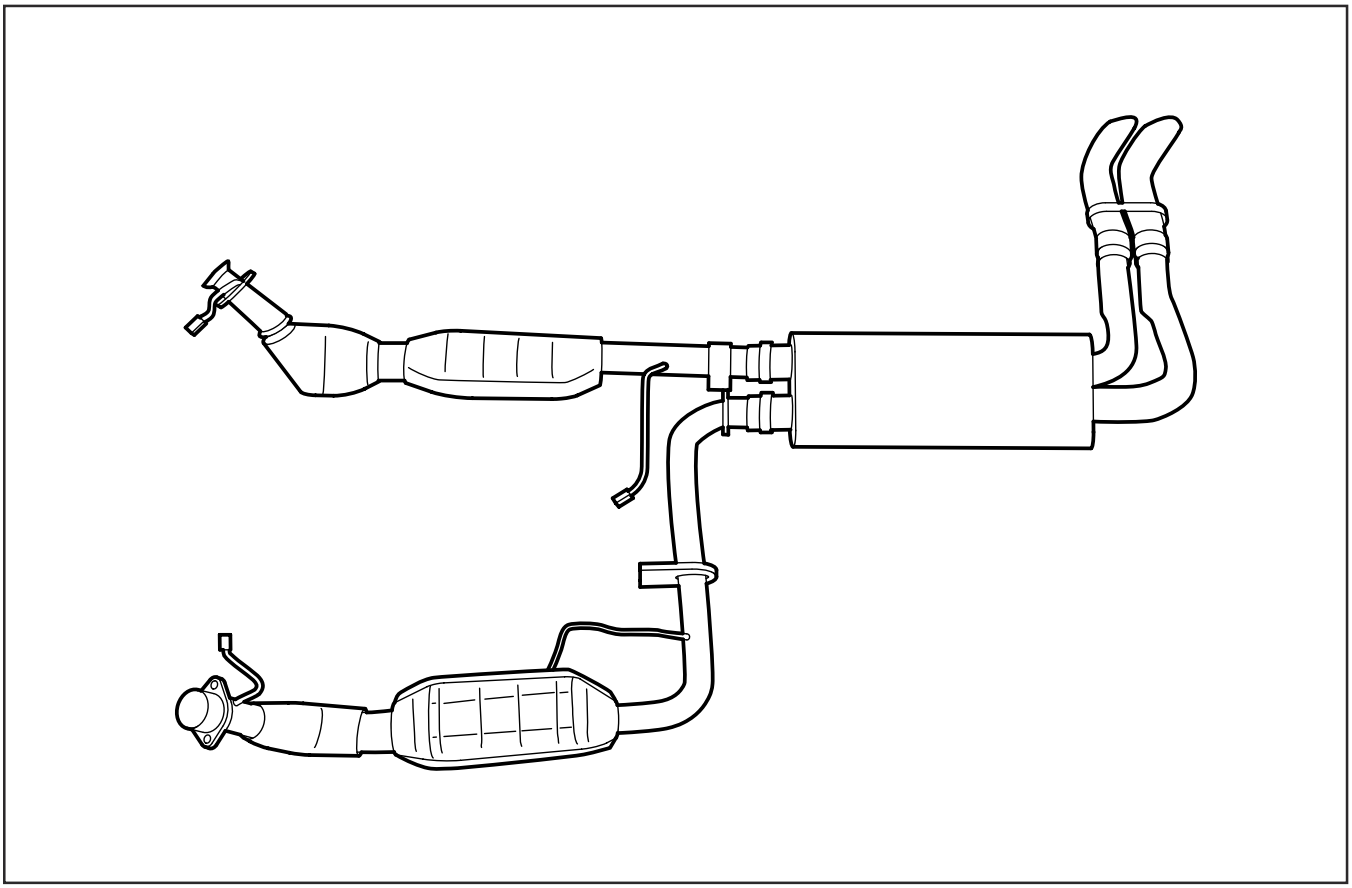
AXLES



SVTL030-A

- The Lightning uses a 9.75 inch limited slip differential borrowed from the beefier Ford Expedition.
- The 1999-2000 Lightning's used a 3.55 gear ratio.
  - In 2001, the gear ratio was revised to 3.73 for improved acceleration.
- The numerically higher ratio gives better off-the-line performance, and also improves the dynamic feel of the vehicle during standing-start launches.
- The Lightning uses a lighter, stiffer aluminum driveshaft than the F-150 for increased safety at 140+ MPH.
- The aluminum driveshaft is required to handle the higher rotational speeds developed with the updated rear axle gear ratio.

EXHAUST SYSTEM



SVT Lightning Exhaust System

- The SVT F-150 Lightning is equipped with a true dual exhaust system. The two exhaust pipes pass through a single muffler with dual flow paths.
  - The exhaust pipes are 2.5 in (63.5 mm) in diameter.
  - The ceramic coated tail pipe tips are 3 in (76 mm) in diameter.
- The catalytic converter used on the SVT Lightning is similar to the converter used on F-150 pick up trucks with California emissions.

ENGINE PERFORMANCE

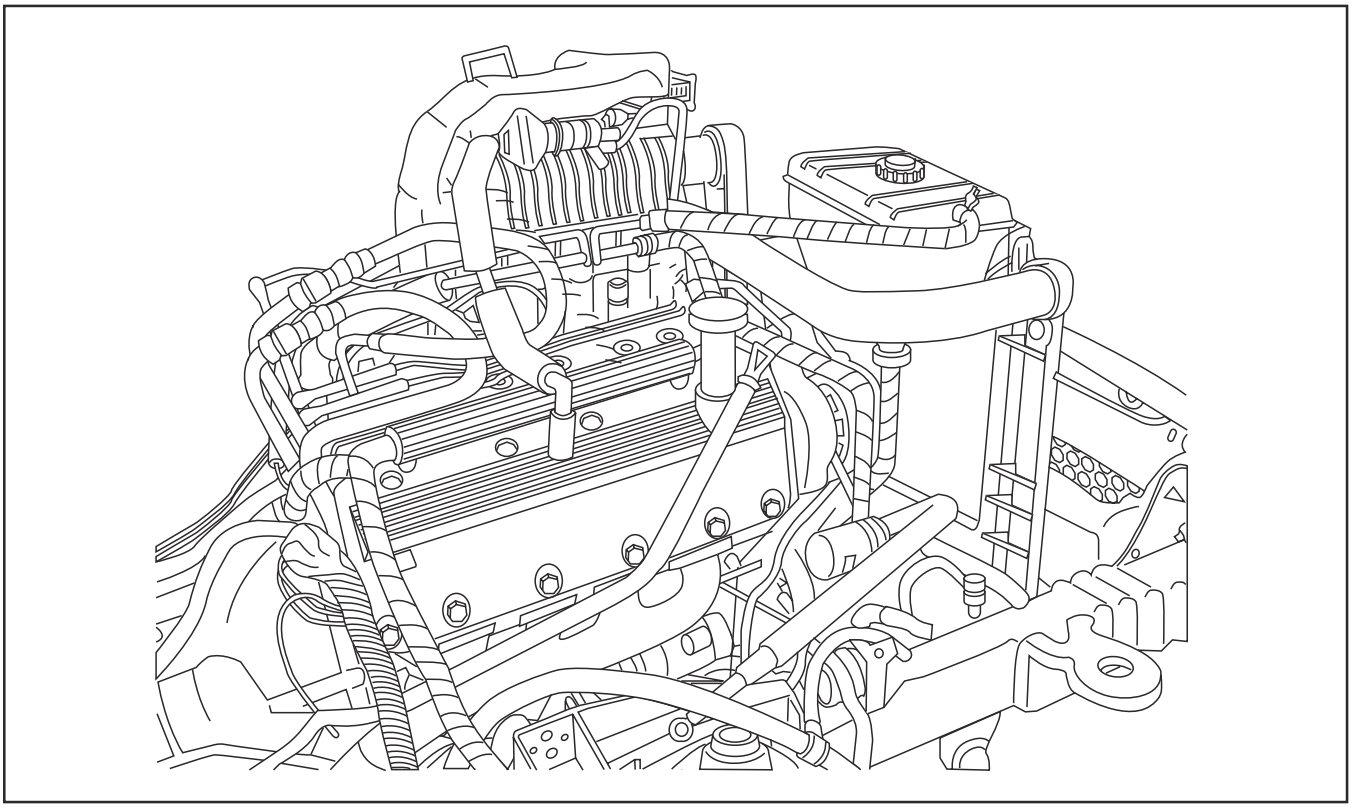
Overview

SVTL011-A

SVT Lightning on the Test Track

- Powertrain enhancements to the Lightning reinforce the vehicle's reputation as the world's highest-performance production pick-up truck.
- Changes that increase airflow in the intake system and a numerically higher final drive ratio were the SVT's primary method for achieving performance improvements.
- All told, powertrain upgrades have cut the Lightning's zero to 60 mph time from 6.2 seconds to 5.8 seconds.
- On the drag strip, quarter-mile times have dropped from 14.6 seconds at 97 mph to 13.9 seconds at 100 mph.
- Horsepower is up to 380 at 4,750 rpm, while torque is rated at 450 foot-pounds at 3,250 rpm.
- Even with outstanding performance numbers like these, the Lightning still meets federal Low Emissions Vehicles (LEV) standards for tailpipe emissions.
- The SVT Lightning achieves increased horsepower and torque by improving the engine's breathing capabilities at several points in the intake system.

ENGINE



SVT Lightning 5.4L Supercharged Engine

- The mainstream F-150 was updated for 2002 and some of the updates were carried over to the Lightning.
- The engine block is strengthened in both the F-150 and the Lightning.
- The front cover was updated for the 2002 F-150 but the front cover on the Lightning vehicles were not.
- 2002 and newer F-150s use 6K front pulleys (formerly 8K). The Lightning still uses the 8K pulleys.
  - The term “8K pulley” refers to the number of grooves in the pulley.
  - The Lightning has 8, the F-150 has 6.
  - The Lightning uses the 8K pulley for improved NVH and durability.

- The crankshaft position sensor and pulse wheel have both been updated in the F-150 and the Lightning.

Engine Comparison

Although the Lightning has the 5.4L engine like the mainstream F-150, there are differences. The differences include:

- Supercharger
- Intercooler
- Air intake changes
- Upper intake
- Lower Intake
- Exhaust system
- Piston and rod assembly.

The 1999 and 2000 5.4L engine in the Lightning used the same cooling fan as the production 6.8L engine. Research indicated that the 5.4L fan provided better cooling. As a result, 2001-2002 Lightnings use the 5.4L fan and the threads in the water pump were revised.

The pistons in the Lightning are dished at the top to reduce cylinder compression from 9.0:1 to 8.4:1 to allow for the use of a supercharger.

- The lower compression reduces spark knock and helps to reduce NOx emissions.

Heavy-duty piston pins provide the extra rigidity needed to handle the extra combustion pressure created by the supercharger.

Air Flow

SVTL018-A

Air Intake Components

- Delivering enough air to the cylinders can be the most difficult part of building a high performance engine.
- The air is drawn into the air tubes through the inlet in the fender.
- The air inlet in the fender is larger in the Lightning than in the mainstream F-150.
- From the air inlet in the fender the intake air travels through the first air tube to the air filter assembly.
- The first air tube is a larger diameter in the Lightning than in the mainstream F-150.
- The air flows across the mass air flow (MAF) sensor and the first of two intake air temperature (IAT) sensors.
- The 2001 and newer model year Lightnings use a 90mm MAF sensor.
  - Previous model Lightning's used an 80mm MAF sensor.
- The air passes through the second air tube, the throttle body and into the supercharger.
- The supercharger compresses the air to allow more air to be forced into the cylinders than is possible in a naturally aspirated engine.
- More air in the cylinders allows the PCM to add more fuel without causing a rich condition.
- The combination of more air and more fuel produces more power.

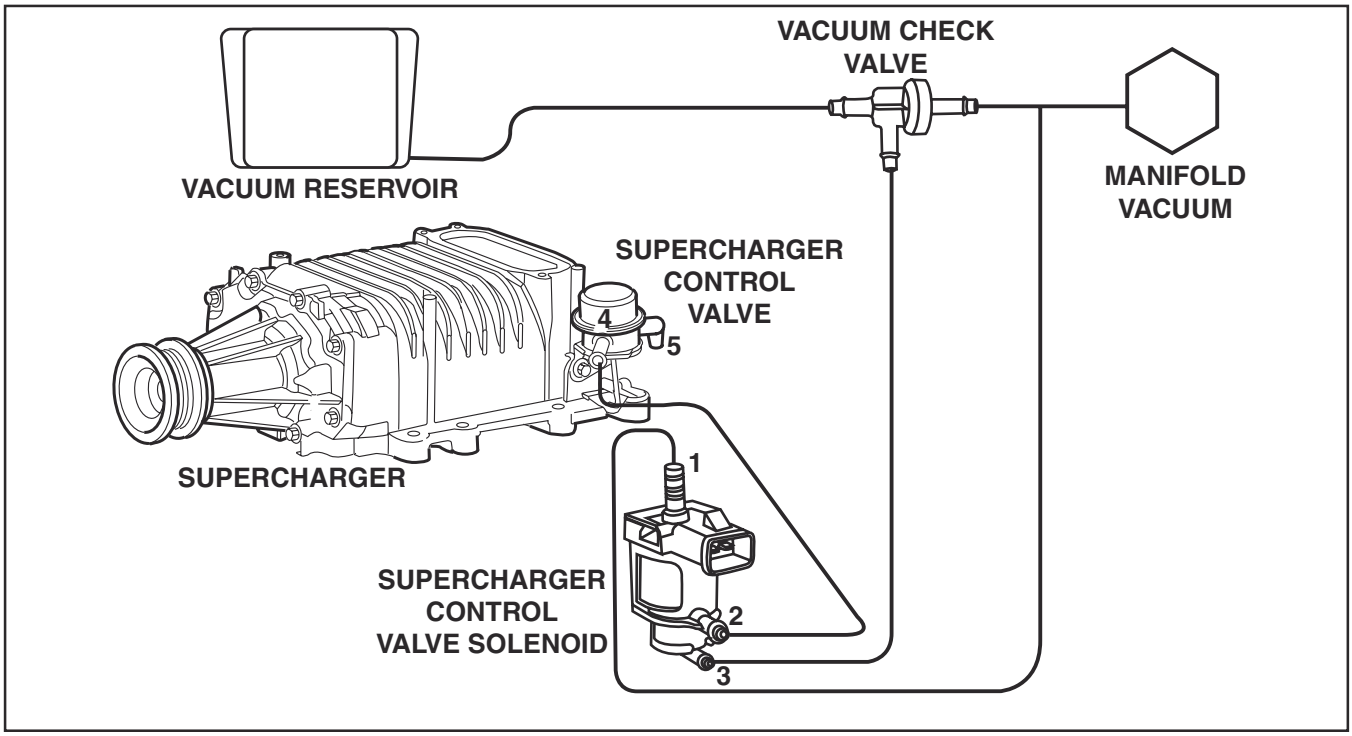
Supercharger

SVTL031-A

Eaton Roots-Type Supercharger

- The belt driven Roots-type supercharger:
  - is mounted above the engine valley.
  - has a cast-aluminum housing and aluminum internal rotors.
  - can provide up to 8 psi of boost, resulting in increased torque and horsepower.
- An analog boost gauge on the dash allows the driver to monitor supercharger operation.

Supercharger Boost Control



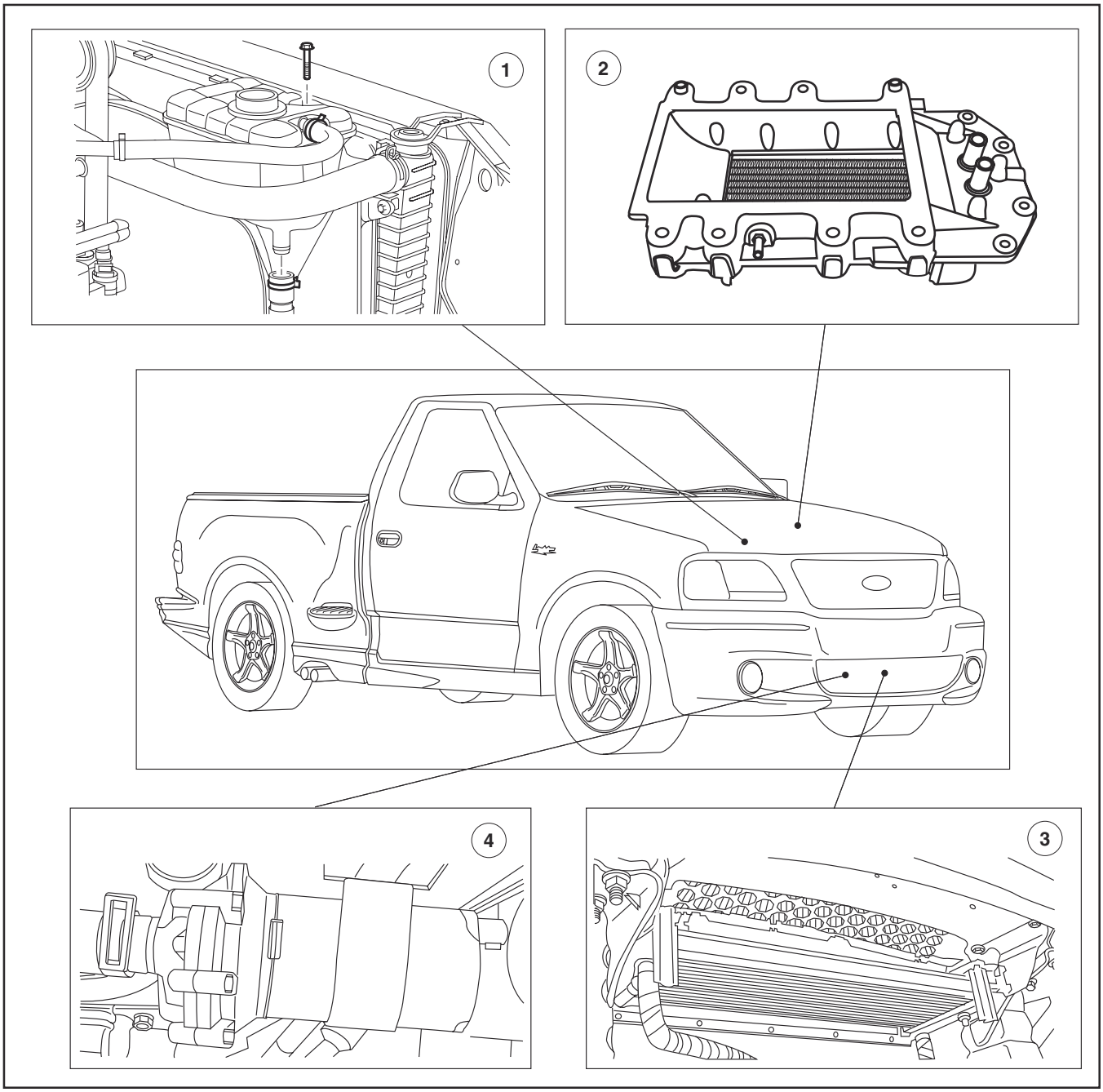
Supercharger Boost Control

Supercharger Boost Control System

- If intake air were always allowed to pass through the supercharger vanes, there would be more pressure than required during low engine load and fuel economy would decrease.
- To prevent this, a supercharger boost control valve is used to send air pumped through the supercharger back into the fresh air inlet (area above the vanes) during low engine load.
- The valve is controlled by manifold vacuum.
  - When engine load is low, high manifold vacuum opens the valve, allowing intake air back into the inlet.
  - As engine load increases, manifold vacuum is reduced, closing the valve and pressurizing intake air.
- The supercharger boost control solenoid (SBCS) is failsafe device that provides vacuum to the boost control valve during periods of low engine vacuum.
- The solenoid is activated (dumps boost pressure) under the following conditions:
  - Cylinder head temperature (CHT) greater than 113°C (236° F).
  - Secondary intake air temerature (IAT2) greater than 121°C (250° F).
  - Transmission fluid temperature (TFT) greater than 149°C (300°F).
  - Engine misfire is greater than 3%-5% (may cause emissions failure or catalyst damage).
  - Engine speed greater than 5400 rpm.
- The vacuum comes from a reservoir located under the hood on the right fender well behind the battery.

NOTES

Intercooler



Intercooler System Components

Item	Description
1	Coolant Reservoir
2	Charge Air Cooler
3	Intercooler Radiator
4	Coolant Pump

- The supercharged air passes through a charge air cooler that is mounted to the lower surface of the upper intake manifold, below the supercharger outlet port.
- When the air is compressed in the supercharger, the temperature of the air charge increases.
- The charge air cooler removes heat from the compressed air to reduce the temperature of the intake air before it reaches the cylinder.
  - The intercooler system transfers heat from the air to the fins of the charge air cooler and then to the coolant, which is circulated through the intercooler cooling system to the intercooler radiator.
- Reducing the temperature of the intake air increases the density of the air, resulting in greater combustion pressures and more engine power output.
- The coolant in the intercooler system is completely independent of the engine cooling system.
- The coolant is a 50/50 mix of anti-freeze and distilled water.
- Coolant is circulated through the intercooler system by an electric pump.
  - The coolant pump motor is turned on and off by a PCM controlled relay.
- Heat is transferred from the radiator to the surrounding air and the coolant is again circulated to the charge air cooler to complete the cycle.

Secondary Intake Air Temperature Sensor

- After the air is cooled by the air charge cooler, a second IAT reads the temperature of the air charge.
- The temperature of the air entering the cylinders is used to adjust the fuel trim.
  - If there are concerns with the downstream IAT, the fuel trim may be artificially rich.
- The secondary IAT is also used to activate the intercooler pump.
  - The pump relay is turned on when the secondary IAT value is approximately 70° F (21°C).
- The PCM uses two different codes for the IAT sensors, one for upstream and one for downstream.

Barometric (BARO) Pressure Sensor

- In order to more acurately deliver fuel, the Lightning uses a barometric (BARO) pressure sensor to measure the density of the ambient air.

Knock Sensors

- Although the knock sensors are correctly wired in the engine the knock sensors are not used by the PCM.

Diagnosis

- Concerns relating to the supercharger and the intercooler may include:
  - lack of power.
  - idle concerns.
  - white smoke from the exhaust.
  - excessive whine from the supercharger.

Lack of power

- A lack of power concern may indicate that the supercharger is not functioning properly. Possible causes include:
  - loose or broken belt or pulley.
  - malfunctioning bypass valve.

Idle concerns

- Idle concerns related to the supercharger may be caused by:
  - leaking gaskets.
  - malfunctioning bypass valve.
  - leaking intercooler.

White smoke from the exhaust

- White smoke from the exhaust may be caused by a leaking intercooler.

Excessive Whine From the Supercharger

- An excessive whine from the supercharger may indicate that the supercharger bearings are worn or damaged.
  - The bearings cannot be replaced separately.

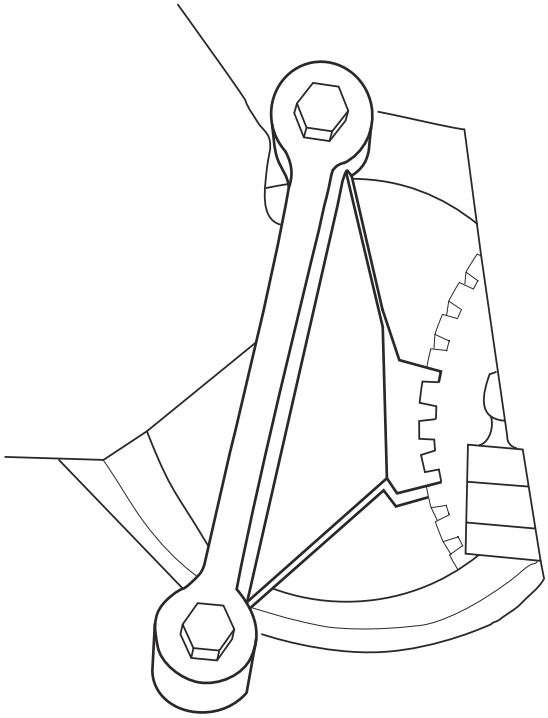
Repair

Supercharger Repair

- The supercharger is not serviceable and must be replaced as an assembly.
- The oil level in the supercharger gear case should be checked and filled (if low) at the 30,000 mile service interval.

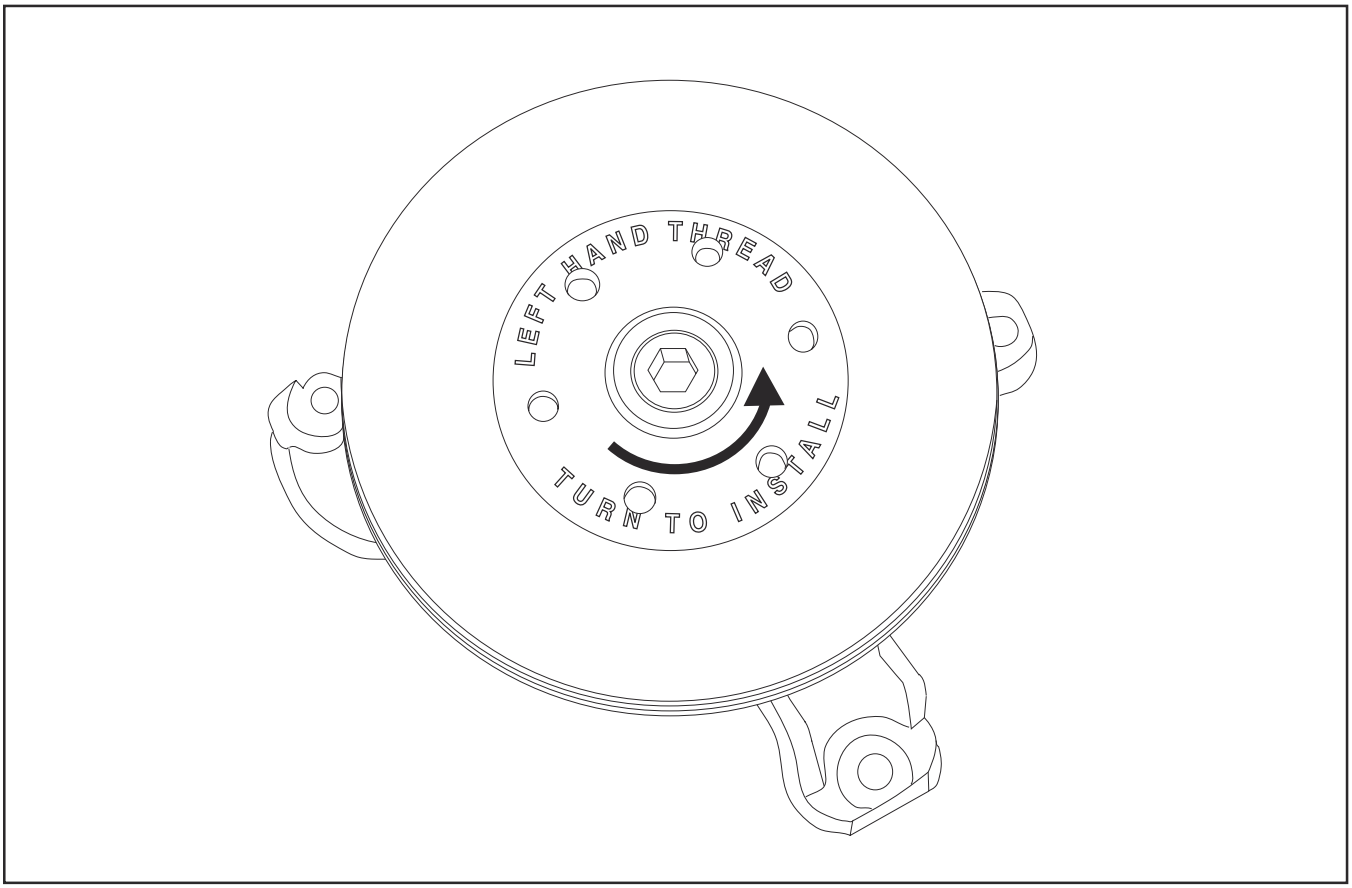
The supercharger uses Synthetic Supercharger Fluid: E9SZ-19577-A, Ford specification: ESE-M99C115-A

Accessory belt replacement



Flywheel Locking Tool (303-673)

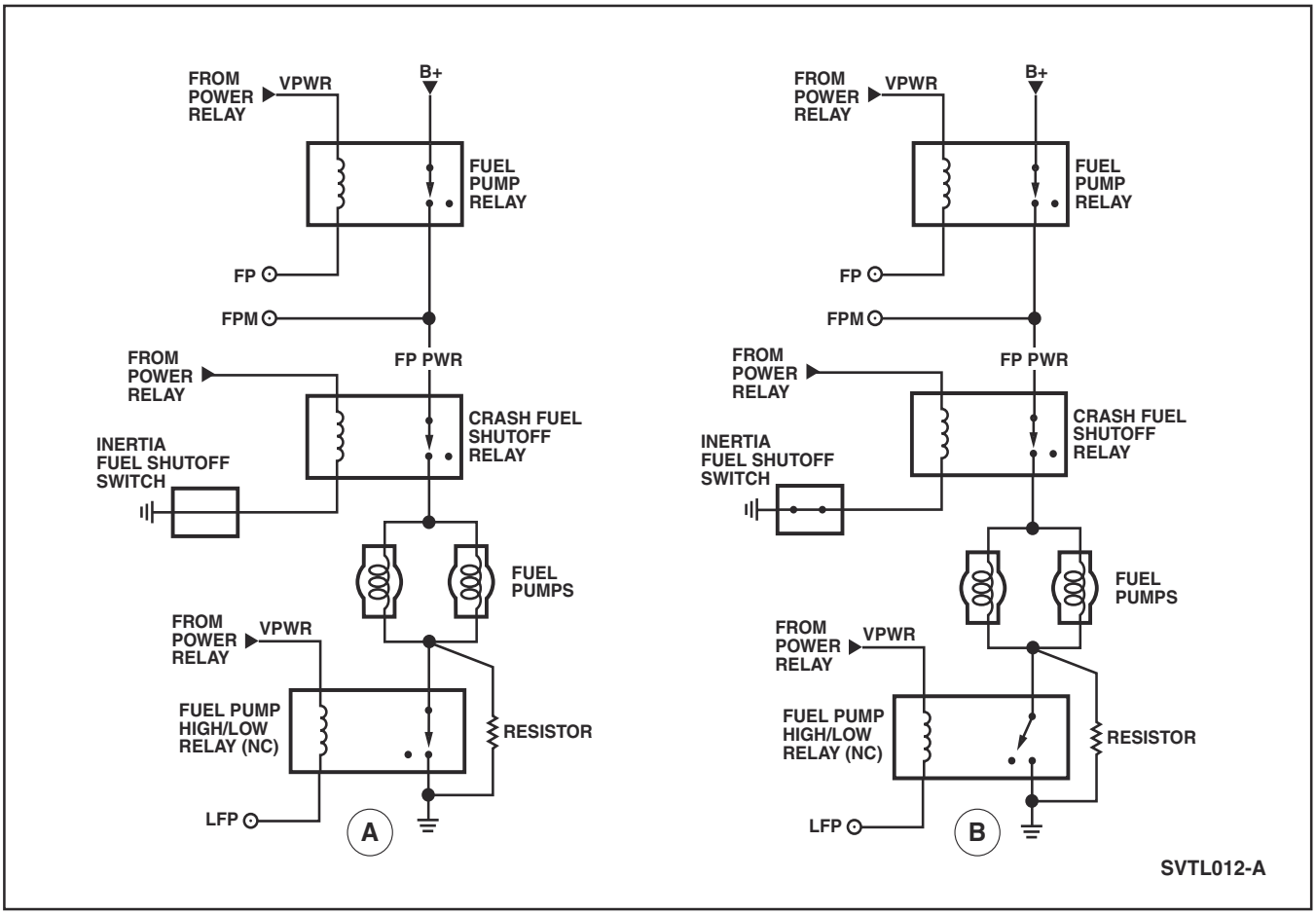
- In order to replace the accessory belt, the supercharger belt, the idler support bracket, and the crankshaft extension (supercharger drive) pulley must be removed.
- Remove the supercharger belt.
- Remove the starter and use the flywheel locking tool (special tool number: 303-673) to hold the flywheel in place and prevent the crankshaft from rotating.



Crankshaft Extension Pulley and Support Bracket

- Remove the three bolts that attach the crankshaft extension pulley support bracket.
- Remove the crankshaft extension pulley and support bracket using a 14 mm hex wrench.
- Loosen the belt tensioner and remove the belt.

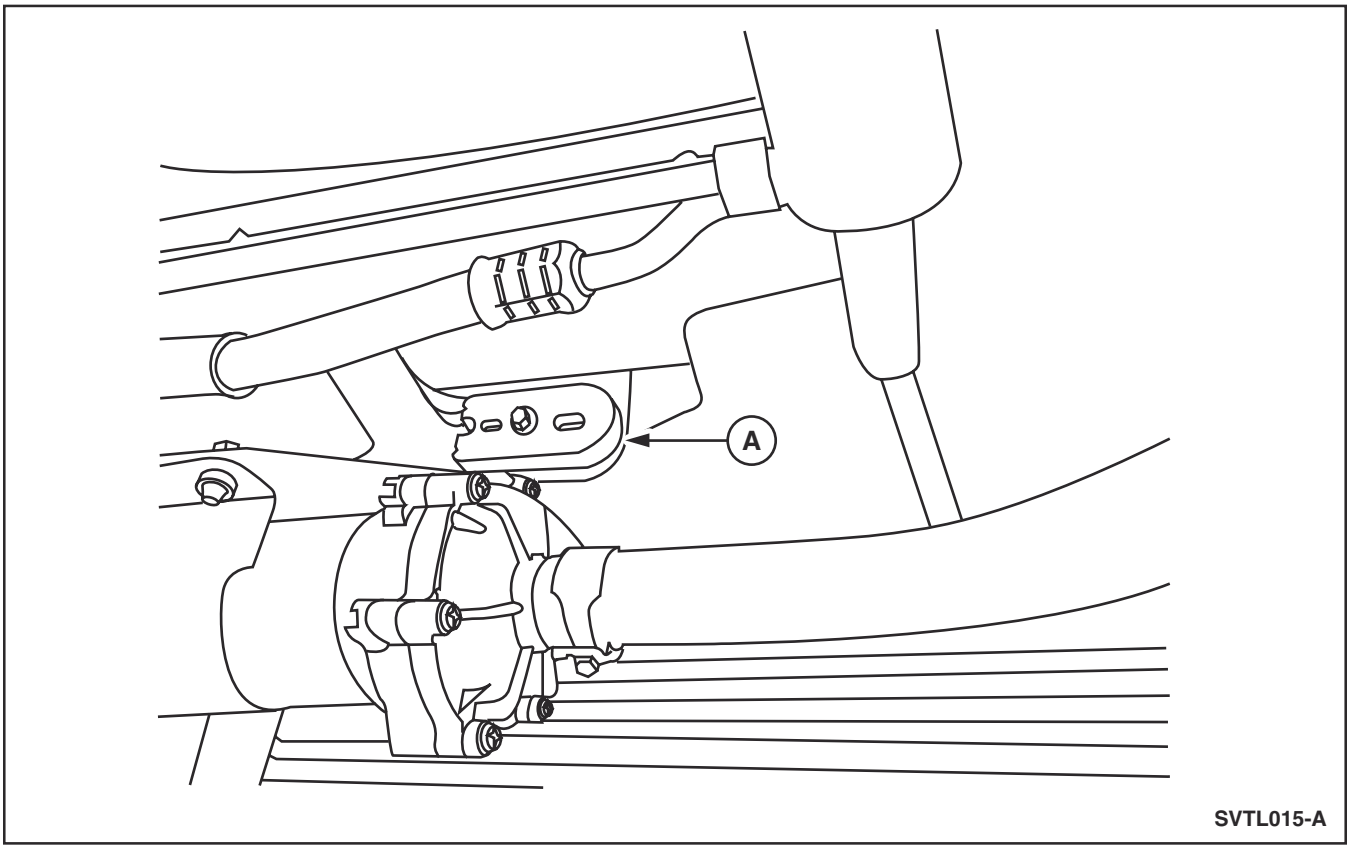
Fuel Pumps



Fuel Pump Wiring Diagrams in High (A) and Low (B) Speeds

- The fuel system on the Lightning utilizes two fuel pumps on a single fuel delivery module.
- The pumps are wired in parallel and operate at two speeds: high and low.
  - During periods of heavy engine load, both pumps operate at high speed.
  - As engine load decreases, both pumps are commanded to low speed by the PCM.
- Pump speed is controlled on the ground side by the PCM energizing or de-energizing the fuel pump high/low relay.
  - When the relay is commanded “on” by the PCM **(B)**, the current to the fuel pump must pass through a dropping resistor on the ground side of the circuit.
    - The current drop created by the resistor reduces pump speed.
  - When the relay is commanded “off” by the PCM **(A)**, The current travels directly to ground.
    - When the current travels directly to ground, pump speed is high.

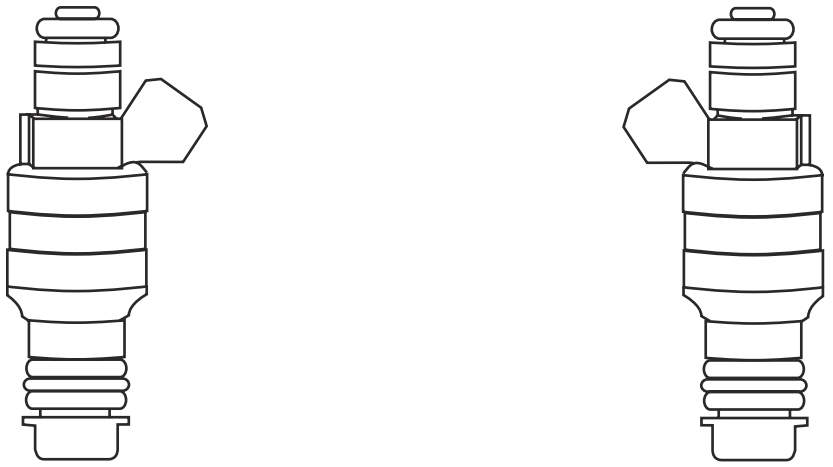
Fuel Delivery



- The resistor **(A)** is located on the radiator support next to the supercharger intercooler pump motor.
- The inertia fuel shutoff switch completes the path to ground to the inertia switch relay.
- If the vehicle is jarred hard enough, the inertia switch opens, de-energizing the inertia switch relay, breaking the current flow to the fuel pumps.
- The SVT F-150 Lightning does not have an inertia-switch-activated indicator in the instrument panel.

NOTE: The fuel pump relay, inertia switch relay, and low speed fuel pump relay are all supplied voltage through the number eighteen fuse in the battery junction box, which is supplied voltage by the PCM power relay located in the battery junction box.

Fuel Injectors



SVTL016-A

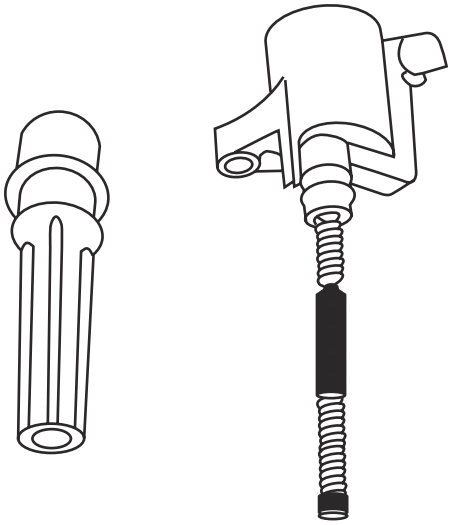
Higher Flow Injectors

- Since the supercharger can draw in more air, the Lightning uses different fuel injectors than the F150 to make use of that air with more fuel, to produce more power.
- The Lightning fuel injector has a maximum flow rate of 42 pounds of fuel per hour.
- The F1-50 fuel injector has a maximum flow rate of 19 pounds per hour.

Fuel Injector Flow Test

- The injectors used in the Lightning cause the results of the WDS injector flow test to have slightly different results.
- When performed on the F-150, the WDS injector flow test should indicate an injector "on time" of around 150 milliseconds.
- When performed on the Lightning, the WDS injector flow test should indicate an injector on-time between 50 - 90 milliseconds.

Ignition



SVTL017-A

Ignition Coil and Boot

- The PCM controls the exact spark timing to produce maximum power.
- The ignition system on the Lightning is the same as the ignition system on the mainstream F-150.
- The spark plugs used in the Lightning have a cooler heat range.

TECHNICAL DATA

Engine

Configuration:	Longitudinally mounted, single overhead cam, 90 degree Triton™ V-8, supercharged/intercooled, cast iron block, aluminum-alloy heads, forged steel crankshaft.
Bore x Stroke:	90mm x105.6mm
Displacement:	5,410cc
Compression Ratio:	8.4:1
Horsepower:	380 hp @ 4,750 rpm
Torque:	450 lb.-ft @ 3,250 rpm
Specific output:	70.2 horsepower per liter
Redline:	5,250 rpm (fuel shut off @ 5,400 rpm)
Valve Train:	Single overhead camshafts, chain drive, roller finger followers with hydraulic lash adjustment, beehive valve springs, two valves per cylinder
Intake Valves:	1 per cylinder 44.5mm head diameter
Exhaust Valves:	1 per cylinder 36mm head diameter
Fuel system:	Sequential electronic fuel injection, premium calibration
Induction system:	Pressure charged with Eaton™ Corporation Generation IV Roots-type supercharger; water-to-air intercooler.
Supercharger:	8.0psi pressure
Mass-air sensor:	90mm diameter
Exhaust Manifolds:	Cast-iron tuned header-style manifold.
Exhaust system:	Tuned dual exhaust, ceramic-coated dual exhaust tips

Drivetrain

Transmission	Four-speed automatic (4R100)	
Drive Shaft	4.5-in Aluminum	
Rear Axle	9.75-in ring gear with limitied slip differential, 3.73:1 gear ratio	
Gear	**Ratio**	**Maximum Speed in Gear**
1st	2.71	43 mph (68 km/h)
2nd	1.53	76 mph (123 km/h)
3rd	1.00	119 mph (191 km/h)
4th	0.71	142 mph (228 km/h)
Reverse	2.176	

Suspension

Front	Short- and long-arm type, coil springs, tubular gas-charged Bilstein shock absorbers, 31mm solid stabilizer bar
Rear	Solid axle, staggered gas-charged Bilstein shock absorbers, five-leaf springs, 23mm solid stabilizer bar

Steering

Type	Recirculating ball, power assist **Gear Ratio** 14.0:1
Turns	**3.3 lock to lock**
Turning diameter	44.3 ft.

Brakes

Front	12.1 in (308mm) vented disc, twin piston caliper
Rear	13.1 in (334mm) vented disc, single piston caliper
ABS	Four-wheel, three sensor system

Dimensions, Capacities

Wheelbase	119.8 in. (3,043 mm)
Length	208 in. (5,283 mm)
Height	70.9 in (1,801 mm)
Width	79.1 in. (2,009 mm)
Track, f/r	65.3 in. /65.3 in. (1661 mm/ 1661,mm)
Head room	40.8 in. (1,036 mm)
Leg room	40.9 in. (1,039 mm)
Shoulder room	63.8 in. (1621 mm)
Hip room	61.0 in (1,549 mm)
Curb weight	4,670 lb. (2,120 kg)
Fuel capacity	25 Gallons (94.62 liters)
Weight Distribution f/r	57% / 43%
Payload	1350 lb. (363 kg)
Towing capacity	5,000 lb (2,270 kg)

Performance

0-60 mph	5.8 seconds
Quarter mile	13.9 seconds @ 100 mph
0-100 km/h	5.9 seconds
0-100-0 mph	22.0 seconds
Top speed	142 mph (228 km/h)
Braking	60-0 136 ft
Braking	80-0 238 ft
80 ft. slalom	63.6 mph
100 ft. skidpad	0.85g
Fuel Economy (estimated)	13 mpg city, 17 mpg highway

Horsepower and torque numbers are the mean of test results generated according to Society of Automotive Engineers Standard J1349. Performance data are generated under closed course conditions on a test track according to procedure R-403. Observed data are corrected to standard ambient conditions. Vehicle weight is corrected to production curb weight plus 300 pounds. Many factors may affect vehicle performance.

NOTES

OBJECTIVES

After completing this course, the technician will be able to describe the differences between the mainstream Focus and the SVT Focus regarding the following systems:

- Body Features and Miscellaneous Equipment
- Suspension Systems.
- Brake Systems
- Getrag Transaxle
- Clutch and Pressure Plate
- Axles
- Powertrain Components
- Engine Performance Components

CONTENTS

BODY

Exterior

SVTF001-B

SVT Focus

The SVT Focus is the latest performance value from Ford SVT, and the team's first entry into the compact, front-wheel-drive performance market niche, often called the "hot hatch" segment. The SVT Focus enters this segment with a significant performance value advantage.

- The exterior of the SVT Focus is based on the Focus ZX3 with some unique SVT components.
- SVT unique body components include:
  - SVT fog lamps
  - Tailgate mounted rear spoiler
  - Front fascia, with driving lights
  - Rear emblem including SVT Logo
  - Honeycomb mesh front grille
  - Rear bumper with mesh honeycomb grille
  - Variable intermittent wipers
  - Rear window defrost (standard)
  - Speed dependent front wipers
  - Body color rockers, side moldings and door handles
  - Painted power heated foldaway front mirrors
  - Sunroof (Optional)
  - Blackened Headlamps

Tire Clearance

- There is less tire clearance on the SVT Focus because of the extra room taken up by the massive 215/45R17 Continental Sport Contact tires.
  - These tires have been specifically tuned to match the suspension and character of the SVT Focus.
- The Continental Sport Contact tires are wrapped around a 17" x 7" aluminum 6-spoke wheel for better road holding capability and looks.
- The tires on the SVT focus are outstanding on wet or dry surfaces, but are not great on snow.
  - The owner guide suggests using snow tires if you are in an area where snow is likely.

Colors

- The SVT Focus is a prime example of the SVT design philosophy which seeks to subtly emphasize the vehicle's capabilities.
- Along with the colors of the European Appearance package, the following colors are available:
  - Infra-Red
  - CD Silver
  - Pitch Black
  - Sonic Blue

5-Door

SVT Focus 5-Door

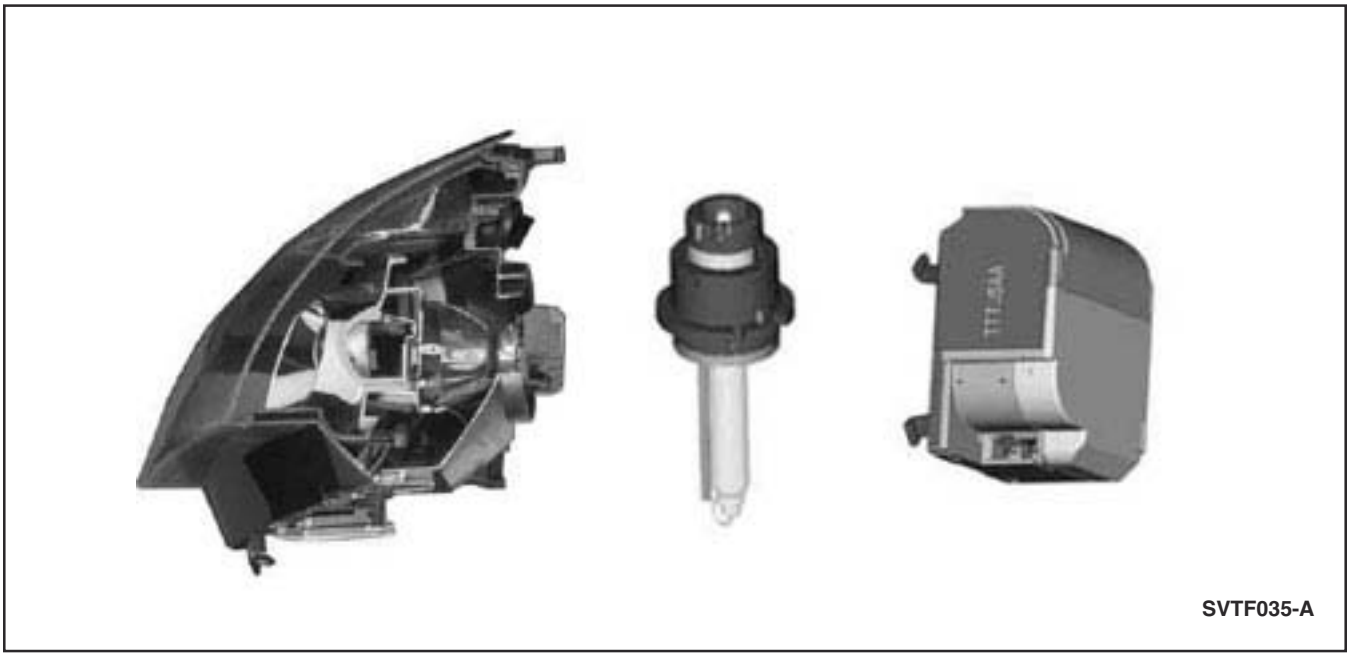
- Starting with the 2003 model year, Ford offers yet another way to enjoy the the impressive dynamics of the SVT Focus with the addition of a 5-door model.
- The 5-door model includes all of the same features that have won the SVT 3-door hatchback critical acclaim from the enthusiast media.
- Special rocker panels are not used on the 5-door model.

European Appearance Package

European Appearance Package Interior

- The European appearance package, also introduced in the 2003 model year includes all of the features and options of the SVT Focus.
- In addition, the Euro-Package includes:
  - Recaro seats
  - Multi-spoke wheels
  - High intensity discharge (HID) headlamps
- New color options including:
  - Screaming Yellow
  - Competition Orange

High Intensity Discharge (HID) Headlamps



- High Intensity Discharge (HID) lamps are different from standard halogen lamps in performance.
- HID lamps provide clearer, whiter light and project a more defined beam than halogen lamps.
- Due to the differing power requirements of the HID system, an electrical ballast is incorporated into the lamp which regulates power flow to the lamp.
- Igniting the bulb in a HID system requires 1100 volts at 14 amps.
- The ballast takes voltage from the generator and steps the voltage up to the required start-up voltage.
  - Once the lamp is started, the required voltage to run the lamp is 67-102 volts, at 2-6 amps.
  - If the lamp goes out of any reason, the HID system automatically reignites the lamp.
  - In the event of a short to ground, the ballast shuts down the power to the bulb until the next time the system is switched on.
- The headlamp housing has a small triangular arrow. The bulb also has a triangular arrow. When the bulb is correctly installed, the arrows on the bulb and housing should be point at each other.

Caution: The bulb gets very hot!

- The bulb fits into the housing in 4 different positions. If the bulb isn't in the correct position when the electrical connector is attached, damage to the bulb or connector may result.
- Before the ballast can be mounted to the housing, the electrical connector must be attached. Once the electrical connector is attached, the ballast may be mounted to the housing using the 3 fastening screws.

WARNING: HIGH VOLTAGE CAN SHOCK, BURN, OR CAUSE SEVERE INJURY OR DEATH. ONLY QUALIFIED PERSONNEL CAN PERFORM SERVICE.

Interior

SVTL003-A

SVT Focus Interior

Seats

- The color-coded seats with leather highlights increase support and include manual lumbar adjustment and infinite recline adjustment.
- The driver seat includes power height adjustment.

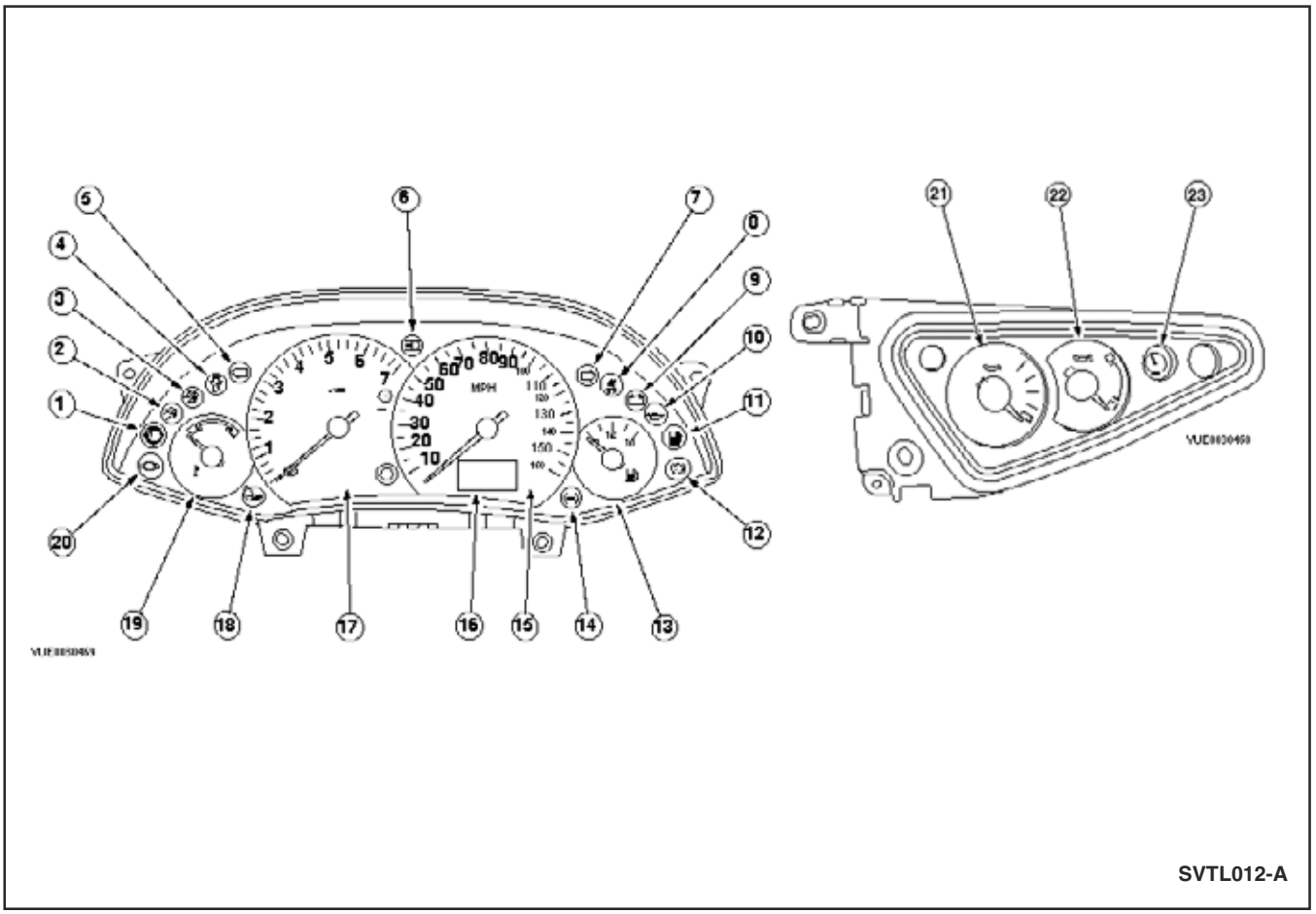
Controls

- The steering wheel is wrapped in black leather with perforations at the three-o'clock and nine-o'clock positions.
- The parking brake handle is wrapped in leather and includes a satin aluminum release button.
- The shift handle has a leather boot and black leather wrapped around the aluminum handle.
- The HVAC controls incorporate silver bezels.

Pedals

- Metallic pedal covers add to the performance feel of the SVT Focus.
- The pedals are positioned to facilitate heel-and-toe downshifting.

Cluster



SVT Focus Instrument Cluster and Oil Pressure and Temperature Cluster

Item	Description
1	Powertrain warning lamp
2	Air bag warning indicator
3	Deactivated air bag warning indicator
4	Door ajar indicator
5	Turn signal indicator
6	High beam indicator
7	Turn signal indicator
8	Safety belt indicator
9	Charge warning indicator
10	Oil pressure warning indicator
11	Low fuel indicator
12	Parking brake/brake warning indicator

Item	Description
13	Fuel gauge
14	Anti-lock brake system (ABS) warning indicator
15	Speedometer
16	Odometer
17	Tachometer
18	Traction control system (TCS)
19	Temperature gauge
20	Malfunction indicator lamp (MIL)
21	Oil pressure gauge
22	Oil temperature gauge
23	Speed control indicator

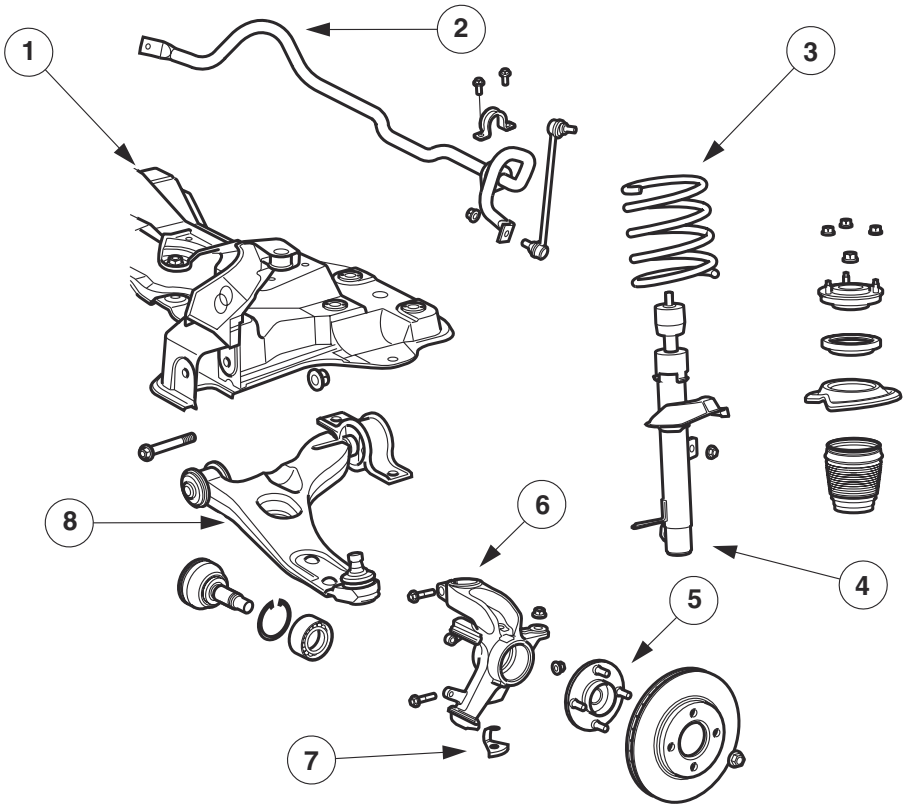
- The SVT lineage is also evident in the instrument cluster. Bold, clean titanium-faced electro-luminescent gauges include:
  - 160 mph speedometer
  - Tachometer
  - Fuel gauge
  - Temperature gauge
- Oil pressure and oil temperature gauges are part of an auxiliary cluster fitted in place of the ZX3's coin storage compartment.
- The auxiliary cluster contains the voltage inverter that converts battery voltage to the high voltage required for the electroluminescent illumination.

Audio

- The standard audio system features a 60-watt peak power AM/FM stereo radio and single-disc CD player.
- The optional Audiophile Sound System is powered by a 290-watt peak power AM/FM stereo radio with upgraded speakers, an eight inch powered sub-woofer, and a six-disc, in-dash CD changer.
- Both systems have fingertip controls on the steering column for changing volume, radio stations and CD tracks.

CHASSIS

Front Suspension



SVT Focus Front Suspension

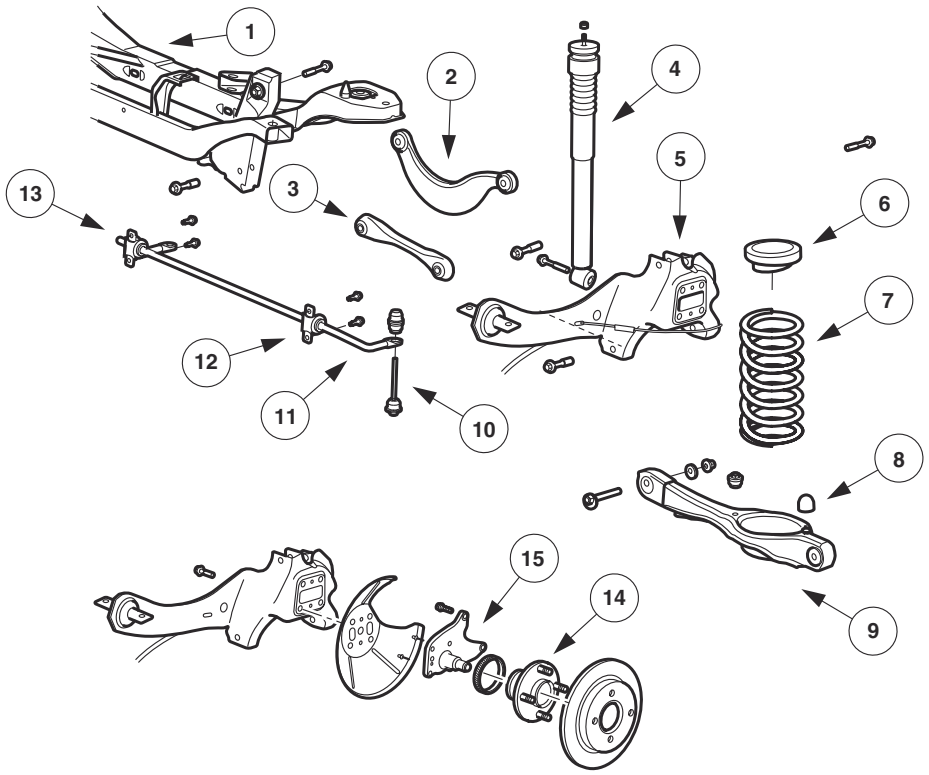
Item	Description
1	Crossmember
2	Stabilizer bar
3	Spring
4	Strut

Item	Description
5	Wheel hub
6	Wheel knuckle
7	Lower arm ball joint heat shield
8	Lower arm

- The suspension has been modified to give the SVT Focus the renowned controlled, compliant SVT feel.
- When the SVT chassis engineers began retuning the Focus suspension system, they first began tuning the spring rates of the car to achieve proper ride balance.
- Next, attention was focused on the stabilizer bars and dampers to hone in on the desired steady state and transitional balance of the vehicle.
  - Springs and stabilizer bars dictate the steady state (long sweeping corner) balance, and damper tuning controls transitional (corner entry and exit) balance.

- Springs and dampers have the largest effect on vehicle ride performance.
- From that point, the tires and suspension bushings are tuned to get the desired response from the overall chassis.
- Finally, the steering is fine-tuned to provide the driver with responsive and positive steering feedback.
- Spring Rates/Stabilizer Bars:
  - Front: 22N/mm (125.6 lb/in) 21 mm (0.827in)
  - Rear: 27.5N/mm (157.0 lb/in) 21 mm (0.827in)
- Suspension should be viewed as a total system, not just a conglomeration of components.
  - For example, most people think that spring rates define how a vehicle rides and handles.
  - Though spring rates have a large effect, there are many components within the system that affect ride and handling.
- "Wheel Rate" is a measure of all the contributing components in the system and better characterizes a vehicle's ride and handling ability.
  - Wheel rate is defined as the force required to displace the wheel by one inch with respect to the body.
  - This takes into account the spring rate (with link ratio), bushing rates, tire spring rate, stabilizer bar contribution, and any friction that may be in the system.
- The SVT steering knuckle is modified to accept the larger SVT brakes.
- This is unique since the base Focus utilizes a bolt-on style caliper in lieu of an integrated caliper bracket on the knuckle.

Rear Suspension



SVTF006-A

SVT Focus Front Suspension

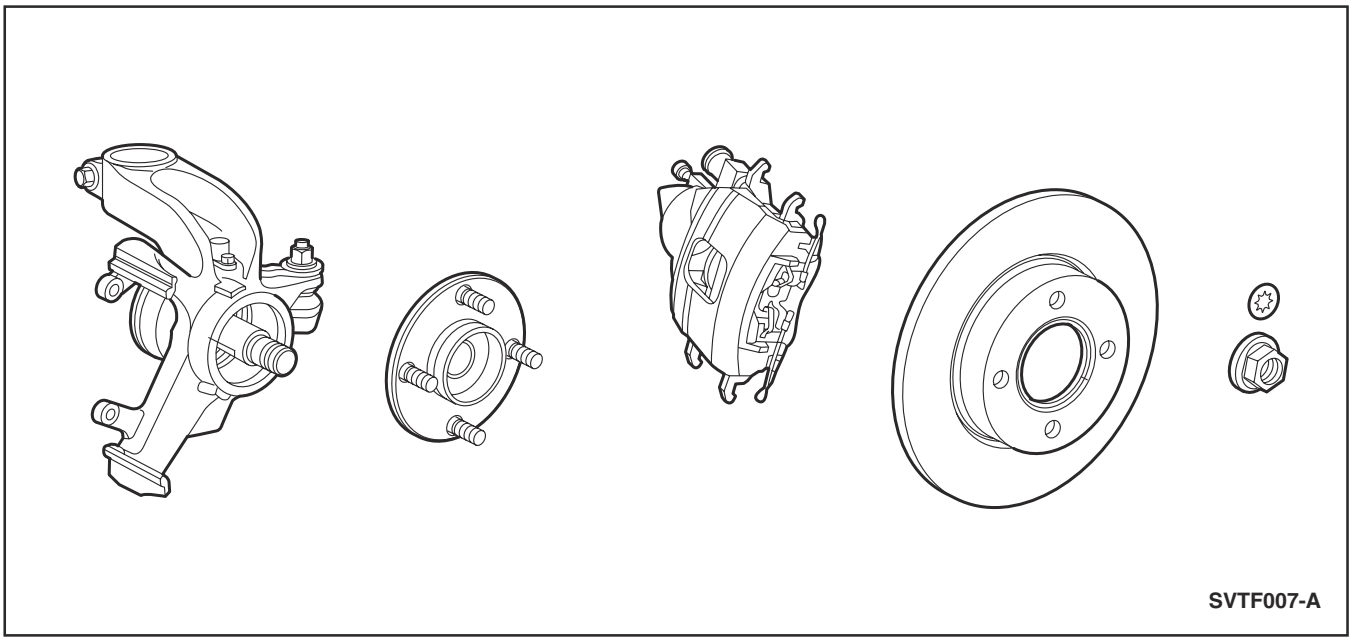
Item	Description
1	Crossmember
2	Upper arm
3	Front lower arm
4	Shock absorber assembly
5	Tie - bar and knuckle
6	Spring pad
7	Spring
8	Bump stop

Item	Description
9	Rear lower arm
10	Stabilizer bar link
11	Stabilizer bar
12	Stabilizer bar bushing
13	Stabilizer bar bushing clamp
14	Wheel spindle
15	Wheel hub

The rear suspension is modified to match the characteristics of the front suspension.

- Revisions include:
- SVT retuned shocks.
- Angled coil springs with a rate of 157 lb/in.
- The rear stabilizer bar droplink bushings have been upgraded to urethane for an improvement in handling balance and steering response.

Front Brakes



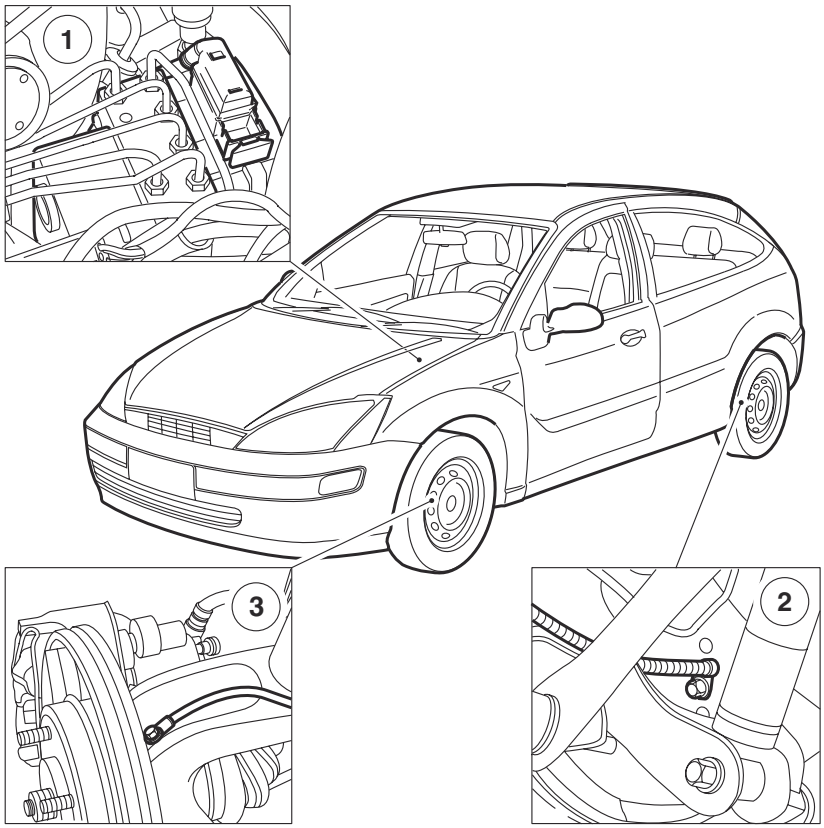
SVT Focus Front Brakes

- The front brakes use a 300 mm (11.8 inch) vented disc rotor and a single piston caliper for enhanced braking performance.
- The SVT steering knuckle is modified to accept the SVT brakes.
- The Anti-lock Brake System (ABS) is a four-channel, four-sensor system.

Rear Brakes

- The rear brakes in the SVT Focus use 280 mm (11.0 inch) solid rotors and single piston calipers.

Traction Control (Optional)



Optional Traction Control (with Cold Weather Package)

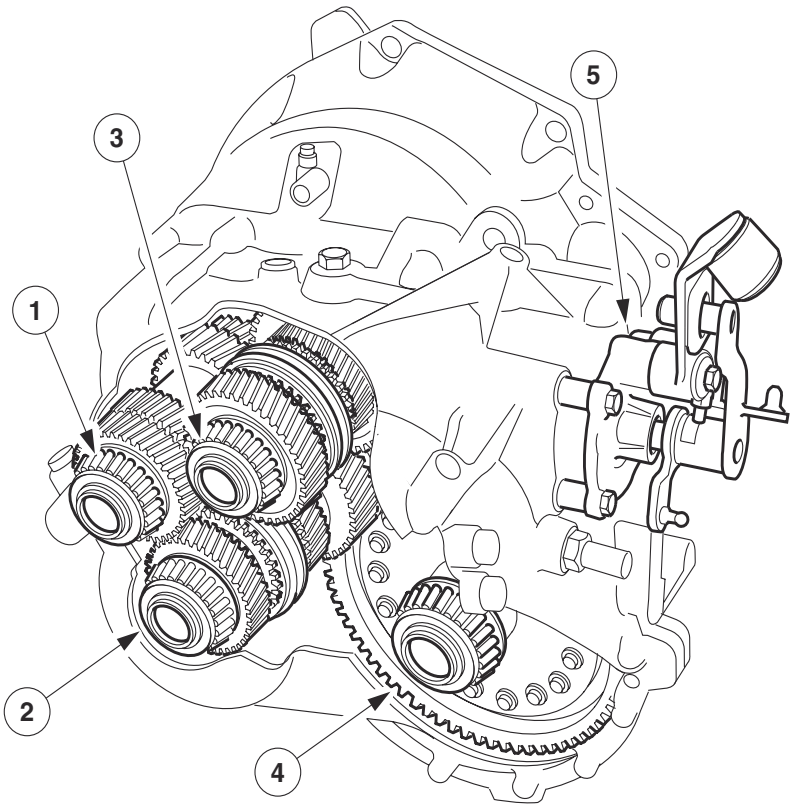
Item	Description
1	Hydraulic control unit
2	Rear wheel sensor
3	Front wheel sensor

- With the optional traction control enabled, full brake and engine intervention occurs at the appropriate times. This system is diagnosed the same way as the traction control in the mainstream Focus.
  - Brake intervention occurs below 20 MPH and engine intervention can occur at any time.
- If the traction control is disabled using the TC OFF button (for racing applications for instance) engine intervention never occurs. The brake intervention will occur below 20 MPH even with the traction control in the disabled state.
- If the traction control fuse is removed from the SVT Focus there will be no traction control, anti-lock braking and the electronic brake distribution will not function correctly.
  - With the fuse pulled (or blown), most of the brake force is sent to the rear brakes.
  - This could create a serious safety concern.

Steering

- The SVT Focus steering pump is a falling flow pump.
  - As engine speed increases, power steering pump output decreases to provide a consistent feel.
- The diameter of the torsion bar is increased from 1.7mm to 1.9mm.

Transaxle



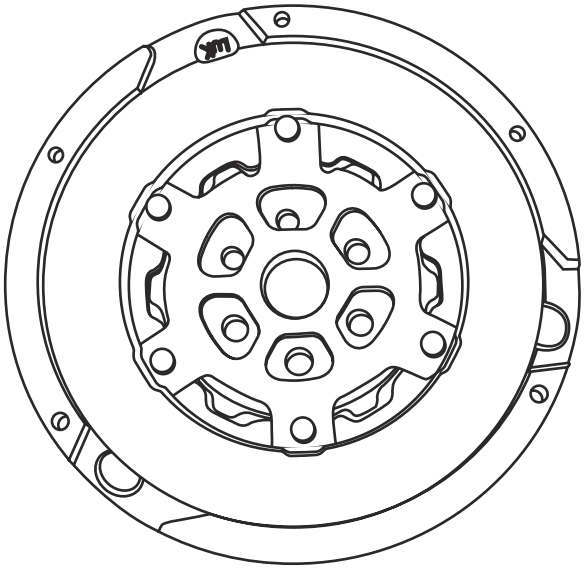
6-Speed Getrag Manual Transaxle

Item	Description
1	Input shaft
2	Output shaft 1
3	Output shaft 2
4	Differential gear
5	Shift tower

- The SVT Focus, 2003 Cobra, and the Cobra R are the only cars in the Ford line equipped with a six-speed gearbox.
- The Getrag transaxle uses 2 output shafts, which allows the transaxle to be much more compact than a conventional six-speed transaxle.
- The gears are divided between the two output shafts as follows:
  - Output shaft 1: first, second, fifth and sixth gear
  - Output shaft 2: third, fourth and reverse gear
- The gears in the Getrag transaxle are all fully synchronized, including reverse.
- The gear wheels on the input shaft are fixed to the shaft.
- The output shafts and the input shaft are supported by roller bearings (clutch housing), sealed ball bearings are used in the transaxle housing.
- The differential is supported in both housings by taper roller bearings.

GEAR	Gear Ratio	Layshaft	Final drive	Overall Ratio
1st gear	4.44:1	1	2.88:1	12.7:1
2nd gear	2.67:1	1	2.88:1	7.7:1
3rd gear	1.33:1	2	4.25:1	5.7:1
4th gear	1.08:1	2	4.25:1	4.6:1
5th gear	1.33:1	1	2.88:1	3.8:1
6th gear	1.08:1	1	2.88:1	3.1:1
Reverse	2.82:1	2	4.25:1	12.0:1

Dual Mass Flywheel

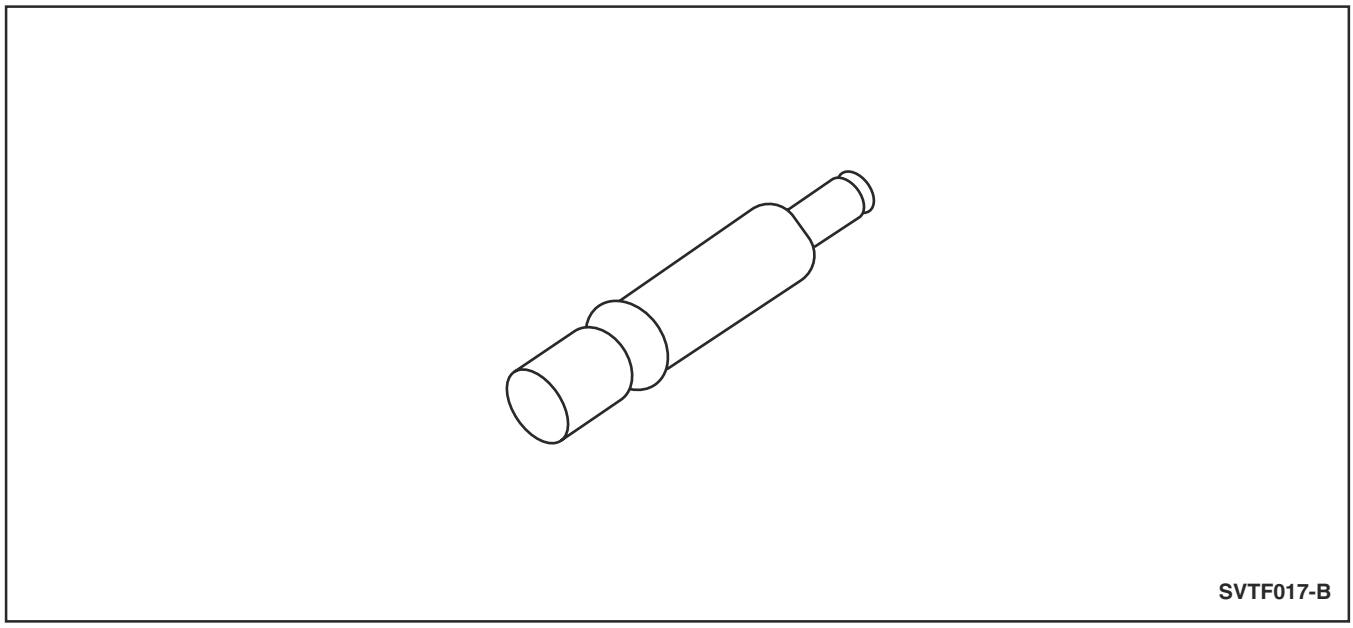


SVTF015-A

SVT Focus Dual Mass Flywheel

- The dual mass flywheel is a dampening device for the vehicle when it is at idle and improves shift feel.
- Six and eight cylinder engines have a natural dampening effect on vibration due to the frequency of cylinder firings.
- It is more difficult to prevent vibration and gear noises in a four cylinder application, particularly at idle.
- The dual mass flywheel system isolates driveline vibrations and prevents them from being transmitted into the passenger compartment.
- The dual mass flywheel divides the mass of the flywheel into two sections.
- One section is bolted to the crankshaft, and the other section is bolted to the pressure plate assembly.
- The two sections are connected with two long springs that run the circumference of the flywheel.
- As power spikes occur, the springs allow the forward section of the flywheel to rotate faster than the rearward section storing the excess energy in the springs.
- After the spike, the stored energy is released from the springs, and the sections rotate at the same speed.
- The results are reduced vibrations and transaxle wear, as well as improved shift feel.
- If the dual mass flywheel isn't operating correctly there will be gear noise and vibration at idle.
- In the past, dual mass flywheel technology has been reserved for high-end sport and luxury cars.
- The SVT Focus is the first application of this technology in a smaller vehicle.
- Use special tool 303-103 to lock the flywheel into place during removal.

Clutch and Pressure Plate



SVT Focus Clutch, Pressure Plate, and Alignment Tool

- To handle the additional torque of the SVT Focus, the spring rate in the pressure plate in the SVT Focus is higher than the mainstream Focus.
  - The SVT pressure plate is not interchangeable with the mainstream Focus.
- The clutch disc is made of the same material as mainstream Focus but the discs are not interchangeable because the input shaft splines are different.
- During the break-in period (the first couple of hundred miles) the customer may be able to smell the clutch. If the condition goes away after the break-in period, it is a normal condition.
- Special tool 308-020 is used to install the clutch and pressure plate onto the flywheel.

Axles

- To handle the extra torque, SVT Focus axles are solid and use a larger constant velocity joint than the mainstream Focus.
- The SVT Focus axles are 13% stronger than those in the mainstream Focus.

POWERTRAIN

SVTF007-B

2.0L SVT Zetec (Duratec ST) Engine

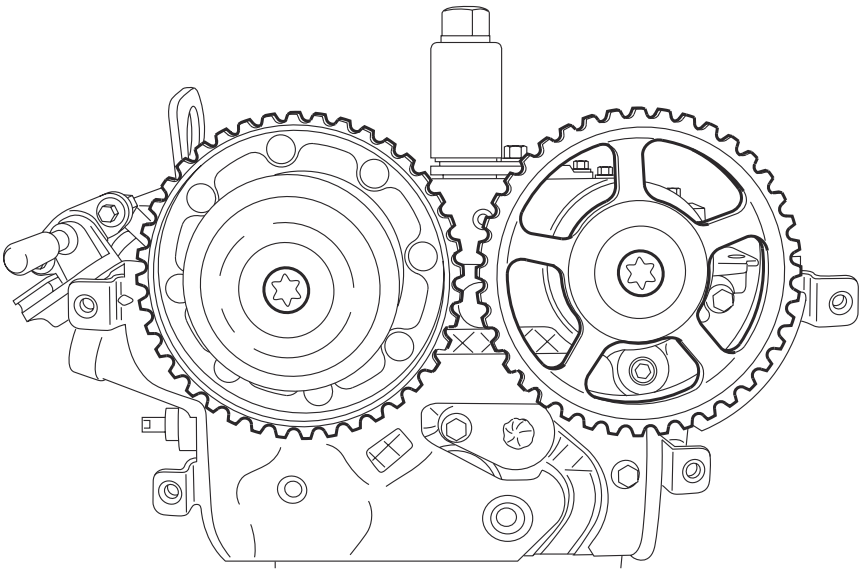
- The SVT Focus is equipped with a modified Zetec 2.0-liter engine with a cast iron block and aluminum cylinder head with Variable Cam Timing (VCT) on the intake valve.
  - In most publications it is referred to as the Duratec ST engine.
  - The Duratec ST produces 170 horsepower at 7,000 rpm and 145 lb.-ft of torque at 5,500 rpm. 85% of torque is generated by 2200 RPM.
  - The redline for the SVT Zetec engine is at 7200 RPM.
  - It is **NOT** a freewheeling engine.
- The intake air system incorporates a dual stage intake manifold.
  - More information on the intake manifold can be found in the Performance section.
- The engine mounts are modified to reduce powertrain presence, to suit increased engine torque and are modified on the right hand side to provide clearance for the VCT system.
- The exhaust is a tuned tubular header system with underbody catalyst.

CAUTION: The Duratec ST is designed to operate using 5W30 GF3 oil. If 5W20 GF3 oil recommended for other Zetec engines is used, engine damage to the Duratec ST engine may occur.

Front Engine Accessory Drive (FEAD)

- In 2004, the A/C compressor was changed to a higher RPM compressor that improves cooling at lower engine speeds.
  - Higher RPM is acheived by using a smaller pulley.
  - This change occurred on the mainstream Focus in 2003.
- In addition, a one-way clutch is incorporated into the generator.
  - The one-way clutch reduces drag variations that occur during generator operation, thus reducing NVH concerns related to the generator.

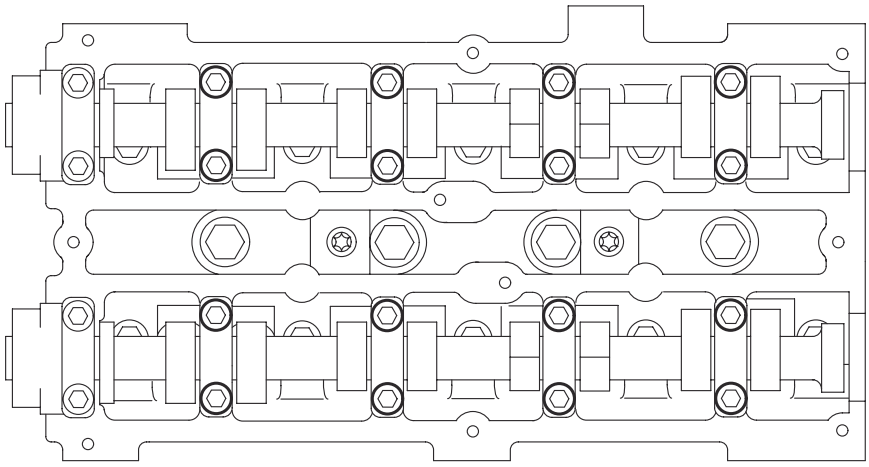
Cylinder Head



SVT Focus Cylinder Head with Variable Cam Timing

- For improved airflow, the intake ports in the SVT Focus cylinder heads are larger in diameter and slightly higher in the head than the mainstream Focus.
- The exhaust ports are exactly the same in the Duratec-ST cylinder head as the ports in the Zetec cylinder head.
- The cylinder head gasket in the Duratec-ST engine is a four-layer Multi-Layered-Steel (MLS) gasket.
- This gasket is not interchangeable with the three-layer gasket used in the mainstream Focus,
- The combustion chamber volume in the Duratec-ST is smaller to raise the compression ratio from 9.6 to 10.2.

Camshaft



SVTF011-A

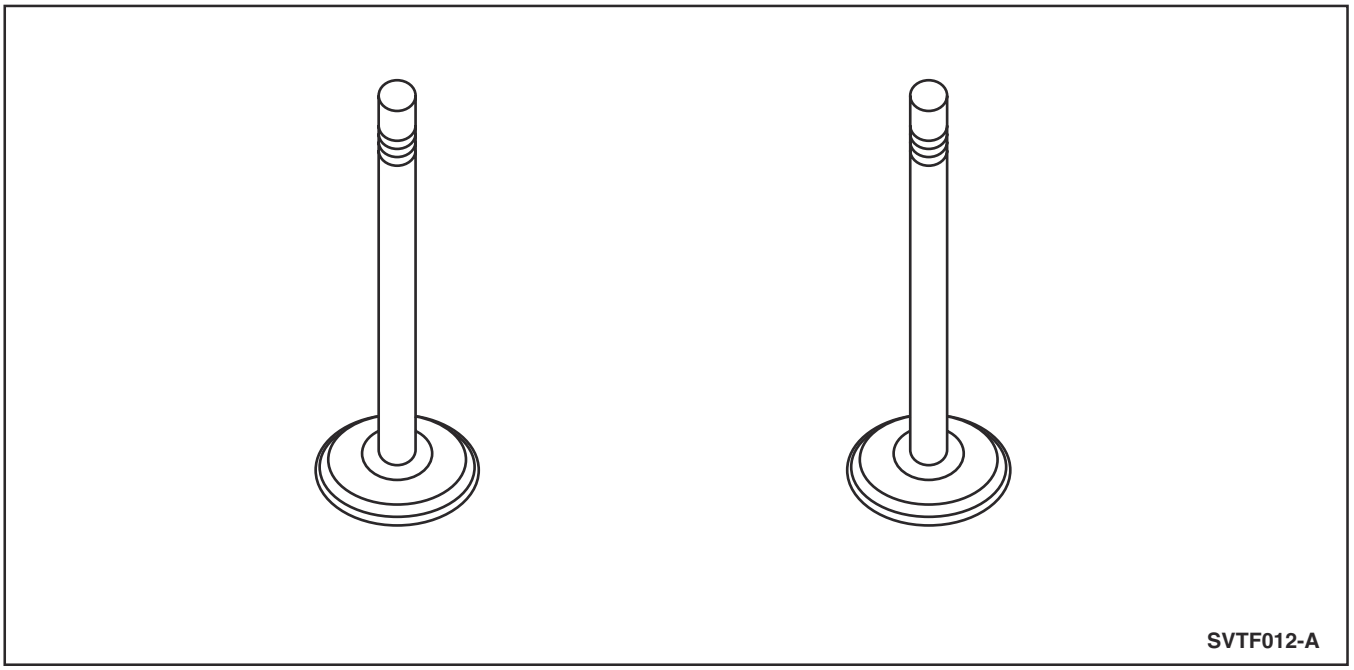
High Lift and Duration Camshafts

- The intake and exhaust camshafts are both modified to increase horsepower.
- The camshafts have high lift and duration to allow the maximum amount of air into the cylinder per stroke.

Camshaft Followers (mechanical bucket tappets)

- The bucket tappets in the Duratec-ST engine are modified to work with the revised valve train.
  - The tappets are graded to give proper valve clearance.
  - The grade number is printed on the top of the bucket tappet.
- The grade number is followed by an “S” on the SVT bucket tappets.
- If mainstream Zetec bucket tappets are installed in an Duratec-ST engine, the piston will hit the valve.

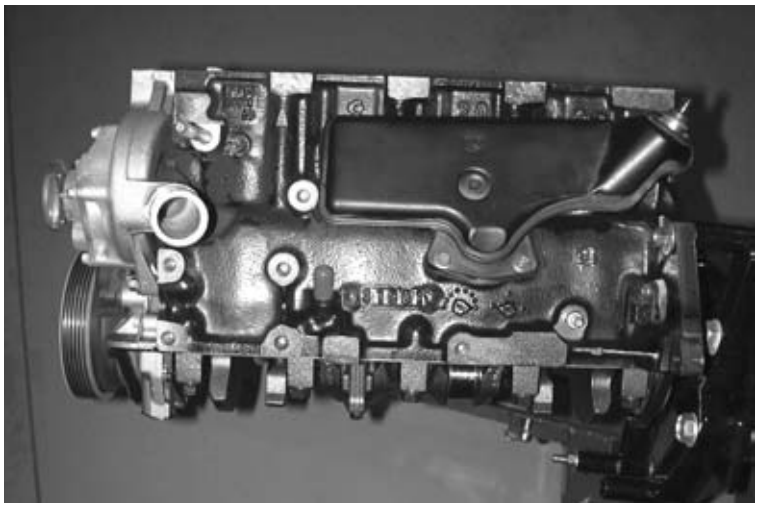
Valves



SVT Focus Intake Valves

- The valves in the Duratec-ST engine are longer than the valves in the mainstream Focus and have three grooves for the collets.
- The intake valve head is larger in diameter than the mainstream Focus.
- The exhaust valve head is the same diameter as the mainstream Focus.

Engine Block



SVTF010-A

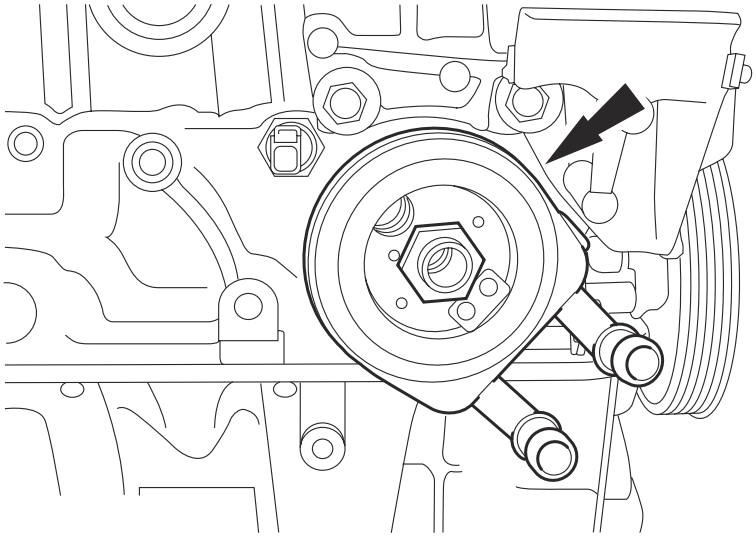
2.0L SVT Zetec Engine Block

- The SVT Focus has oil jets machined into the engine block to help lubricate the cylinder walls.
  - The mainstream Zetec casting is the same as the SVT casting, but the oil jets are not machined into the mainstream engine block.

Pistons and Connecting Rod

- The pistons in the SVT Focus:
  - have a flat top.
  - have a deeper valve pocket to accomodate the larger valves and higher camshaft lift used in the Duratec ST engine.
  - have a larger diameter piston pin.
  - have unique rings designed to reduce flutter during high engine speed operation.
- The connecting rods are forged for increased durability.

Oil Cooler



SVTF014-A

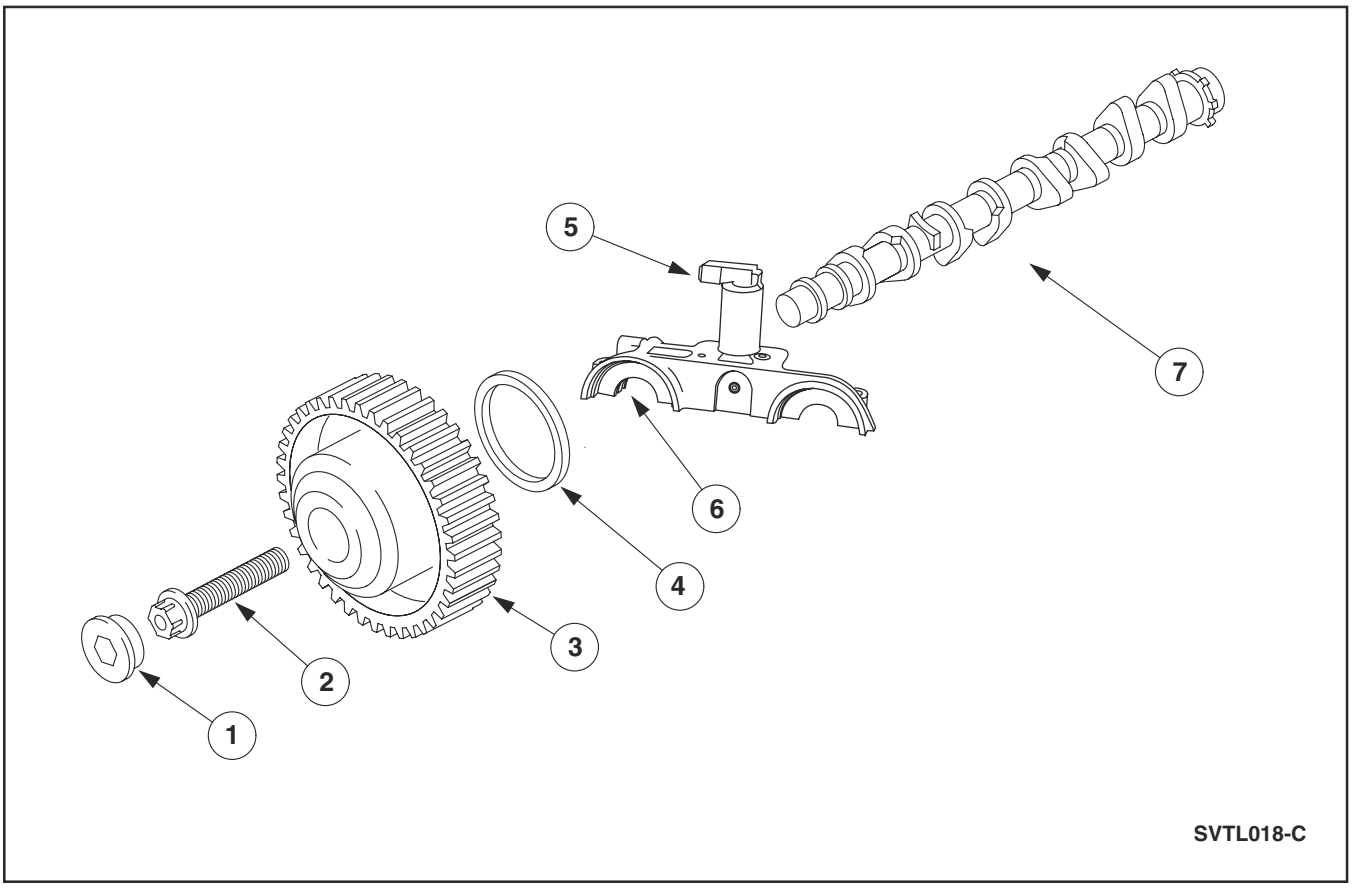
SVT Zetec Modine Type Oil Cooler

- The Modine type oil cooler is an oil to coolant heat exchanger, similar to the system used on the Cobra.
- Coolant flows through one half of the Modine style cooler and hot oil flows through the other half.
- The coolant is in contact with one side of the aluminum fins located in the cooler.
- On the other side of the fins, hot oil from the engine passes through the filter.
- As the hot oil contacts the fins in the oil cooler, heat transfers through the aluminum to the coolant.
- The coolant circulates through the cooling system to the radiator where the heat is released to the outside air.
- The cooled oil passes through the oil filter and back into the engine.

NOTES

ENGINE PERFORMANCE

Variable Camshaft Timing (VCT)

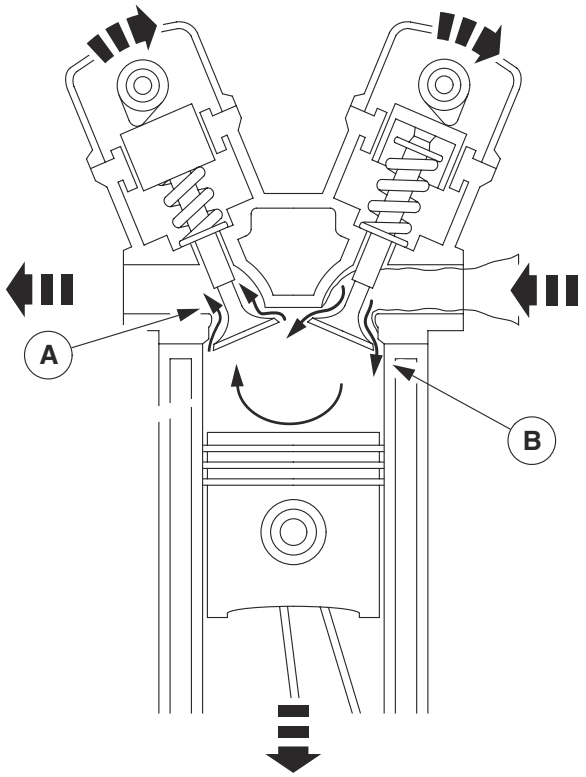


VCT Components

Item	Description
1	Blanking Plug and Seal Assembly
2	Bolt
3	Variable Camshaft Timing (VCT) Unit
4	Camshaft Oil Seal
5	Camshaft Timing Actuator (CTA) also called VCT Solenoid
6	Oil Feed Flange
7	Intake Camshaft

- Cam timing on the intake side is controlled by a Variable Cam Timing (VCT) system.
- VCT allows the powertrain control module (PCM) to advance or retard camshaft timing to provide peak engine performance at all times.
- This system is similar to the VCT system found in the 1998 Contour; one notable difference is that the SVT VCT system is on the intake camshaft and the 1998 Contour engine had the VCT system on the exhaust camshaft.
- The VCT is the link between the timing belt and the camshaft. The PCM uses inputs from the following sensors to determine the correct cam position:
  - Intake Air Temperature (IAT) sensor
  - Engine Coolant Temperature (ECT)
  - Camshaft Position Sensor (CMP)
  - Mass Air Flow (MAF)
  - Crankshaft Position Sensor (CKP)

VCT Theory

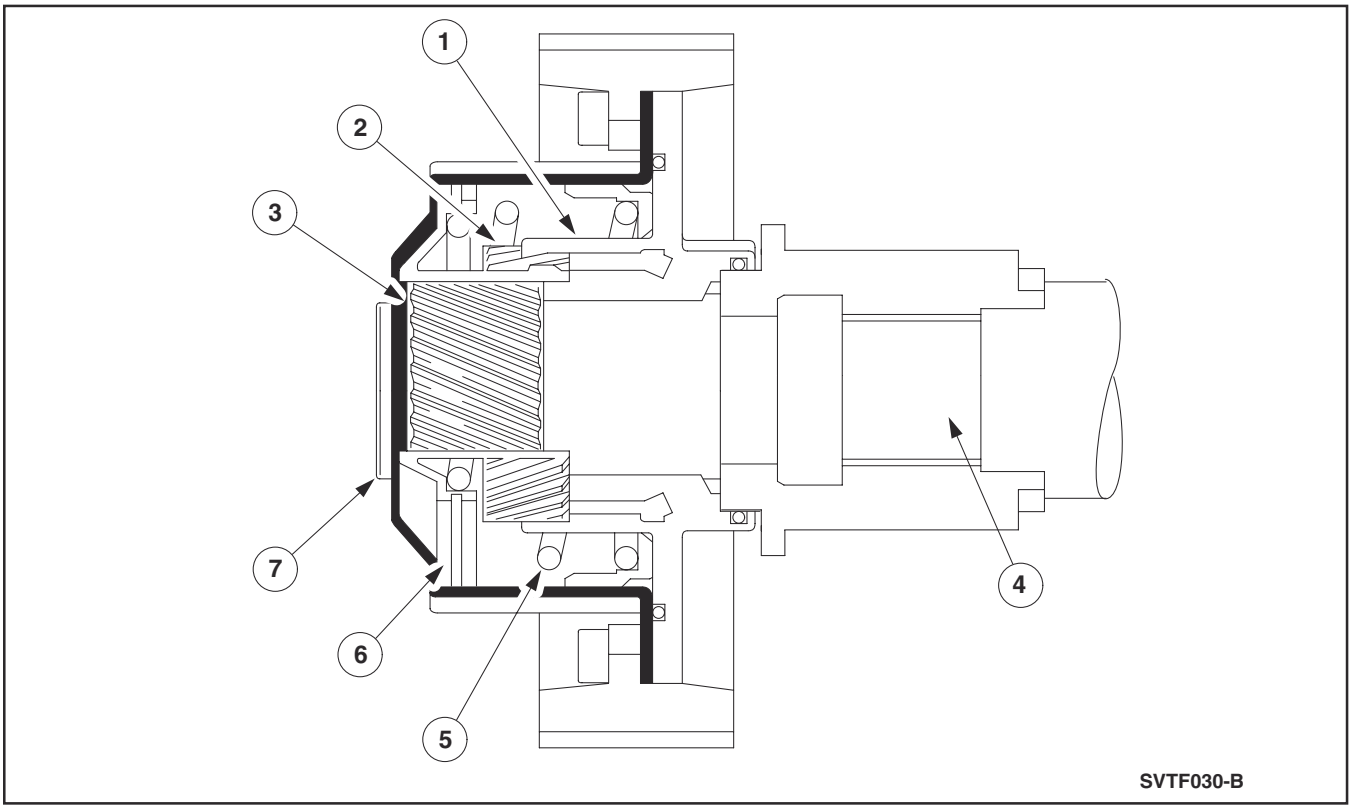


SVTL012-A

Exhaust Gas Inertia Increases Intake Air Flow

- The VCT system is used to change cam timing as the engine operates, significantly increasing engine performance.
- The VCT system on the Focus uses engine oil pressure to move a piston in the VCT drive unit.
- As engine RPM and load increase, the VCT system advances intake cam timing to allow more exhaust valve overlap.
- Valve overlap increases engine efficiency by allowing the inertia of the escaping exhaust gasses **(A)** to draw in the intake air charge **(B)**.
- The increased cylinder charge translates into higher engine performance.

VCT Drive Unit



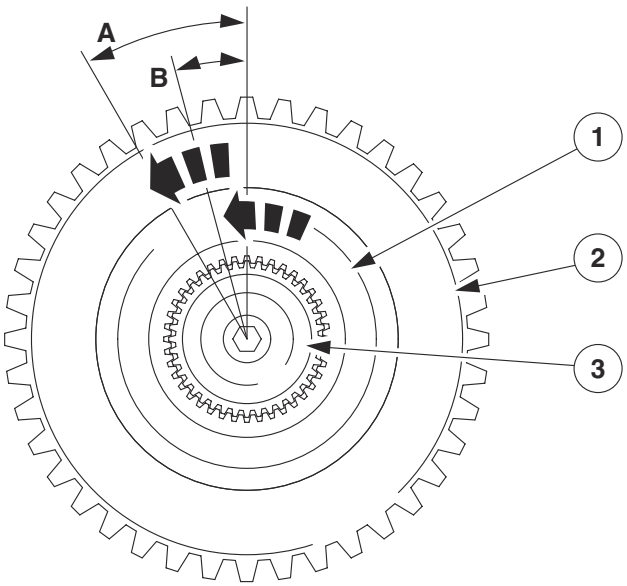
Variable Cam Timing Drive Unit

Item	Description
1	Camshaft Sprocket with Inner Helical Gear
2	Piston with Inner and Outer Helical Gear
3	Center Hub with Outer Helical Gear

Item	Description
4	Intake Camshaft
5	Spring
6	Piston Seal
7	Plug and Seal

- The principle components of the VCT drive unit are:
  - Moveable piston
    - The piston moves inside a cylinder.
    - This movement is caused by oil pressure changes on either side of the piston.
  - Housing
    - The housing acts as a cylinder in which the piston moves.
    - The housing is connected to the intake camshaft drive sprocket.
  - Center hub
    - The center hub is connected to the camshaft.
- These components are attached to each other with helical gears.
- Movement of the piston causes an equal but opposite motion of the other components.

VCT Gears



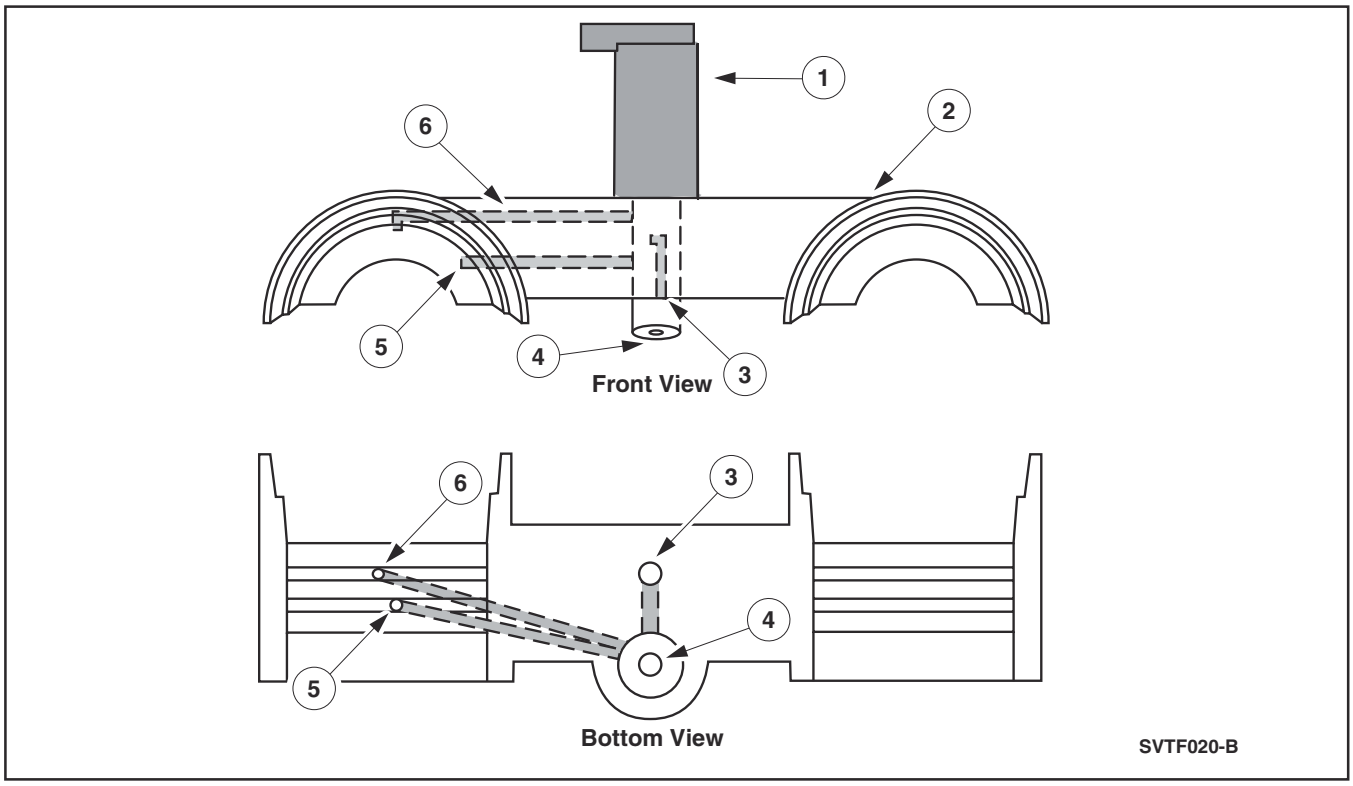
Inner and Outer Helical Gears in VCT Drive Unit

Item	Description
1	Piston with Inner and Outer Helical Gears
2	Camshaft Timing Pulley with Inner Helical Gears

Item	Description
3	Center Hub with Outer Helical Gears
A	30° Total Camshaft Rotation
B	15° Rotation Angle of Piston

- The piston is attached to an inner and an outer helical gear.
- The outer helical gear is engaged with a corresponding helical gear in the drive sprocket.
- The inner helical gear is engaged with a corresponding helical gear on the center hub (attached to the camshaft).
- Piston position is changed by raising or lowering the oil pressure on either side of the piston.
- When the piston moves away from its forward position the helical gears cause an angular rotation of the camshaft which changes camshaft timing.
- If pressurized oil is supplied to the forward oil chamber, the oil in the rear chamber drains into the oil pan and the piston moves backward causing advanced camshaft timing.
- If pressurized oil is supplied to the rear oil chamber, oil in the forward chamber drains back into the oil pan and the piston moves forward causing retarded camshaft timing.
- If pressurized oil is cut off from both oil chambers, both oil return ports are closed and camshaft timing remains at its present timing position.
- If oil pressure is lost, the spring in the VCT drive unit causes the piston to return to the fully forward position (timing retarded 5 degrees).

VCT Operation



Camshaft Timing Actuator (CTA)

Item	Description
1	VCT Solenoid
2	Oil Feed Flange
3	Oil Feed Channel (From Cylinder Head)
4	Oil Return (Bottom of Solenoid)
5	Rear Channel Oil Feed
6	Forward Channel Oil Feed

The camshaft timing actuator (CTA) is a pulse width modulated three-position solenoid valve.

Plunger Position 1

- With the valve plunger in the lower position, oil pressure is routed to the forward oil chamber of the hydraulic cylinder.

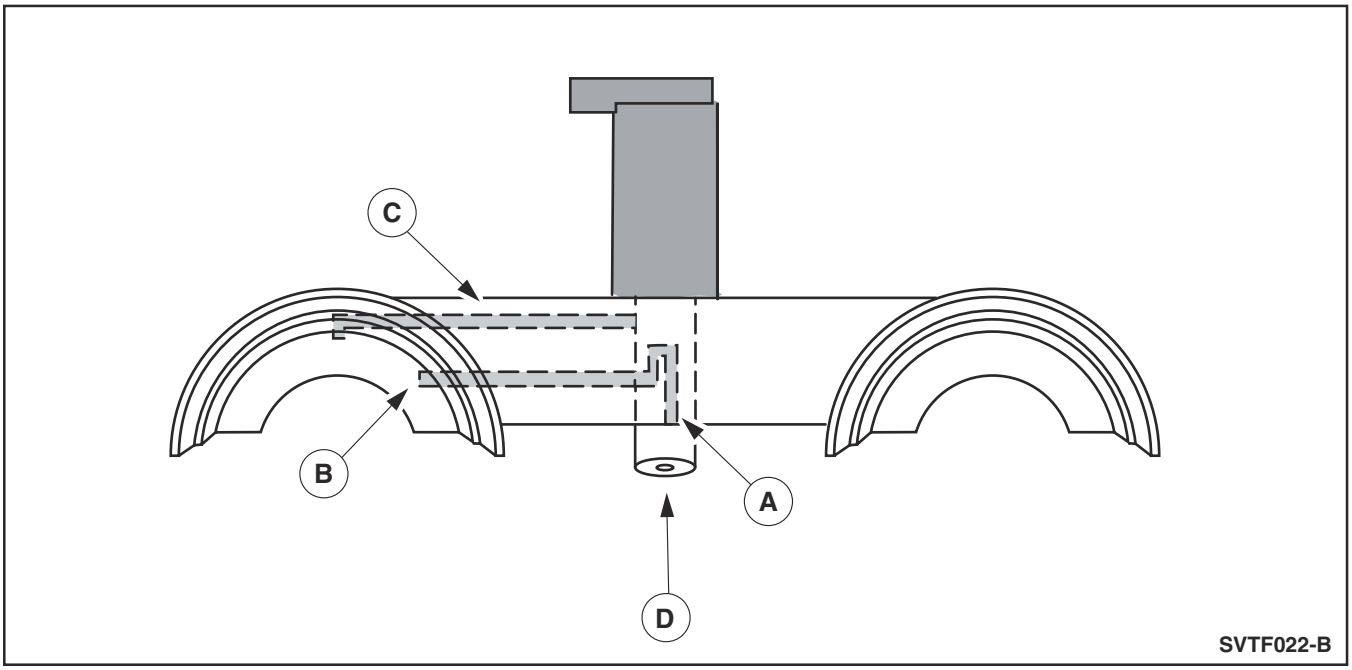
Plunger Position 2

- With the valve plunger in the upper position, oil pressure is routed to the rear chamber of the hydraulic cylinder.

Plunger Position 3

- With the valve plunger at its midpoint, both the oil feed and oil return paths are closed.

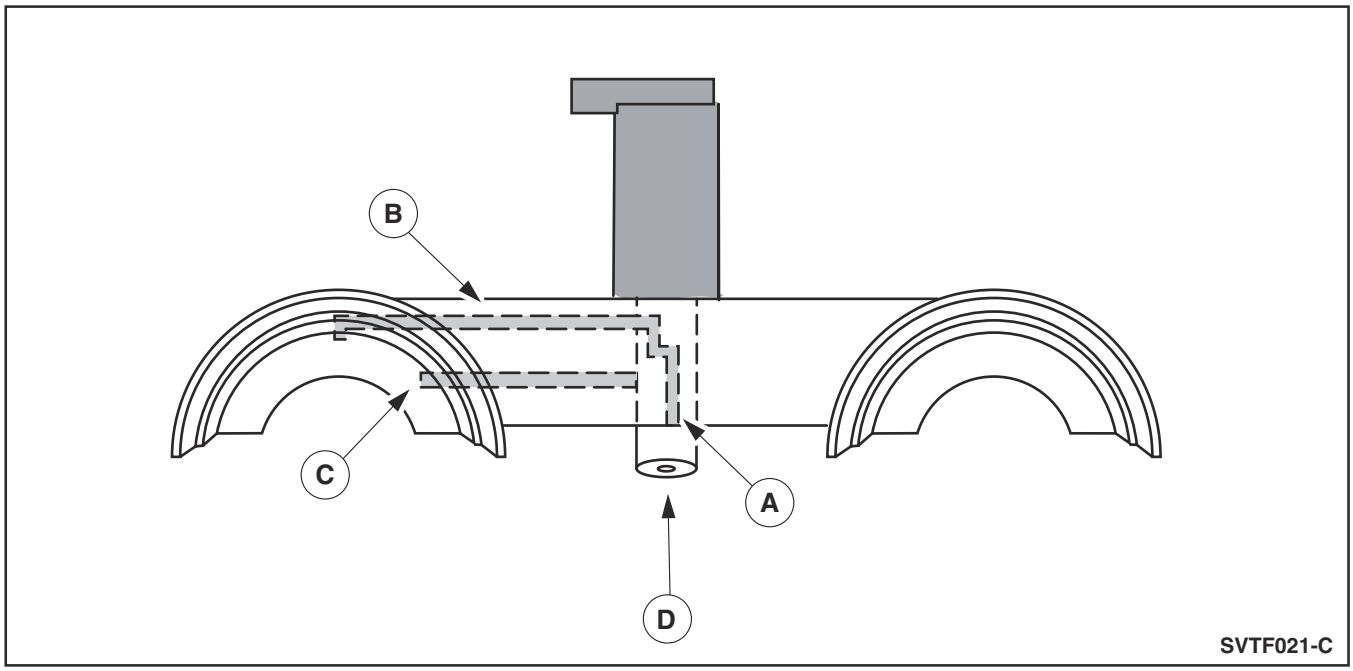
Cam Timing Advance



Cam Timing Advance Oil Path

- When a 100% duty cycle signal is provided to the CTA (plunger position 1), the control plunger is forced down.
- In this position, the oil feed channel **(A)** is connected directly to the forward chamber **(B)** and the rearward chamber **(C)** is connected to the return channel **(D)**.
- The increased pressure on the forward chamber moves the piston rearward advancing camshaft timing and pushing excess oil in the rear chamber to the return channel.

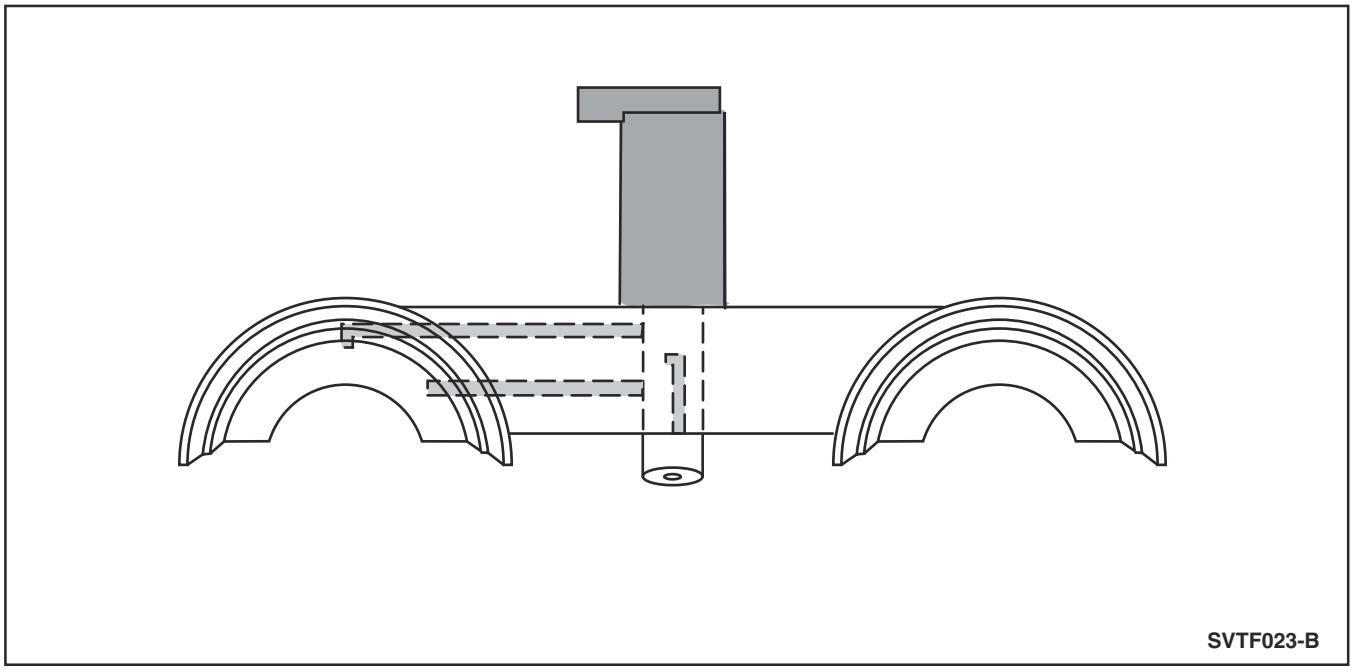
Cam Timing Retard



Cam Timing Retard Oil Path

- When a 0.0% duty cycle signal is provided to the CTA (plunger position 2), the control plunger is forced up.
- In this position, the oil feed channel **(A)** is connected to the rearward chamber **(B)** and the forward chamber **(C)** is connected to the return channel **(D)**.
- The increased pressure on the rearward chamber moves the piston forward retarding camshaft timing and pushing excess oil in the front chamber to the return channel.

Camshaft Timing Hold



Cam Timing Hold

- A 50% duty cycle signal causes the plunger to move to the middle position (plunger position 3).
- In this position, both the oil feed and return channels are closed.
- This holds the hydraulic piston in the VCT drive unit in a fixed position.

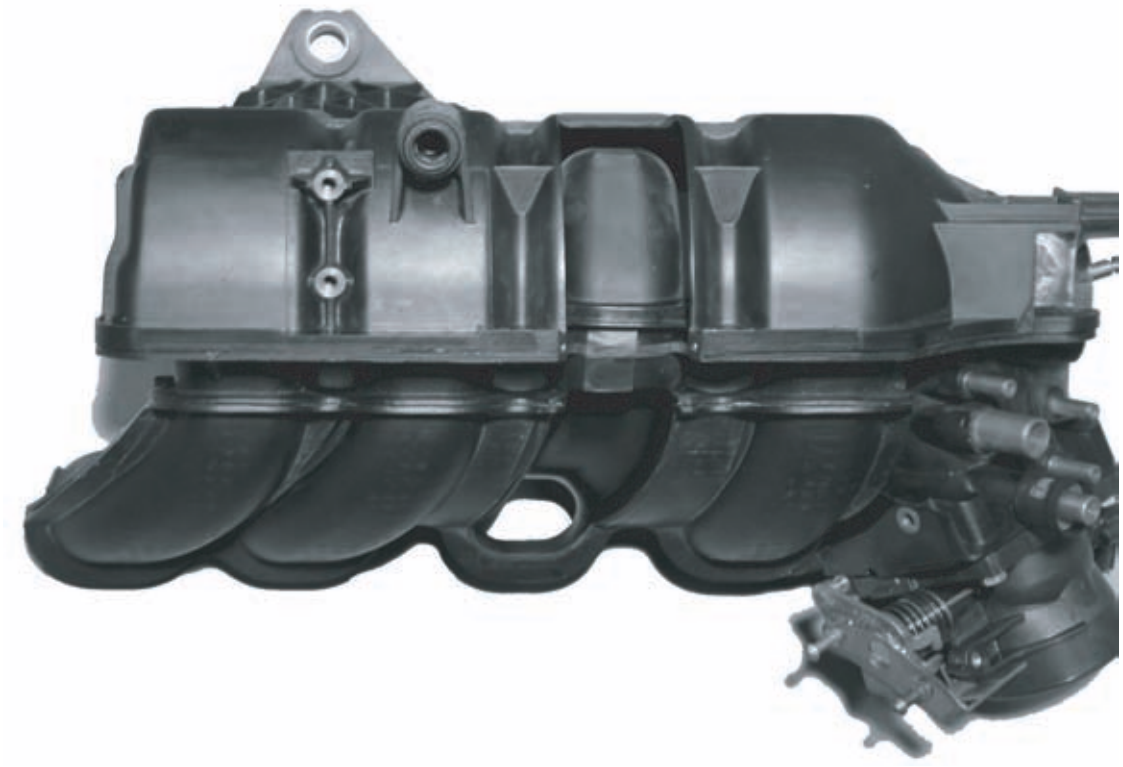
Varying Camshaft Timing

- The PCM can vary camshaft timing to any position between the two end positions by varying the duty cycle of the CTA.

VCT Diagnosis

- If the VCT drive unit piston freezes in the retarded position, the vehicle will exhibit a decrease in performance.
- If the VCT drive unit piston freezes in the advanced position, the vehicle will run rough at low engine rpm's and stall.
- An electronic fault in the VCT system will set a diagnostic trouble code (DTC) and the malfunction indicator lamp (MIL) will illuminate.
  - If the CTA loses power or the circuit is opened, the vehicle will exhibit a lack of power.
  - If the CTA power circuit shorts to ground, the vehicle may exhibit a rough idle condition, stall, or exhibit a no-start condition because the power circuit also powers the fuel injectors.
  - If the CTA control circuit (ground side) shorts to ground, camshaft timing will hold in the fully advanced position and the vehicle will run rough at low engine rpm's and stall.

Dual Stage Intake Manifold



SVTL024-A

Dual Stage Intake Manifold in Long Runner Position

- The intake manifold is a dual-stage intake manifold.
- The dual stage intake manifold allows for different intake runner lengths to provide low-end torque below 6000 RPM and high-end power all the way to the 7,200 RPM redline.

Long Runners

- At low RPMs, air flow is also low.
- Long runners increase the velocity of the incoming air.
- The increased velocity creates inertia that pulls more air into the cylinder.
- This allows more air to enter the cylinder during each intake stroke.
- When the engine is started and running below 6000 rpm, the PCM commands the intake manifold runner control (IMRC) actuator to retract the dual-stage intake manifold to the long runner position.

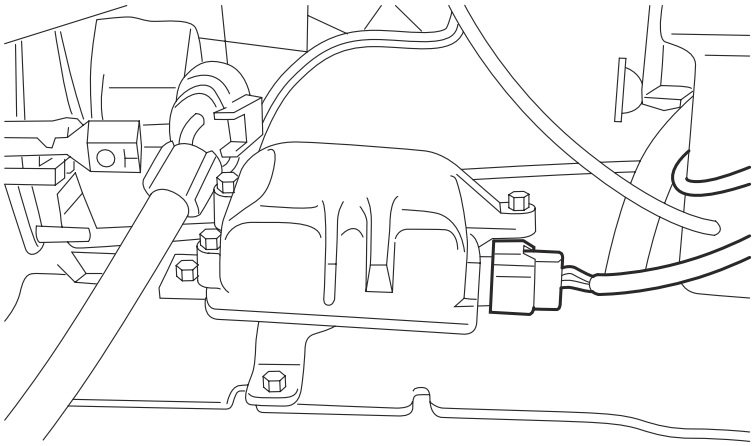
Short Runners

SVTL025-A

Dual Stage Intake Manifold in Short Runner Position

- At high RPMs the restriction created by the long intake runners would restrict the amount of air flow and reduce the amount of horsepower the engine could produce.
  - Short intake runners allow enough air to completely fill the cylinders.
  - When the engine is above 6000 RPM, the PCM commands the IMRC actuator to release the dual-stage intake manifold to the default, short runner position.
- The dual-stage intake manifold is held in the default, short-runner position by a return spring.

Intake Manifold Runner Control (IMRC) Actuator



SVTF026-A

IMRC Actuator Inside Left Front Wheel Well

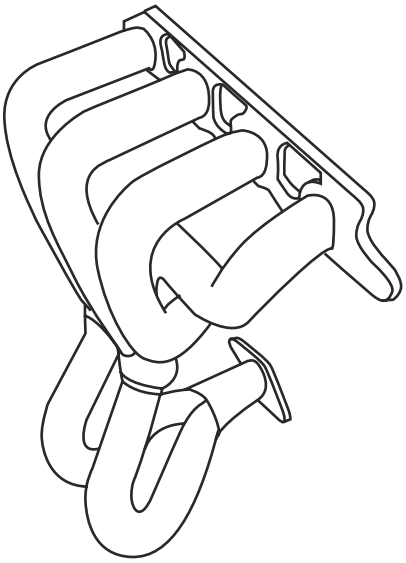
- The IMRC actuator is a servo motor actuated by the PCM.
- The servo motor retracts a cable that moves the intake manifold to the long runner position.
- At 6000 RPM, the PCM commands the intake manifold to the short-runner position.
- The IMRC actuator includes an internal switch to allow the PCM to determine if the intake manifold is in the short or long position.

IMRC System Diagnosis

- If an intake manifold position fault is detected, the PCM will set a diagnostic trouble code (DTC) and illuminate the malfunction indicator lamp (MIL).
- Before performing a road test, the technician can verify that the IMRC actuator can change the intake runner position by observing the manifold lever during engine start-up.
  - The intake manifold runner is in the “short” position when the engine is off
  - Starting the engine will cause the cable to retract and move the runner to the “long” position.
- A road test can be performed to verify that the manifold moves back to the “short” position.

Vehicle State	Runner Position	Engine RPM	Voltage
KOEO			
KOER			
KOER			

Exhaust



SVTF027-A

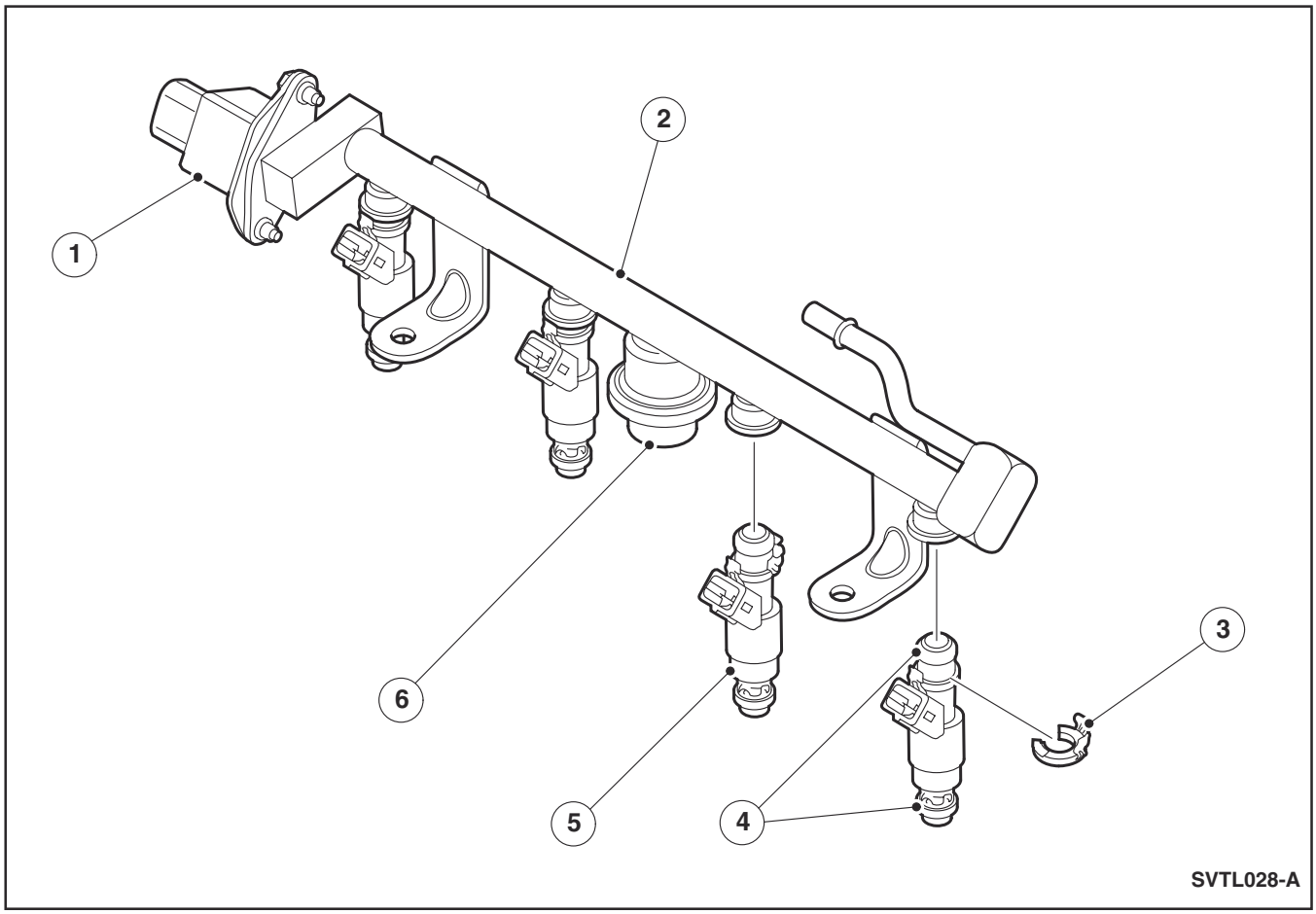
4 Into 2 Into 1 Exhaust Header

- The SVT engineers repositioned the catalyst under the vehicle, allowing enough room for the tuned 4-Into-2-Into-1 tubular header system.
- The engine calibration retards the spark timing during a cold start to heat the catalyst quickly.
- Even with the performance exhaust system, the SVT Focus meets the national Low Emission Vehicle (LEV) standard.
- The exhaust pipe diameter is increased to 58 mm (2.25 in) and includes a 75 mm (3.00 in) chrome tip.

Spark Plugs

- To control detonation and to provide 100,000-mile durability, the spark plugs in the SVT Focus run cooler than the plugs in the mainstream Focus.
- Both of the electrodes on SVT Focus spark plugs are platinum.
- If the wrong plugs are installed in the SVT Focus there is an increased chance of preignition and internal engine damage.

Fuel System

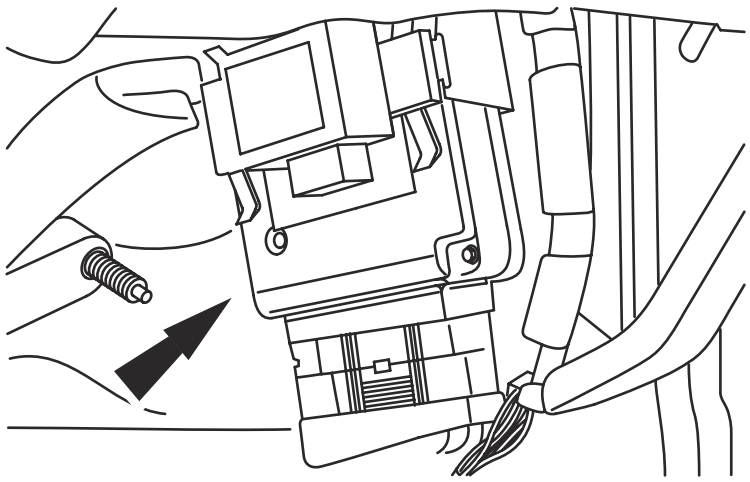


Fuel Charging Components

Item	Description
1	Fuel pressure sensor
2	Fuel supply manifold
3	Fuel injector retaining clip
4	Fuel injector O-ring seals
5	Fuel injector
6	Fuel pulse damper

- The fuel rail pressure sensor is a dead end style sensor. A dead end sensor is simply a sensor that is put on the end of the fuel rail on a returnless fuel system.
- A new fuel pump for the 2004 model year is more resistant to alcohol.
  - The new pump was used in the mainstream 2003 Focus.
- The fuel injectors flow is increased to 30 lbs/hour.
- With the exception of the higher fuel injector flow rate, diagnosis of the fuel system is the same for the SVT as for the mainstream Focus.

PCM



SVTF029-A

PCM Located Under the Right Kick Panel

- The Powertrain Control Module (PCM) used in the SVT Focus is unique.
- The addition of circuits to control the VCT system and the dual-stage intake manifold means that it is not interchangeable with the PCM from the mainstream Focus.
- The PCM is located behind the right kick panel.

TECHNICAL DATA

Engine

Configuration	Inline 4-cylinder, cast iron block, precision die-cast aluminum head, cast aluminum pistons, forged steel connecting rods, nodular cast iron crankshaft.
Bore x Stroke	84.8mm x 88.0mm (3.34 in x 3.46 in.)
Displacement	1,988cc
Compression Ratio	10.2:1
Horsepower	170 hp @ 7,000 rpm
Torque	145 lb.-ft @ 5,500 rpm
Specific output	85 horsepower per liter
Redline	7,200 rpm
Valvetrain	Dual overhead camshafts, four valves per cylinder, variable cam timing on intake camshaft.
Intake Valves	2 per cylinder 33.5mm head diameter
Exhaust Valves	2 per cylinder 28mm head diameter
Fuel system	Sequential electronic fuel injection
Intake Manifold	Dual-stage with 66mm throttle body
Exhaust Manifold	Stainless steel 4-into-2-into-1 tuned header
Exhaust system	Underbody-only catalyst; 58mm (2.28 in.) diameter exhaust pipe; 75mm (2.95 in.) diameter chrome exhaust tip.

Drivetrain

Transaxle	Getrag™ 6-speed manual, twin-layshaft design			
Gear	Gear Ratio	Output Shaft	Differential Ratio	Overall Ratio
1st	4.44:1	1	2.88:1	12.7:1
2nd	2.67:1	1	2.88:1	7.7:1
3rd	1.33:1	2	4.25:1	5.7:1
4th	1.08:1	2	4.25:1	4.6:1
5th	1.33:1	1	2.88:1	3.8:1
6th	1.08:1	1	2.88:1	3.1:1
Reverse	2.82:1	2	4.25:1	12.0:1
Clutch	Hydraulic actuation with dual-mass flywheel			
Driveshafts	High strength, solid output shafts			

Steering

Type	Rack and pinion, power assist
Turns, lock to lock	2.6
Turning diameter	39.1 ft.Wheels & Tires
Wheels	17 x 7 in., five-spoke, aluminum alloy
Tires	Continental P215/45R-17 ContiSportContact

Suspension

Front	SVT-tuned independent MacPherson struts with angled coil spring/damper units and lower A-arms in optimized double horizontal bushings mounted on separate front subframe; 21mm anti-roll bar
Rear	SVT-tuned independent SLA system with one upper and two lower arms plus additional twist-plate longitudinal link, separate vertical damper units; 21mm anti-roll barDrivetrain

Brakes

Front 300mm (11.8 in.) vented disc, single-piston caliper
Rear 280mm (11.0 in.) solid disc, single-piston caliper
ABS Four-channel, four-sensor system.

Dimensions, Capacities

Wheelbase	103.0 in. (2,615mm)
Length	168.1 in. (4,270mm)
Height	56.3 in. (1,430mm)
Width	66.9 in. (1,699mm)
Track, f/r	58.8 in. (1,494mm) / 58.5 in. (1,486mm)
Head room, f/r	39.3 in. (998mm) / 38.7 in. (983mm)
Front leg room	43.1 in. (1,095mm)
Curb weight	2750 lb.
Fuel capacity	13.2 gallons (50 liters)
Weight distribution, f/r	61/39

NOTES

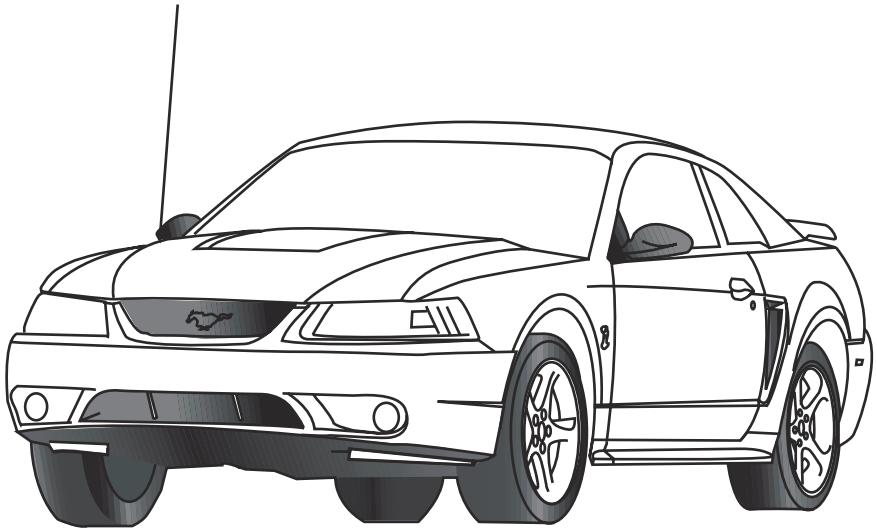
OBJECTIVES

After completing this course, the technician will be able to describe the differences between the mainstream Mustang and the SVT Cobra regarding the following systems:

- Body Features and Miscellaneous Equipment
- Suspension Systems.
- Brake Systems
- Manual Transmission
- Clutch and Pressure Plate
- Axles
- Powertrain Components
- Engine Performance Components

CONTENTS

EXTERIOR



SVTC001-A

2003 SVT Cobra

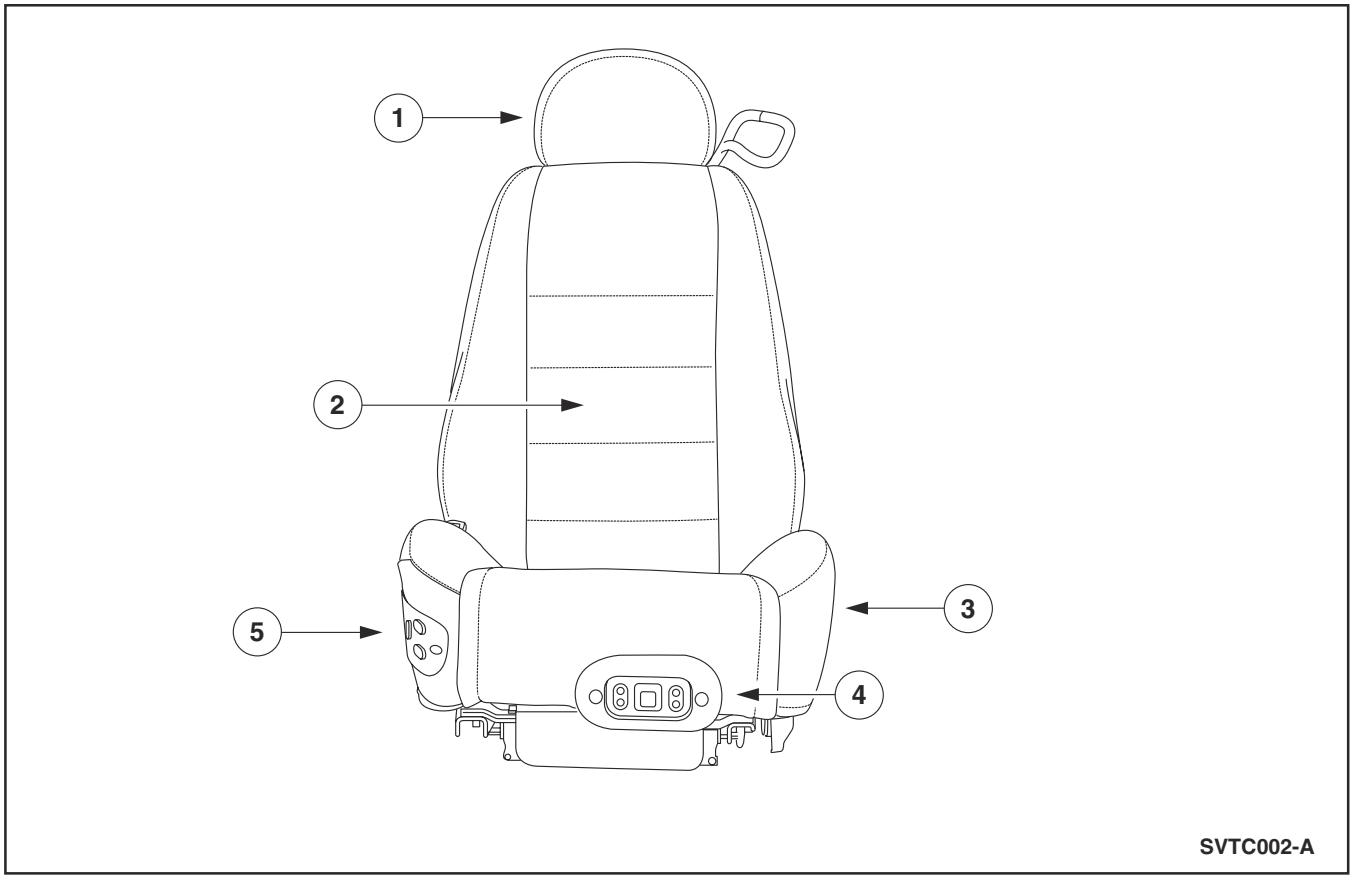
The SVT Cobra reestablishes its identity as the preeminent muscle machine. The Cobra's styling cues are reminiscent of its storied past. However, its dual-overhead cam, 32-valve, supercharged engine plants its tires firmly in the future.

Design features of the SVT Cobra exterior include:

- A more aggressive front fascia that allows more airflow through the engine compartment.
- A redesigned composite hood with flow-through scoops that help vent hot air from the engine compartment.
- Reshaped rocker panels with simple, clean vertical lines.
- Color-keyed, foldaway outside mirrors.
- New round fog lamps.
- A new LED center-high mounted stop lamp (CHMSL) is mounted in the redesigned spoiler.
  - The LED CHMSL includes 40 LEDs mounted in a sealed non-serviceable unit.
- Restyled rear fascia with larger "Cobra" lettering.
- A new acrylic cloth convertible top provides a higher quality appearance and reduced wind noise.
- A new footprint consisting of 275/40-ZR17 Goodyear F1 GS tires designed specifically for the Cobra provides enhanced steering feel, handling, and traction.
  - These wide Goodyear tires are mounted on 17" x 9" cast aluminum wheels with a 26mm offset.
- Airfoil wiper blades that stay planted on the windshield at speeds up to 130 mph.

INTERIOR

Seating



Fully Bolstered Power Driver Seat

Item	Description
1	Front seat backrest head restraint
2	Front seat backrest pad adjuster
3	Seat control switch
4	Lumbar control switch
5	Bolster and lumbar control switches

With this much performance capability, keeping the driver firmly planted in the seat is a priority. The new seat trim lines only hint at the enhancements made by the SVT engineers. Those in tune with comfort and support will notice the taller bolsters, the wider seating surfaces, the longer seat cushion, and taller, slimmer headrest. Sit down and notice the performance feel provided by the redesigned foam and the solid elastic flex-mat that replaces the wire spring suspension for the 2003 model year. Customize the driver's seat using the new power adjustable lumbar, seatback bolsters, and leg bolsters and you can't help falling for the "fits like a glove" feel.

Audio System

- The 2003 Cobra comes standard with a Mach 460 system with speed sensitive volume and 6-disc CD changer/player.

Electroluminescent Instrument Cluster

SVTC018-A

2003 Cobra Instrument Cluster with Supercharger Boost Gauge

- The Cobra includes an electroluminescent instrument cluster with titanium-color gauges.
  - Warning lamps still require bulbs.
- The new cluster doesn't require bulbs for gauge illumination.
- A thin film located in between the faceplate and the graphic plate illuminates when 120 volts is applied.
- The cluster uses the SCP network to collect vehicle data for the display.
- The new cluster includes a vacuum operated mechanical boost gauge.

Steering Wheel Rim

- The steering wheel rim thickness is increased for improved feel.

ELECTRICAL

Battery Cables

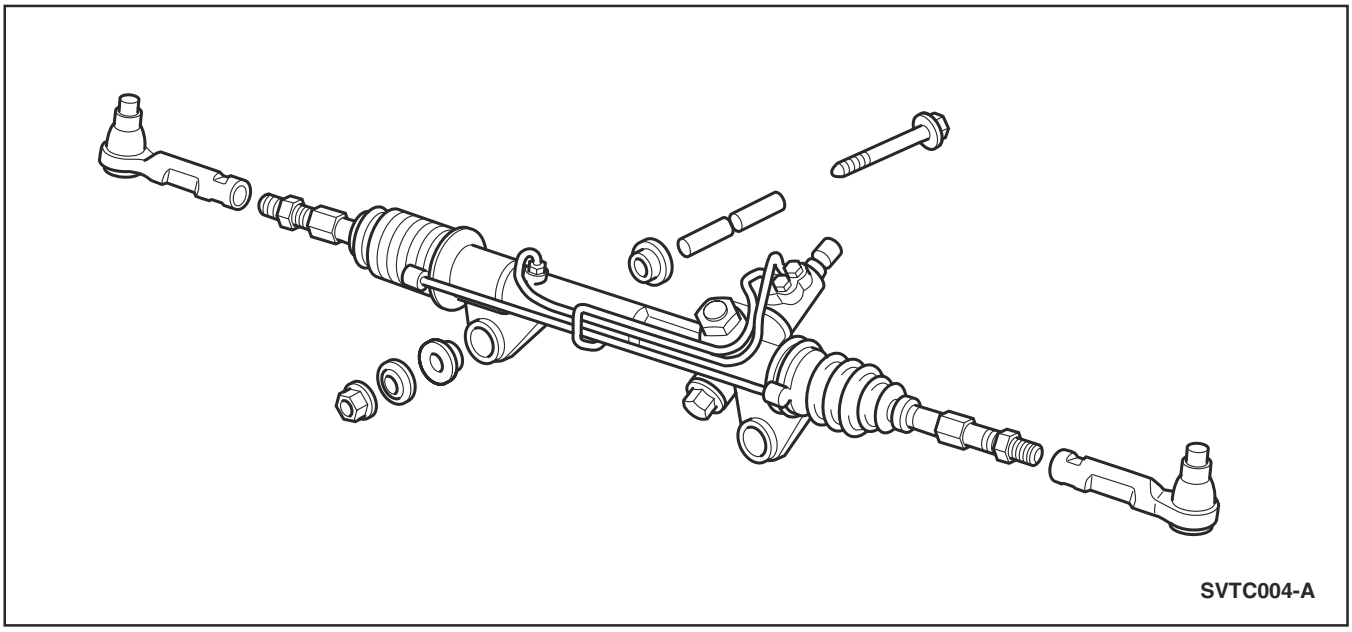
- The battery cables are revised to accommodate the new engine configuration.

CLIMATE CONTROL

- Air conditioning pressure lines are new to accommodate the new engine configuration.

STEERING AND SUSPENSION

Power Steering



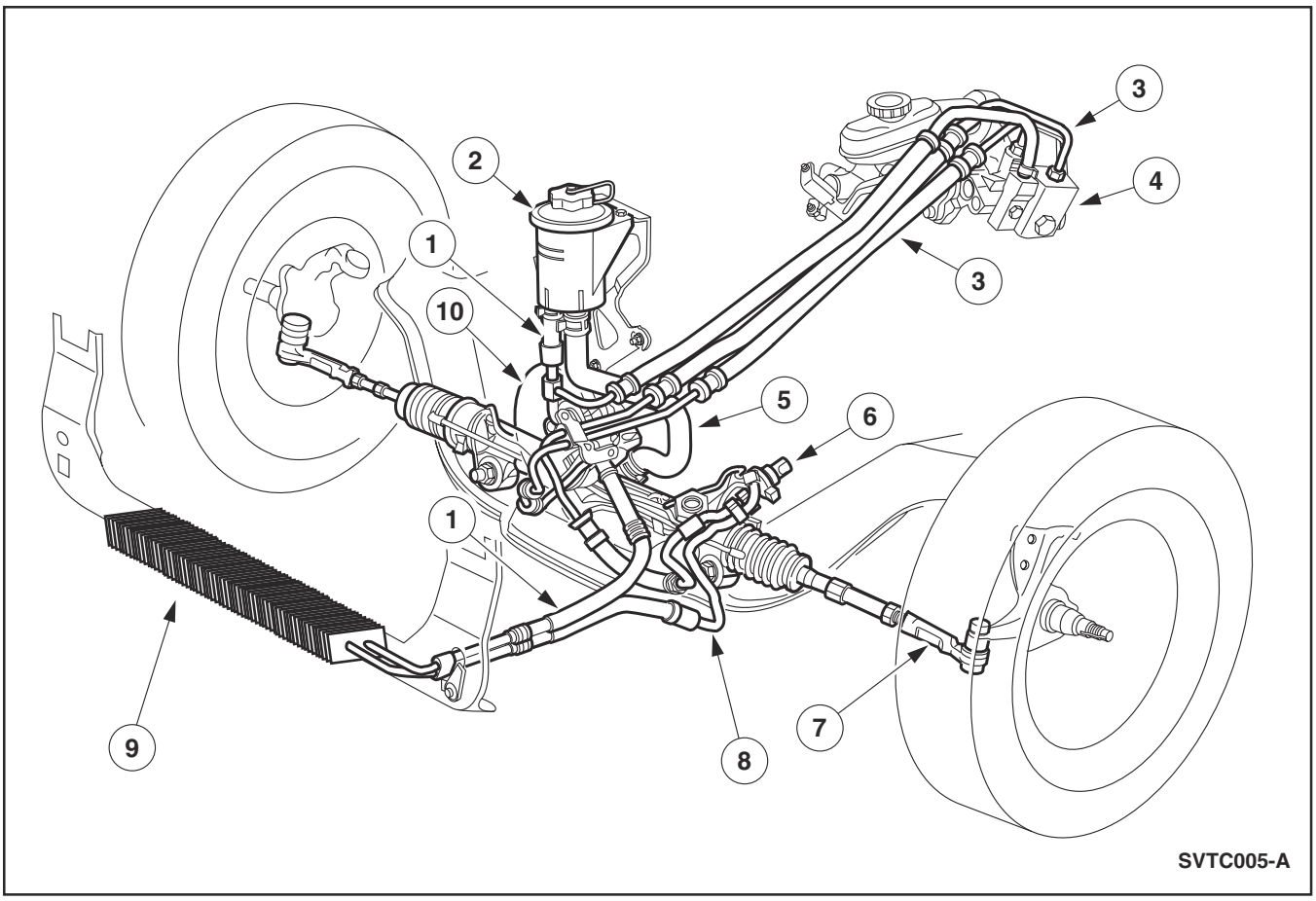
Rack and Pinion Power Steering Gear

- The Cobra is equipped with power assisted rack and pinion steering.
- The steering ratio is 15.7:1.
- The steering restrictors, located on the rack just under the tie rod boots, have been redesigned to accommodate the new wider 275-series tires.
- The steering rack bushings have been hardened and although they look very similar to previous model years but they can be identified by the purple stripe across the front.
  - – Hardening the bushings helps hold the rack more firmly to the cross member and provides improved steering feel.
- The tie rod ends have been shortened to accommodate the lowered suspension and are capped with high temperature boot seals for improved heat resistance under severe operating conditions.

Steering Column

- To help the improved steering feel make its way to the passenger compartment, the steering column has a lower lash splined slider and a stiffer disk isolator.
- A tubular heat shield, integral to the lower tube, helps protect the steering column from engine heat.

Power Steering Pump and Lines



Hydraulic Power Steering System

Item	Description
1	Power steering hose
2	Power steering pump reservoir
3	Power steering hose
4	Hydro-boost assy
5	Power steering hose

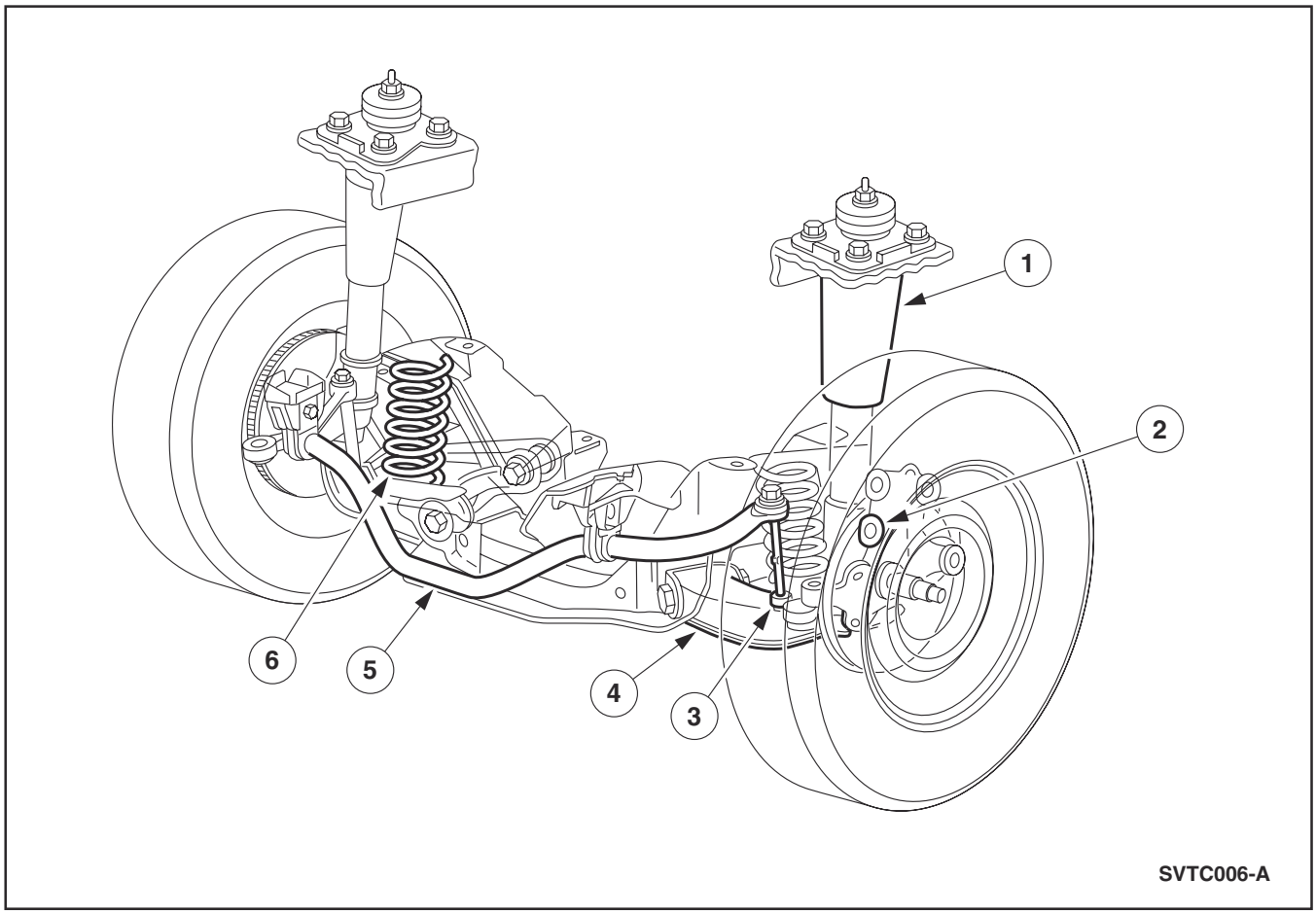
Item	Description
6	Steering gear
7	Tie-rod end
8	Power steering hose
9	Power steering fluid cooler
10	Power steering pump

- The power steering pump has a new inlet and the power steering hoses have been rerouted to accommodate the supercharger package.
- A new fin pack (radiator-style) power steering cooler replaces the old loop style cooler.
  - The new 18-inch cooler is located in front of the radiator support behind the supercharger cooler.

Suspension

- The Cobra keeps a lower profile with the introduction of shorter, higher rate springs.
- The new springs provide the following wheel rates:
  - 300 lb/in (33.89 Nm) wheel rate front and rear on the coupe.
  - 250 lb/in (28.25 Nm) front wheel rate and 235 lb/in (26.55 Nm) rear wheel rate on the convertible.

Front Suspension

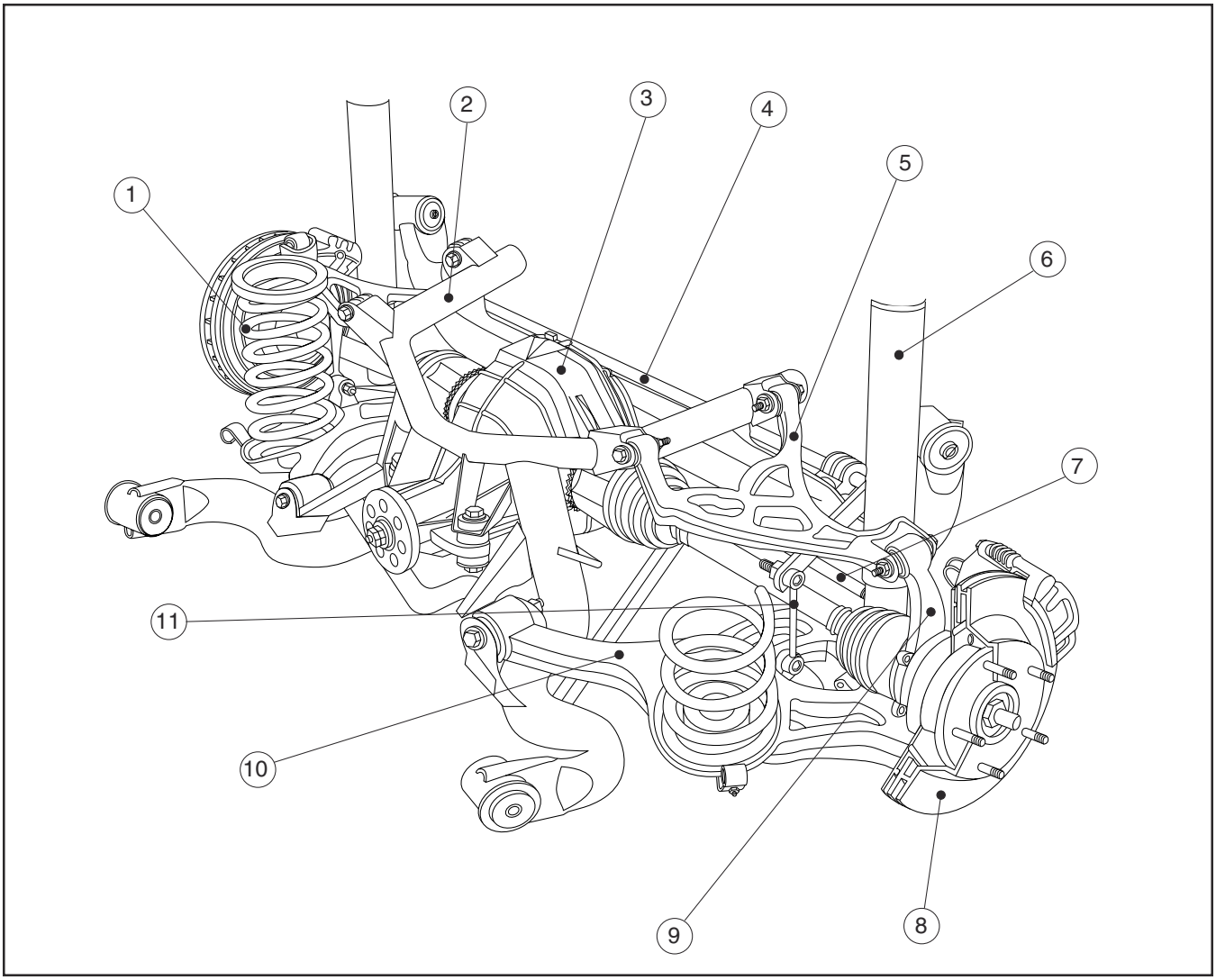


SVT Cobra Front Suspension with Bilstein Gas-Charged Struts

Item	Description
1	Front shock absorber
2	Front wheel spindle
3	Front stabilizer bar link
4	Front suspension lower arm
5	Front stabilizer bar
6	Front coil spring

- The front control arm bushings have an increased rate as well, increasing to 8000 n/mm.
- The stabilizer bar diameter is increased to 29 mm for improved handling.
- And to top off these suspension improvements, Bilstein gas-charged, 46-mm monotube struts provide precise tuning to the upgraded suspension allowing superior handling and less variability.
  - The coupe and the convertible use different shock absorbers that are more precisely tuned to their distinctive body styles.

INDEPENDENT REAR SUSPENSION



SVT Cobra Independent Rear Suspension

Item	Description
1	Linear rate coil spring
2	Tubular steel subframe
3	3.55:1 limited slip differential
4	Tubular stabilizer bar
5	Steel upper control arm
6	Gas charged shock absorber

Item	Description
7	Tie rod
8	11.65 in rear rotor
9	Aluminum alloy spindle
10	Aluminum alloy lower control arm
11	Stabilizer bar link

Principles of Operation

- Vehicle handling, steering, and ride have been greatly improved due to the addition of independent rear suspension (IRS).
- The IRS system is carried by a unique tubular steel subframe that replaces the traditional solid axle.
- The IRS:
  - widens the rear track by 1.2 inches.
  - reduces unsprung weight to 125 pounds.
  - greatly reduces the potential for suspension bottoming.
- The upper control arms are constructed of cast steel and the lower control arms are constructed of cast aluminum.
- The left and right tie rods control toe characteristics during cornering.
  - Both tie rod assemblies use identical components (same part numbers for both sides).
- The IRS uses 470 lb/in linear rate coil springs.
- The IRS uses solid, heat-treated halfshafts.

Improvements

- In order to firm up the independent rear suspension, the rear subframe bushing stiffness is 400% greater.
  - Revised vertical voids also improve stiffness.
- Rear handling balance has been improved by lowering the location of the inner pivot joint.
  - Lowering the pivot joint reduces roll understeer during cornering.
- The rear stabilizer has been strengthened with the addition of higher grade steel ends.
- The ball joint races have been upgraded for increased durability.
- A tubular crossbrace helps to stabilize the differential during hard acceleration.

Diagnosis and Repair

- Because the IRS provides for better control under a wider range of driving conditions, it is very important to properly maintain system adjustments.

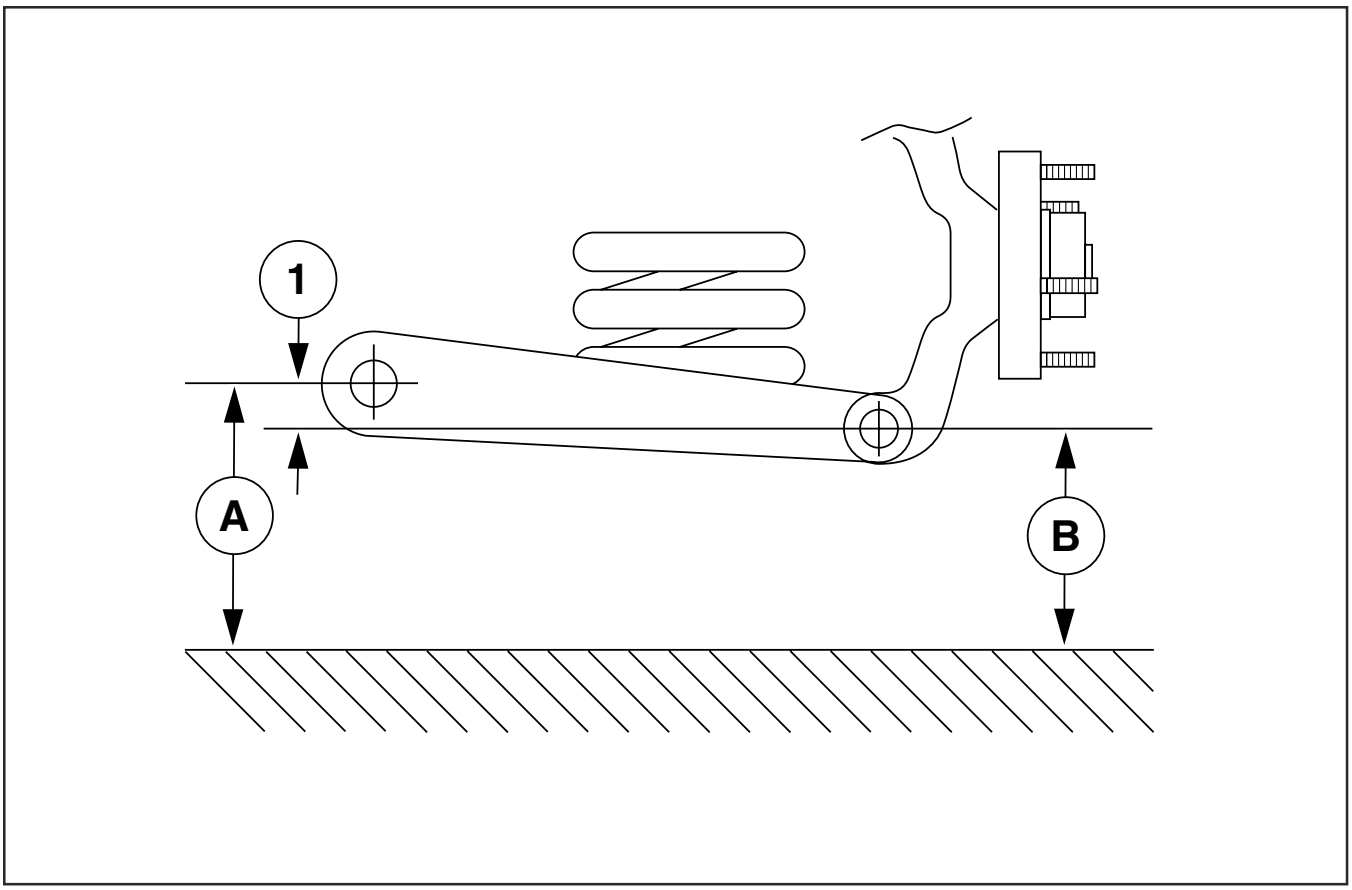
Rear Alignment Adjustments

NOTE: Tire pressure is critical to proper alignment and good road feel. Make sure that tire pressure is within specification before proceeding with an alignment.

NOTE: Before making any suspension measurements or adjustments, make sure that the rear slip plates on the alignment machine float freely.

NOTE: All of the following alignment specifications are for a vehicle with an empty trunk and a full tank of fuel.

Ride height



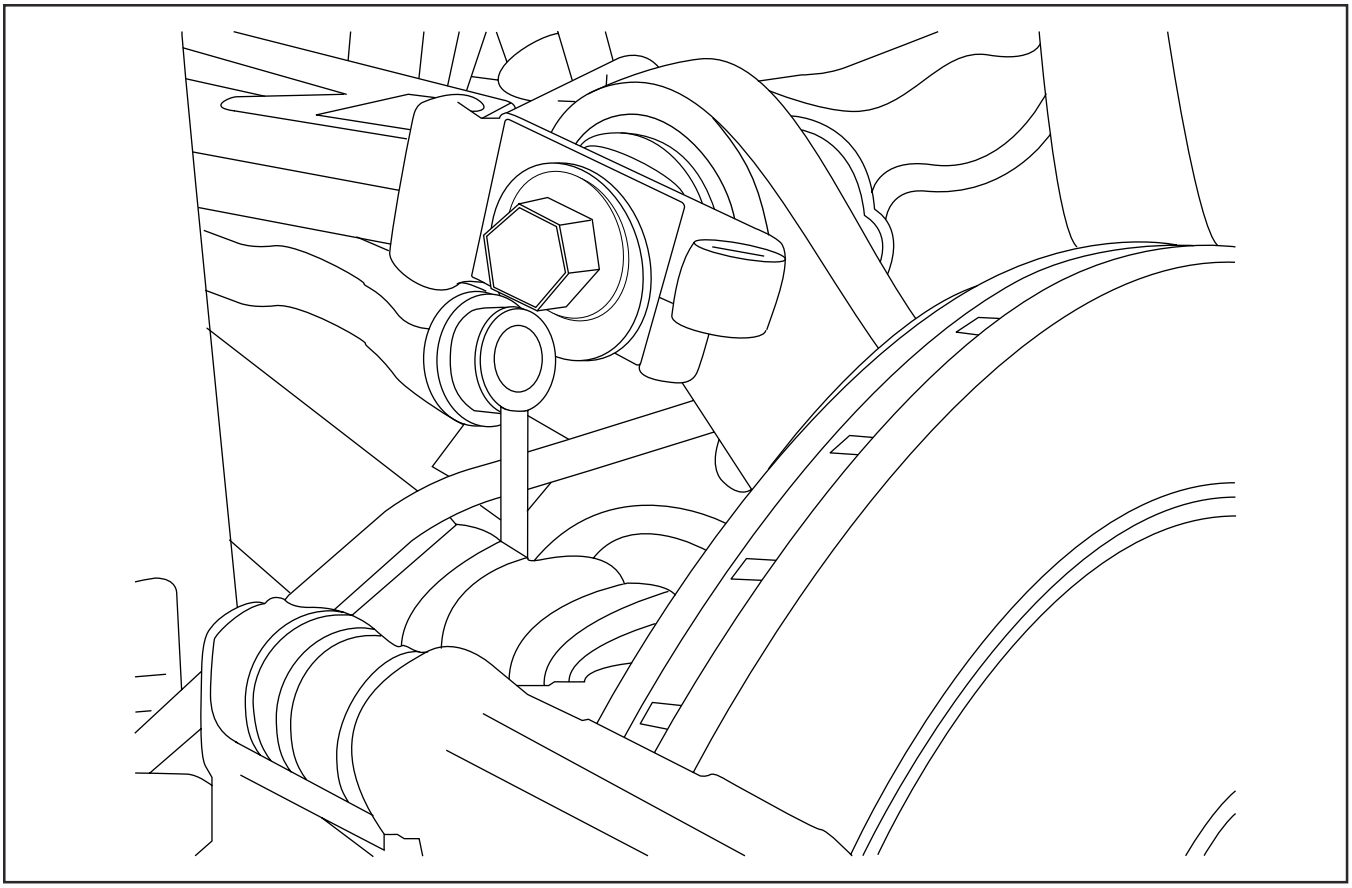
Rear Ride Heaight Measurement Location

Item	Description
1	Ride height = A-B
A	Measurement A
B	Measurement B

- To obtain the rear ride height measurement.
  - On a level surface, measure the distance from the center of the lower ball joint bolt to the ground (measurement B).
  - Then, measure the distance between the center of the lower control arm rear pivot bolt to the ground (measurement A).
  - To obtain the ride height, subtract the first measurement from the second measurement: (ride height = measurement A minus measurement B).

Rear Ride Height	
1999-2002	36.3 mm ± 7.6 mm
2003 and newer	18 mm ± 7.6 mm

Rear camber

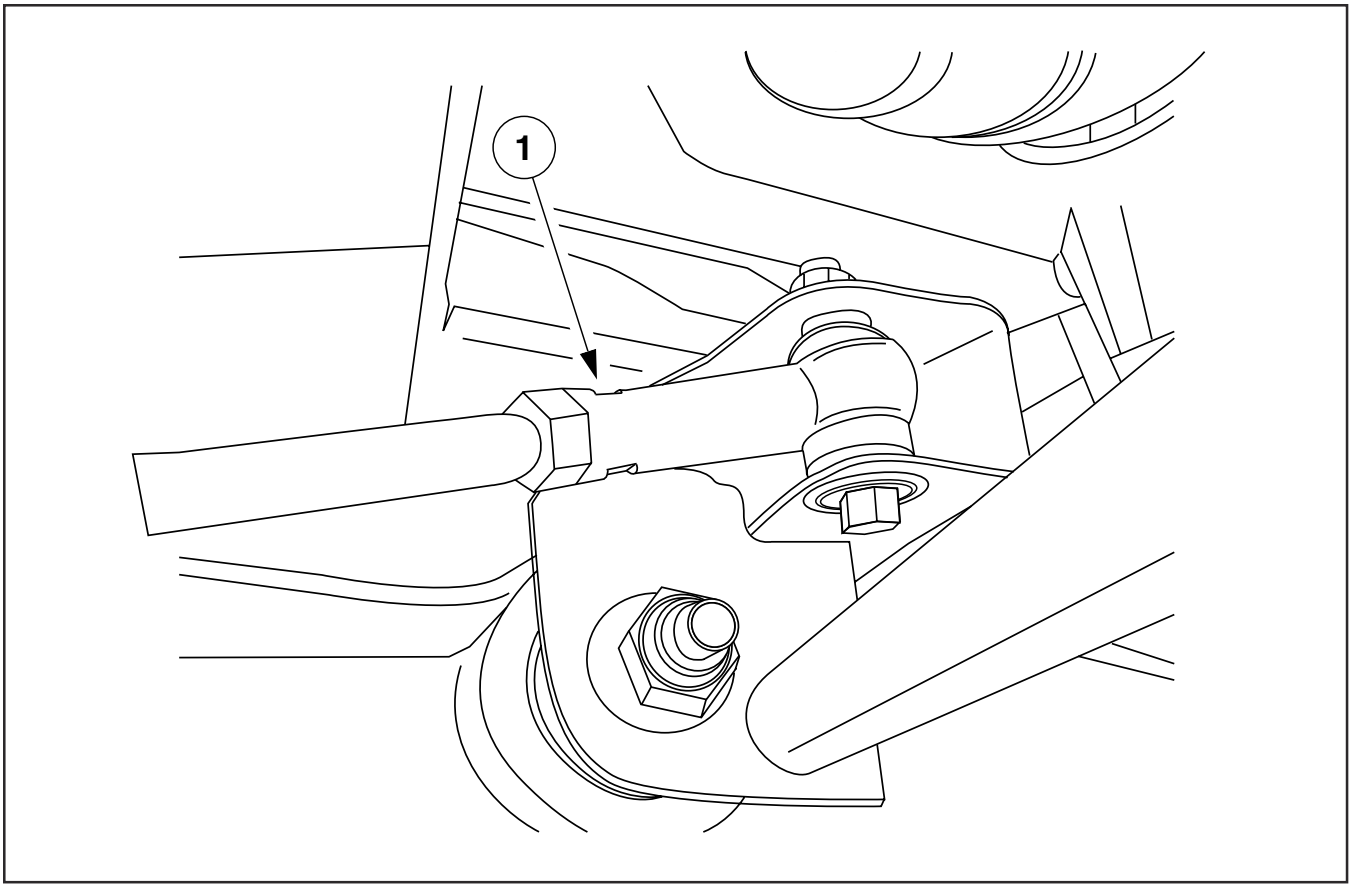


Rear Camber Adjusting Cam

- In order to adjust rear camber, loosen the upper ball joint nut and rotate the adjustment cam.
- Camber specifications are as follows:

Camber	LH	RH
	-0.7° +/- 0.2°	-0.7° +/- 0.2°

Rear toe



Inner Tie Rod End

Item	Description
1	Flat for open end wrench

- Rear wheel toe can be adjusted by loosening both tie rod ends and rotating the tie rod.

CAUTION: The inner tie rod end has flats to accommodate the use of an open end wrench. Always use these flats when adjusting the tie rod to prevent damage to the inner tie rod end boot (grease seal).

- Rear toe specifications are as follows:

Toe	LH	RH
	0.125° +/- 0.075°	0.125° +/- 0.075°

NOTE: When tightening the jam nut at the inner tie rod end, the toe adjustment will increase slightly (approximately .03° - .04°). Adjusting the toe to approximately .08° - .09° before tightening the jam nut should compensate for this change.

Subframe Bushings

- Because of the extremely high amount of pressure required to press fit bushings into the subframe assembly, the subframe bushings are not replaceable.

Differential

- Removal of the differential requires removal of exhaust components and both halfshafts. Refer to the Mustang Workshop Manual, Section 204-02 for the correct procedure.

Halfshafts

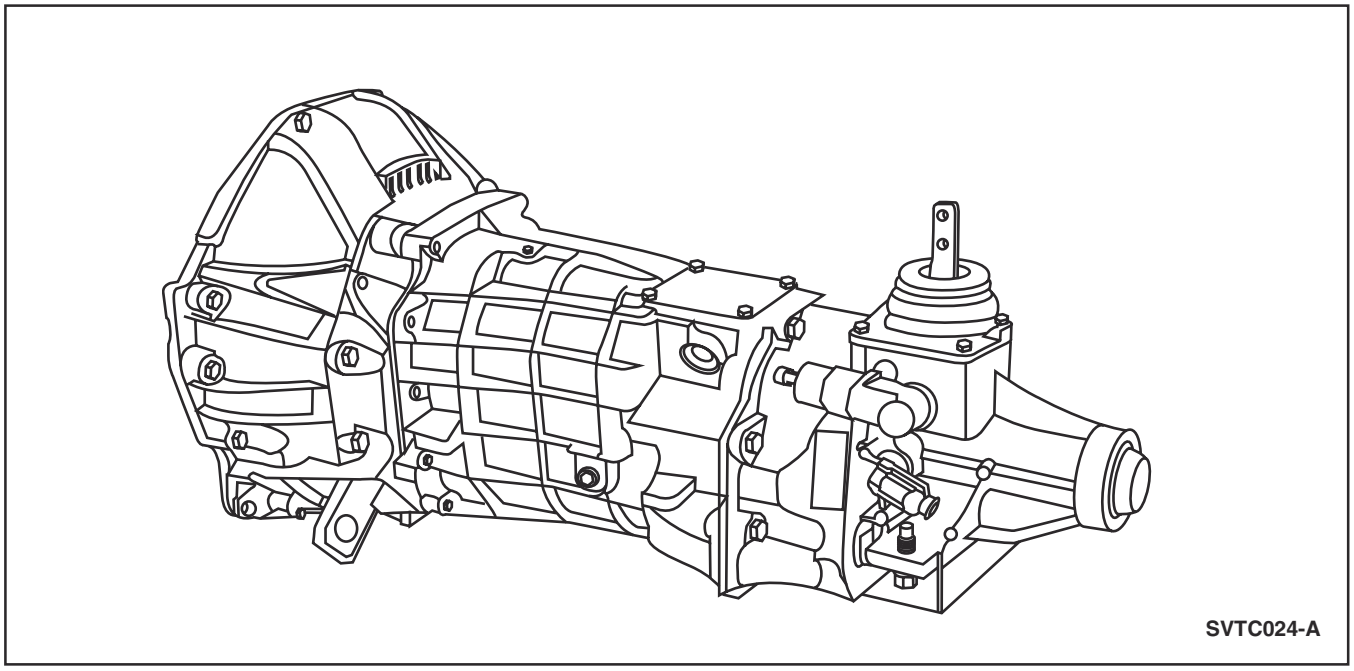
- The CV joints on the SVT Cobra are not repairable. They must be replaced as an assembly.

BRAKES

- Upgraded pad material for the rear brakes provide better performance and heat dissipation.

Transmission and Drivetrain

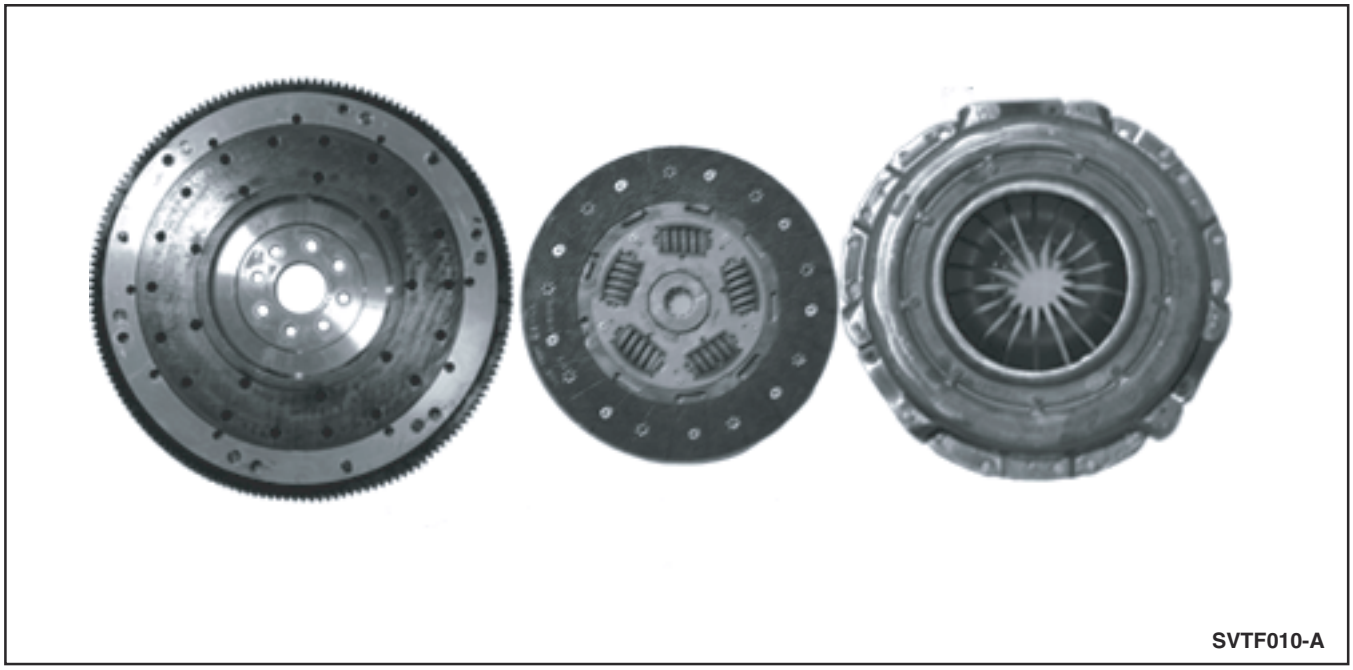
Manual Transmission



SVT Cobra 6-Speed TTC™ T56 Manual Transmission

- The new short-throw shifter with brushed aluminum highlights is only the beginning of the changes to the manual transmission.
- Beginning in 2003, the Cobra manual transmission was upgraded to a 6-speed TTC™ T56 manual transmission with carbon fiber blocker rings.
  - The T56 transmission provides improved shift characteristics and greater durability.
- The transmission includes a PCM-controlled reverse lockout solenoid to prevent damage to the gearbox.

Flywheel, Clutch, and Pressure Plate



SVT Cobra Clutch Flywheel, and Pressure Plate

- The new aluminum flywheel assembly with steel inserts lowers the engine rotational inertia and weight to improve vehicle performance and reduce shift effort.
- A new, stronger clutch disc handles higher engine torque.
- The new pressure plate assembly provides improved reliability and lower NVH.
  - The pressure plate is the same size as the current Cobra but has a higher clamp load and increased torque capacity.
  - Despite the strengthening of the springs, the pedal effort is quite similar to the current Cobra.

Driveshaft

- The new aluminum driveshaft helps to lower the weight of the drivetrain and provides stability for higher rotational speeds.

Axle Shafts

- New Cobra-R type 31-tooth axle shafts have increased torque capacity to help bring the Cobra's increased power to the road.

NOTES

POWERTRAIN

Engine Block

SVTC010-A

The New 4.6L 4-Valve Supercharged Engine

- The engine block for the supercharged 4.6L is cast iron for proven durability.
- The center bulkhead has additional clearance to accommodate the fully counterweighted forged crankshaft.

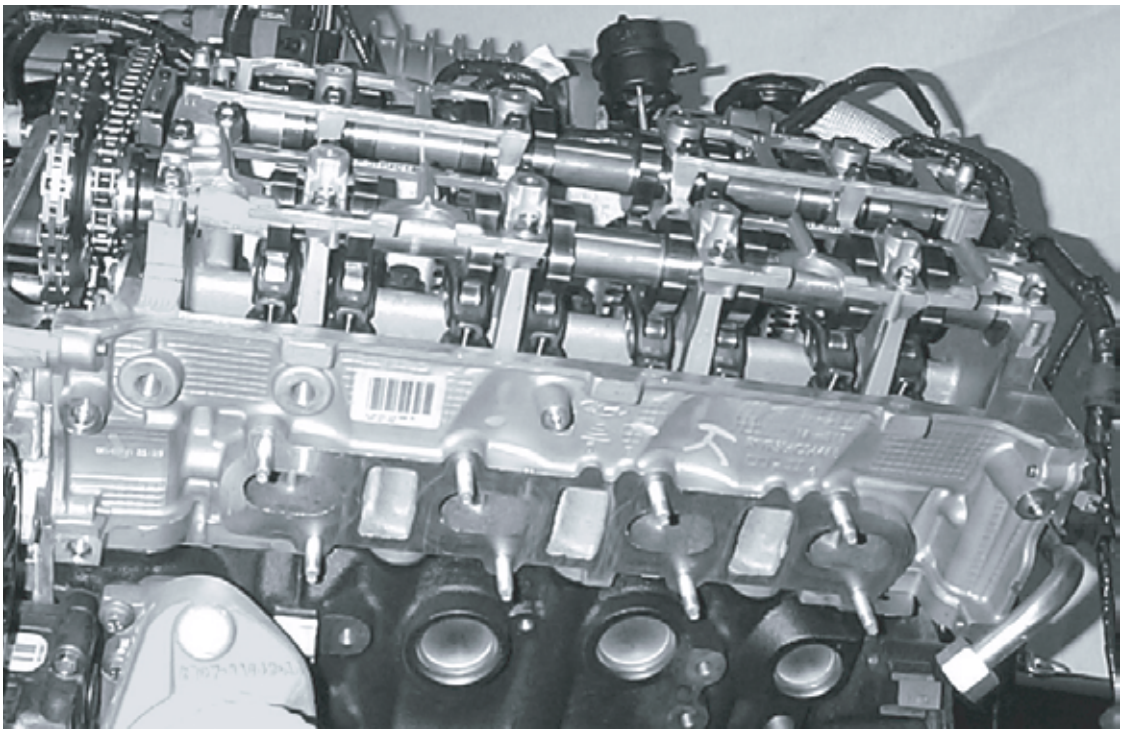
Pistons and Crankshaft

SVTC009-A

SVT Cobra/Manley Performance Products Piston and Connecting Rod

- Cobra's new forged pistons are designed to help manage the changes in heat and expansion characteristics created by the supercharged air flow.
  - These pistons are similar to the Lightning pistons.
  - However, the dish is shallower and the pin offset is reduced from 1.25 mm to 1.00 mm.
- The Cobra connecting rods are upgraded to Manley Performance Products forged H-beam machined rods with machined end caps.
  - The Manley rods are paired with ARP brand connecting rod bolts and a high-strength piston pin bushing for increased durability.
- These new piston assemblies are sealed to the cylinder walls with a Sealed-Power ring pack.
  - These performance rings incorporate a Napier second ring that has a hook shape in the lower outer edge to help remove excess oil from the cylinder wall.
- The Cobra's forged crankshaft has been rebalanced for the new piston and rod assembly.

Cylinder Heads



SVTC019-A

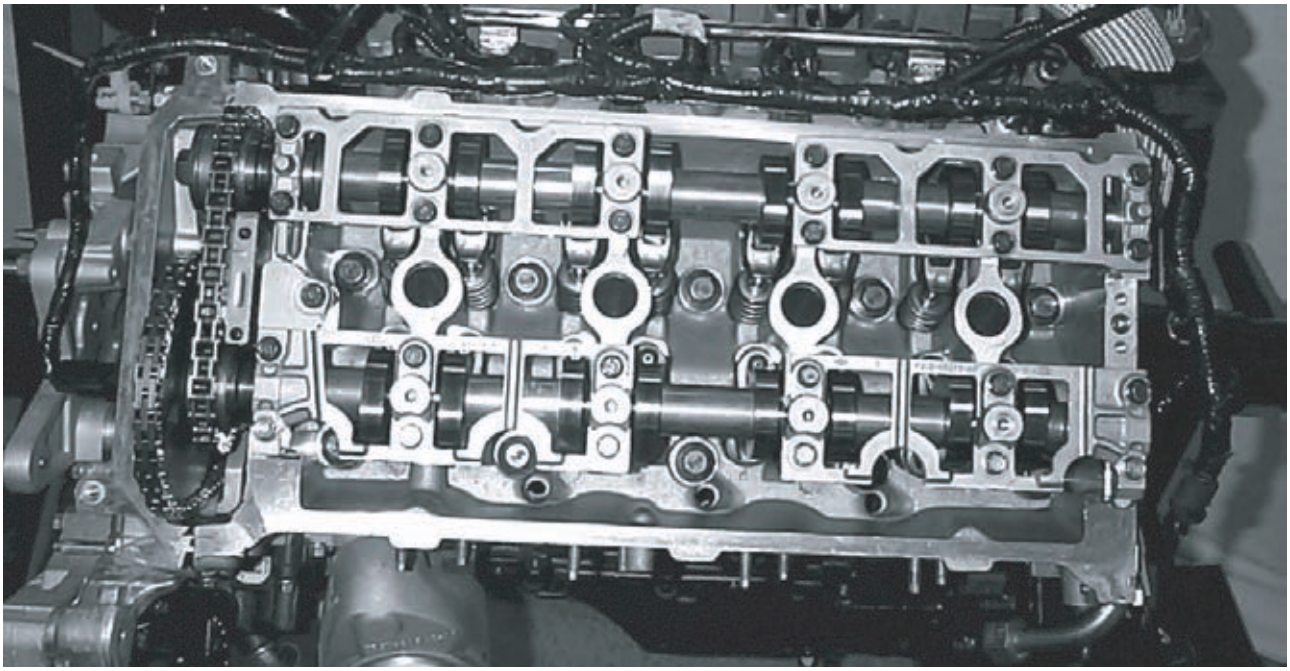
SVT Cobra Cylinder Head

- The flow characteristics of the cylinder heads are improved to provide improved low-end torque while maintaining excellent high rpm flow characteristics.
- Exhaust airflow is improved by changing the shape of the exhaust port opening.
  - Using previous model year cylinder heads in 2003 and newer Cobras will result in a port mismatch.

Camshafts

- The intake camshafts are updated to optimize the valve timing curve for the redesigned cylinder head ports.

Valve Train



SVTL020-A

New Engine Front Cover and Redesigned Timing Chain Guide

- The engine front cover has been redesigned for use with the cast iron block and 4-valve cylinder heads.
- The left timing chain guide is redesigned for use with the cast iron block.

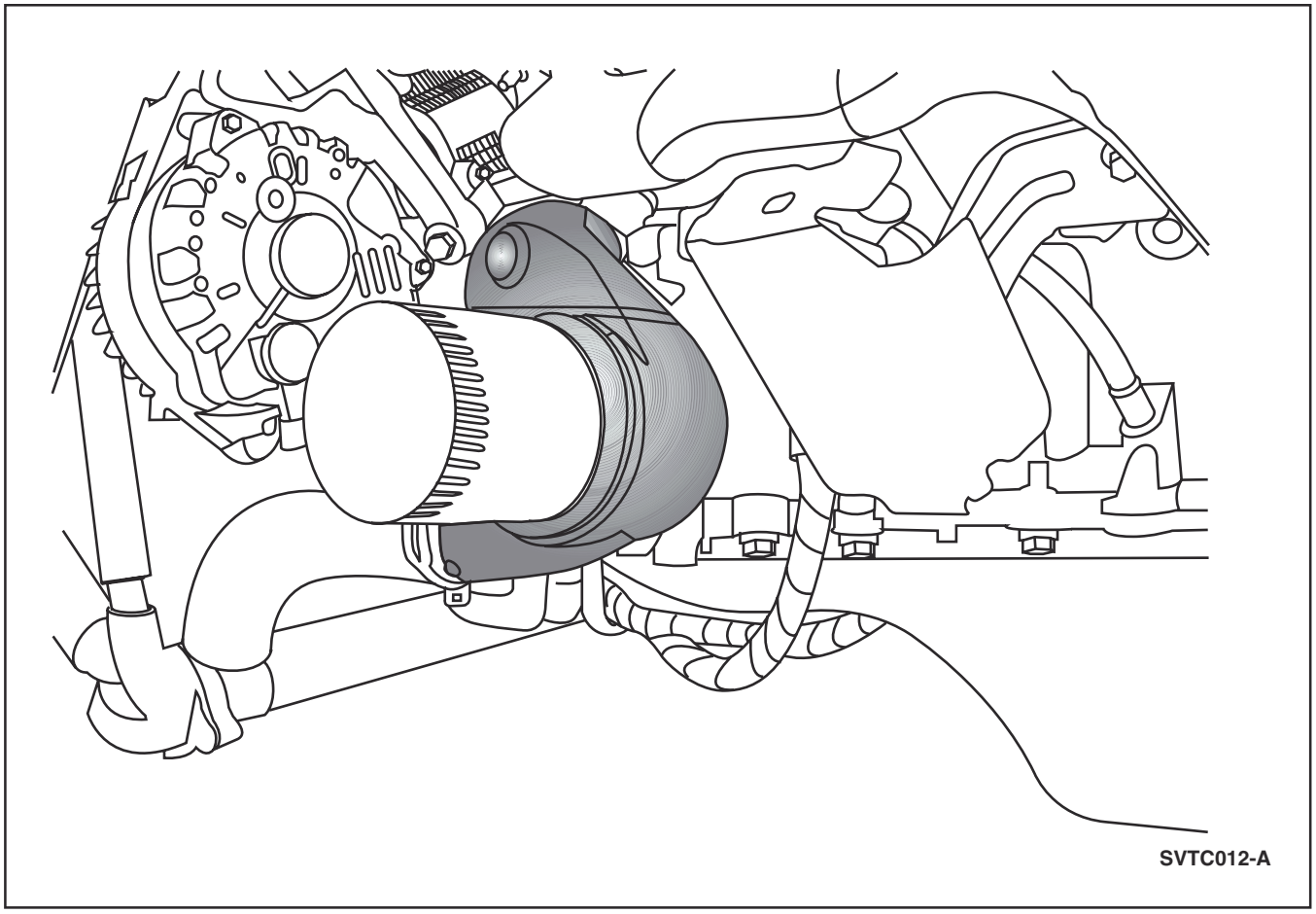
Intake Manifold

- The intake manifold is all new to incorporate mounting for supercharger and the supercharger intercooler components.

Exhaust Manifold

- With more air coming in, engineers redesigned the exhaust ports on the cylinder heads to allow more air out.
- New three-layer metal exhaust manifold gaskets mate the revised cylinder heads to the new exhaust manifolds with updated mating flanges.

Engine Oiling



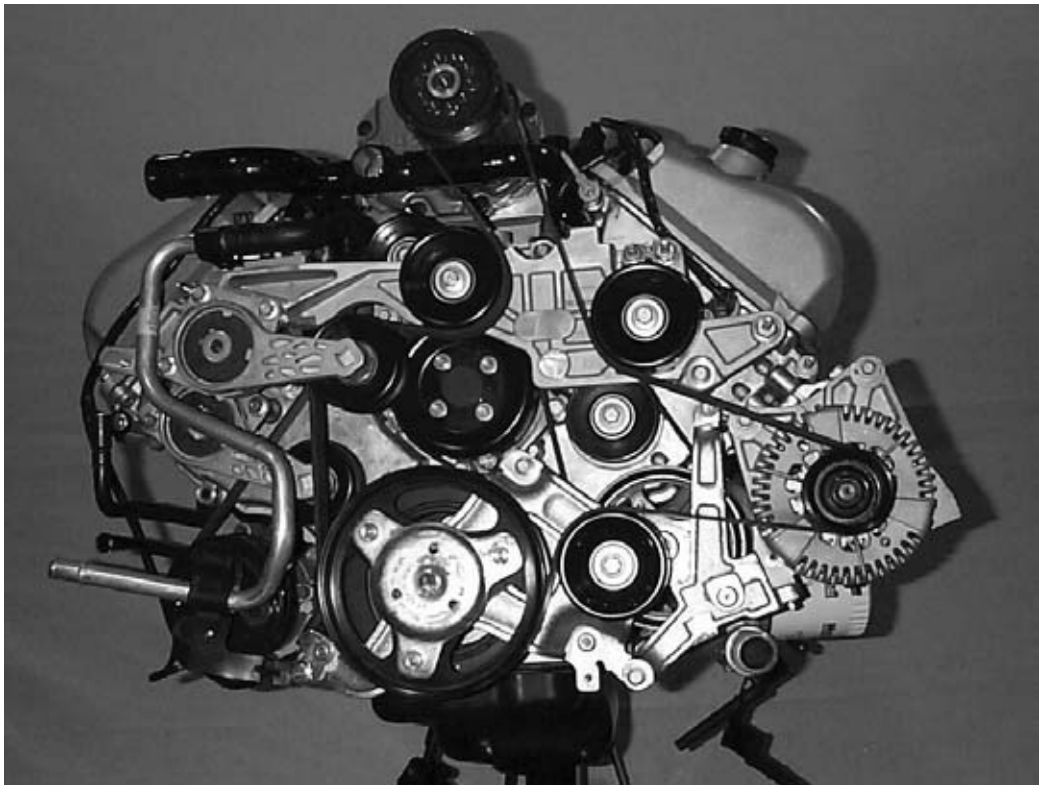
SVT Cobra Modine Style Engine Oil Cooler

- The engine oil cooler has a new exterior shape to provide room for the new engine configuration.
- The new cooler uses the same interior cooler core to provide a continued high level of oil temperature reduction.

Engine Cooling

- The radiator core tubes on the Cobra are internally dimpled.
  - The internal dimples increase the surface area of the radiator tubes and improve cooling.

Front Engine Accessory Drive (FEAD)



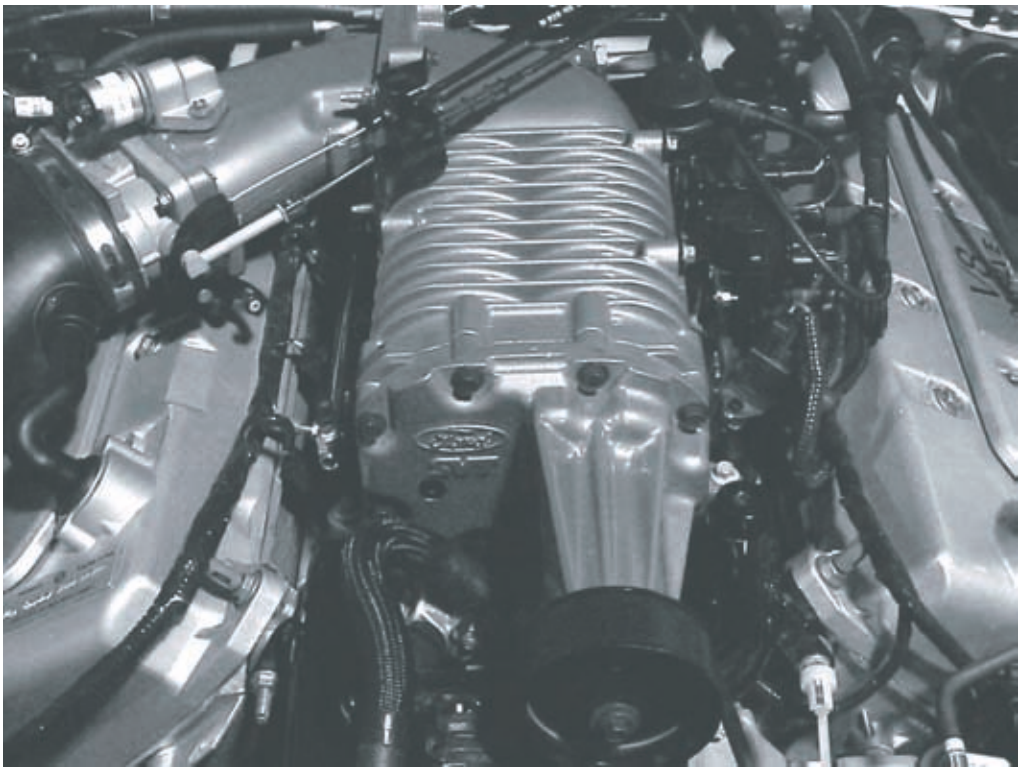
SVTC021-A

Dual-Belt Front Engine Accessory Drive

- A new dual-belt front engine accessory drive provides power to engine accessories and the new Eaton supercharger.
- The primary belt on the crank damper drives the water pump, power steering pump, and A/C compressor and includes three idler pulleys and a tensioner.
  - Two idlers are mounted to the front cover and one on a bracket in the front of the engine valley.
- The primary belt (closest to engine) is color coded with a red ID tag.
- The secondary belt drives the alternator and supercharger and includes three idler pulleys and a tensioner also used on the secondary system.
- The secondary belt is driven by a crankshaft extension pulley threaded (left hand) to the crank damper and supported by a bracket.
  - Two of the idlers are mounted on a “bridge” bracket that mounts to the front cover over the primary FEAD, and one mounts to the secondary crankshaft drive bracket.
- The secondary belt is color coded with a yellow tag.
- The crankshaft damper has been updated to handle the increased engine horsepower.
- A stamped metal guard covers the supercharger pulley.

ENGINE PERFORMANCE

Supercharger

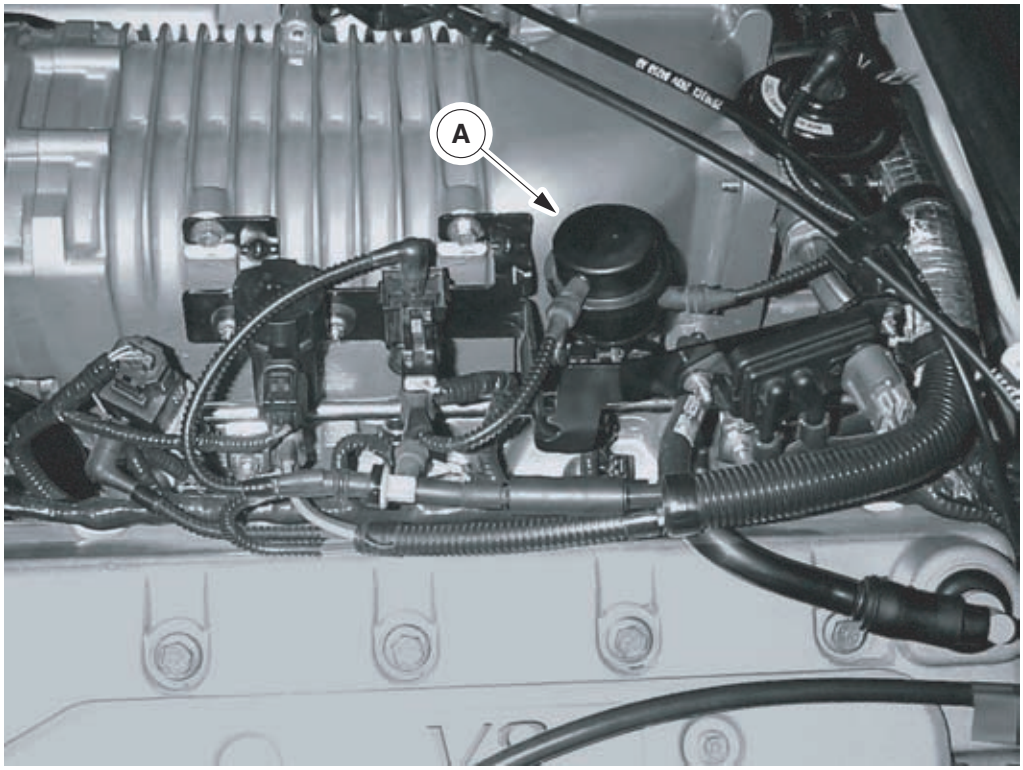


SVTL012-A

2003 SVT Cobra Eaton Roots-Type Supercharger

- The Cobra's increased power is developed primarily by the use of an Eaton Roots-type supercharger.
- The belt driven Roots-type supercharger:
  - is mounted above the engine valley.
  - has a cast-aluminum housing and aluminum internal rotors.
  - can provide up to 8 psi of boost, resulting in increased torque and horsepower.
- An analog boost gauge on the dash allows the driver to monitor supercharger operation.
- The Cobra includes a new air cleaner lid and new inlet and outlet tubes to provide all of the air that the supercharger needs.

Supercharger Boost Control

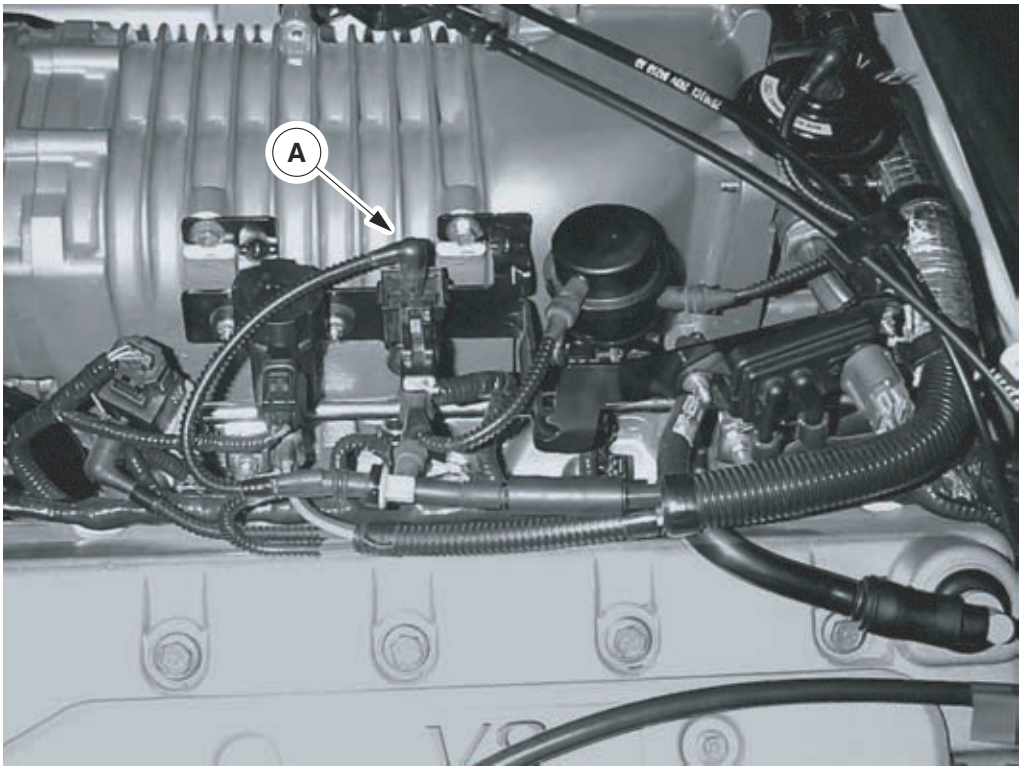


SVTC015-A

Supercharger Boost Control Valve

- If intake air were always allowed to pass through the supercharger vanes, there would be more pressure than required during low engine load and fuel economy would decrease.
- To prevent this, a supercharger boost control valve **(A)** is used to send air pumped through the supercharger back into the fresh air inlet (area above the vanes) during low engine load.
- The valve is controlled by manifold vacuum.
  - When engine load is low, high manifold vacuum opens the valve, allowing intake air to be recycled into the fresh air inlet.
  - As engine load increases, manifold vacuum is reduced, closing the valve and forcing the pressurized air into the engine.

Supercharger boost control solenoid (SBCS)



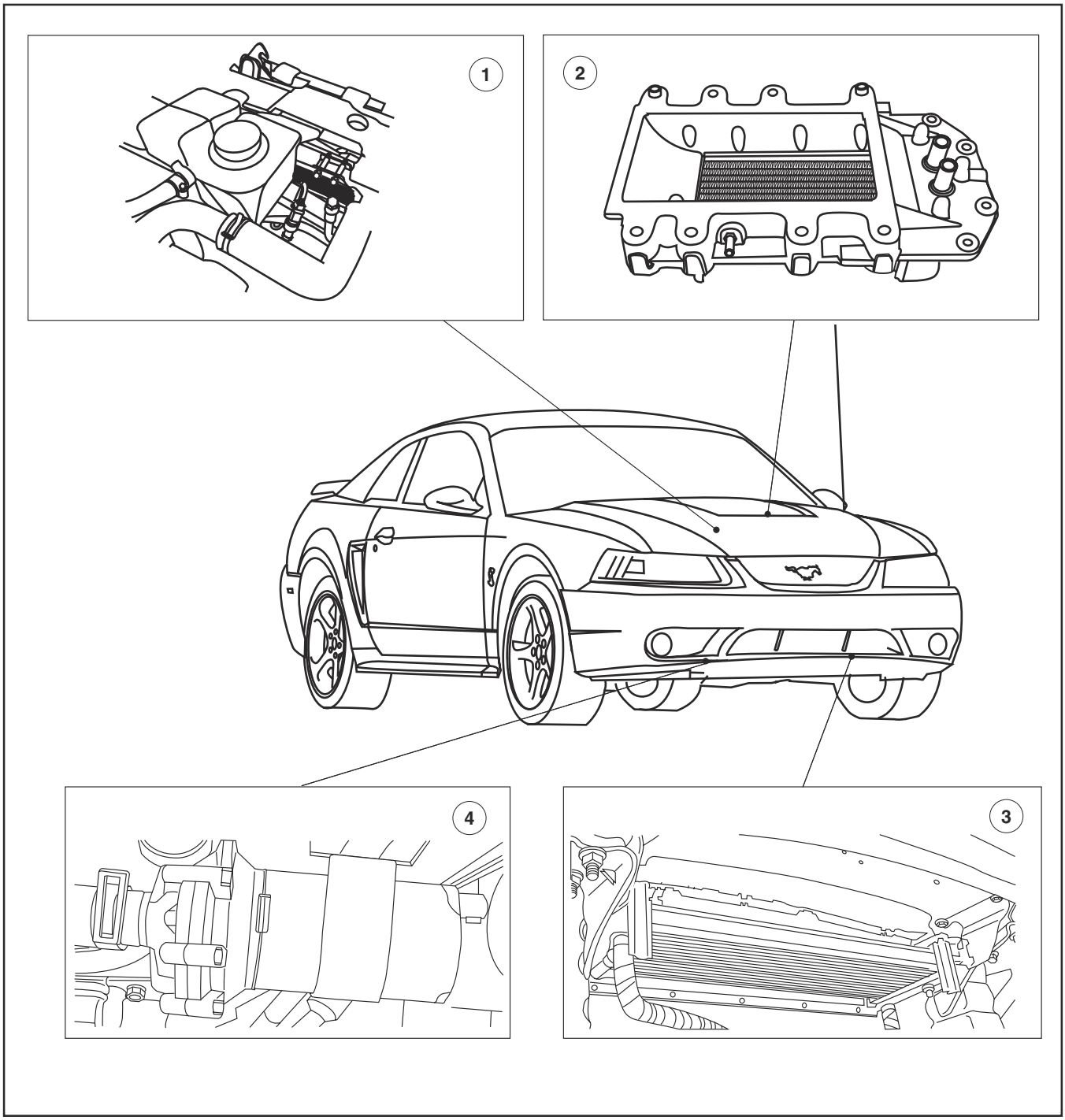
SVTC016-A

Supercharger Boost Control Solenoid (SCBS)

- The supercharger boost control solenoid **(B)** is a failsafe device that provides vacuum to the boost control valve during periods of low engine vacuum.
- The solenoid is activated (dumps boost pressure) under the following conditions:
  - Cylinder head temperature (CHT) greater than 121°C (250° F).
  - Intake air temperature (IAT) greater than 121°C (250° F).
  - Engine misfire is greater than 3%-5%.
- The vacuum comes from a small reservoir located behind the right shock tower.

NOTES

Intercooler System



2003 SVT Cobra Intercooler System

Item	Description
1	Coolant Reservoir
2	Charge Air Cooler
3	Intercooler Radiator
4	Coolant Pump

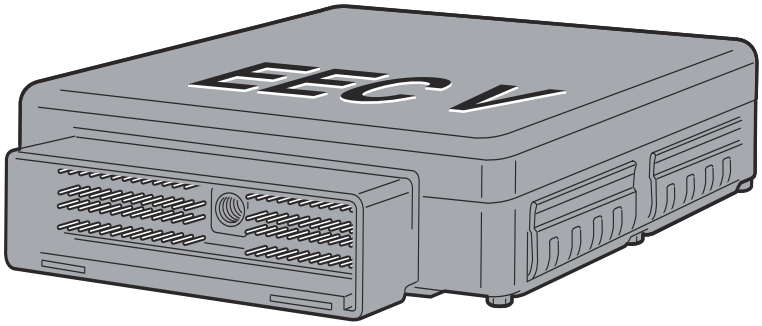
- The supercharged air passes through a charge air cooler that is mounted to the lower surface of the upper intake manifold, below the supercharger outlet port.
- When the air is compressed in the supercharger, the temperature of the air charge increases.
- The charge air cooler removes heat from the compressed air to reduce the temperature of the intake air before it reaches the cylinder.
  - The intercooler system transfers heat from the air to the fins of the charge air cooler and then to the coolant, which is circulated through the intercooler cooling system to the intercooler radiator.
- Heat is transferred from the radiator to the surrounding air and the coolant is again circulated to the intercooler to complete the cycle.
- Reducing the temperature of the intake air increases the density of the air, resulting in greater combustion pressures and more engine power output.
- The coolant in the intercooler system is completely independent of the engine cooling system.
- The coolant is a 50/50 mix of ethelyne glycol anti-freeze and distilled water.
- Coolant is circulated through the intercooler system by an electric pump.
  - The coolant pump motor is turned on and off by a PCM controlled relay.

Powertrain Controls

The electronic engine controls have been modified to control supercharger and intercooler operation. Changes include:

- New EEC Processor
- Intake Air Temperature (IAT) Sensor
- Integrated Secondary Intake Air Temperature (IAT) Sensor /Manifold Absolute Pressure (MAP) Sensor
- New Higher Flow Mass Air Flow Sensor (MAF)
- Supercharger Boost Control Solenoid (SBCS)
- Intercooler Pump Relay

EEC Processor



SVTC025-A

SVT Cobra PCM

- The new EEC processor accommodates the new sensors and control circuits for the intercooler pump relay and the supercharger air bypass system.

Integrated Secondary Intake Air Temperature Sensor (IAT)/Manifold Absolute Pressure (MAP) Sensor

- The integrated secondary intake air temperature sensor (IAT)/manifold absolute pressure (MAP) sensor is mounted to the supercharger housing.
- A port that extends into the supercharger provides a path to the piezo-electric sensor that measures intake air pressure and a thermistor that measures intake air temperature.
- After the air charge cooler cools the air, a second IAT reads the temperature of the air charge.
- The temperature of the air entering the cylinders is used to adjust spark advance.
  - This helps to prevent detonation caused by a too-hot air charge.
- The secondary IAT is also used to activate the intercooler pump.
  - The pump relay is turned on when the secondary IAT value is approximately 70° F (21°C).
- The PCM uses two different codes for the IAT sensors, one for upstream and one for downstream.

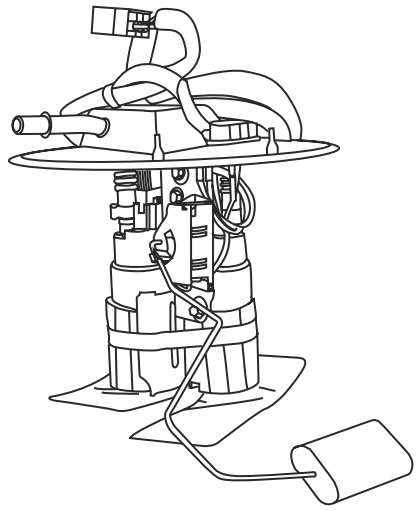
Intercooler Pump Relay

- The intercooler pump relay is a ground-side, PCM controlled relay that turns the intercooler pump on and off.

Higher Flow Mass Air Flow Sensor (MAF)

- The MAF tunnel size has been increased from 80mm to 90mm to allow air to flow more freely into the engine.

Fuel System



SVTC023-A

Dual Fuel Pump

- The fuel tank on 2003 model year and newer Cobras includes a higher flow dual pump module and a new baffling system to provide a consistent fuel supply to the new higher flow injectors.
- The throttle body uses a dual torsion spring throttle return to provide excellent driver feedback in a smaller unit.
- A new idle speed control valve with an anti-resonance boot helps reduce NVH concerns.

Engine Emission Controls

- Engine emissions have been fine tuned with the addition of new PCV hose routing and a revised EGR valve, orifice and tube.

TECHNICAL DATA

Engine

Configuration	4-valve V-8 engine, cast iron block, precision die-cast aluminum head, forged pistons, forged steel connecting rods, nodular cast iron crankshaft
Bore x Stroke	82.0mm x 90.0mm (3.34 in x 3.46 in.)
Displacement	4,601 cc; 280 cu. in.
Compression Ratio	8.5:1
Horsepower	390 hp @ 6,000 rpm
Torque	390 lb.-ft @ 3,500 rpm
Specific output	84.8 horsepower per liter
Redline	6,500 rpm (fuel shut-off occurs at 6500)
Valvetrain	Dual overhead camshafts, chain drive to exhaust cams, secondary chains from exhaust to intake cams, roller finger followers with hydraulic lash adjustment, oval-wire beehive-shaped valve springs, four valves per cylinder
Intake Valves	2 per cylinder 37mm head diameter
Exhaust Valves	2 per cylinder 30mm head diameter
Fuel system	Sequential electronic fuel injection
Induction System	Eaton™ Corporation Generation IV Roots-type supercharger with water to air intercooler
Boost Pressure	8.0 psi maximum
Intake Manifold	Cast aluminum, tuned equal length runners
Throttle Body	57mm twin bore
Mass-air sensor	90mm diameter
Exhaust Manifold	Cast iron
Exhaust system	Dual, stainless steel, 2.25-inch diameter; 3.0 inch polished exhaust tips

Drivetrain

Rear axle	8.8-in. ring gear with 3.55:1 limited-slip differential, aluminum case	
Driveshaft	Aluminum, with hardened yoke and U-Joints	
Clutch	11.0-in. single-plate	
Half-Shafts	31-spline with increased capacity	
Transmission	TTC™ T-56 6-speed manual	
	Gear	**Ratio**
	1st	2.66
	2nd	1.78
	3rd	1.30
	4th	1.00
	5th	0.80
	6th	0.63
	Reverse	2.90
	Final drive	3.55

Steering

Type	Rack and pinion, power assist
Gear ratio	15.0:1
Turns, lock-to-lock	2.5
Turning diameter	41.7 ft.

Suspension

Front	Modified MacPherson strut system with gas-charged Bilstein™monotube dampers and separate 600 lb./in. coil springs (500 lb./in. on convertible), 29mm tubular stabilizer bar
Rear	Multi-link independent system, cast iron upper control arm, aluminum lower control arm, fixed toe-control tie rod, aluminum spindle, gas-charged Bilstein™ monotube dampers, 600 lb./in. coil springs (470 lb./in. on convertible), 26mm tubular stabilizer bar

Brakes

Front	13.0 in. (330mm) vented Brembo™ disc, PBR™ twin-piston caliper
Rear	11.65 in. (296mm) vented disc, single-piston caliper
ABS	Four-channel, four-sensor system.

Wheels & Tires

Wheels	17 x 9 in., five-spoke, cast aluminum-alloy, machined surface, exposed lugs, optional chrome wheels available
Tires	Goodyear™ Eagle F1, 275/40ZR-17

Dimensions, Capacities

Wheelbase	101.3 in. (2,573mm)
Length	183.5 in. (4,661mm)
Height, coupe	52.5 in. (1,336mm)
convertible	52.9 in. (1,344mm)
Width	73.1 in. (1,857mm)
Track (front and rear)	60.3 in. (1,530mm)
Head room, f/r	38.1 in./35.5 in. (968mm/901mm)
Leg room, f/r	41.8 in./29.9 in. (1,062mm/759mm)
Curb weight, coupe	3,665 lb. (1,662 kg)
Convertible	3,780 lb. (1,715 kg)
Fuel capacity	15.7 gallons (59.4 liters)
Weight distribution, f/r	57%/43%

NOTES

OBJECTIVES

After completing this course, the technician will be able to describe the affect on vehicle warranty caused by the following modifications:

- Aesthetic Modifications
- Engine Performance Modifications
- Drivetrain Modifications
- Suspension Modifications

After completing this course, the technician will be able to describe Ford Motor Company warranty procedures.

After Competing this course, the techncian will describe methods that can be used to increase customer satisfaction.

CONTENTS

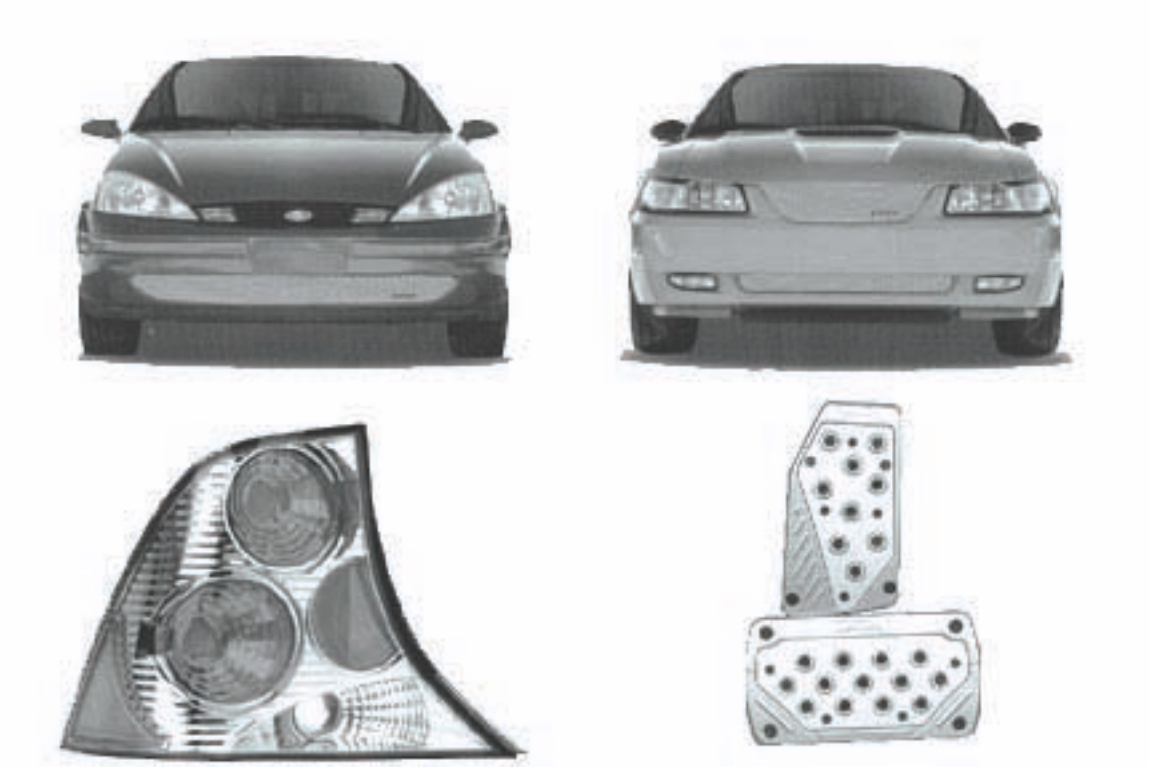
INTRODUCTION

- Ford engineers design SVT vehicles to operate under a wide range of conditions while still meeting federal safety, emissions, noise, and fuel economy standards, as well as customer expectations for drivability, NVH (noise, vibration, and harshness), serviceability, and QRD (quality, reliability, and durability).
- Extensive engineering development provides high performance while meeting these standards and expectations.
- However, because many owners of SVT vehicles are enthusiasts, it is not uncommon for them to modify their vehicles in an attempt to extract even higher performance.
- Although modifications can increase performance, they will usually compromise one or more of the following areas:
  - Emissions
  - Fuel Economy
  - Drivability
  - Reliability
  - Noise
  - Durability
- In addition, if modifications are not suitable for a specific application, or installed incorrectly, they can also negatively impact safety.
- The three most common type of vehicle modifications are:
  - Aesthetic or styling
  - Engine Performance
  - Suspension
- Since many modifications can significantly affect the operating and performance parameters of the vehicle, they can sometimes void a portion of the vehicle warranty.

NOTE: Some dealers sell and service aftermarket components. The decision to warrant these components and absorb these costs rests solely with the dealership. Ford Motor Company does not warrant aftermarket components or any defects that they may cause.

NOTE: Some aftermarket component manufacturers make claims that their components increase vehicle performance and/or component durability. Ford Motor Company neither supports nor refutes these claims.

AESTHETIC MODIFICATIONS



SVTL012-A

Common Aesthetic Modifications

- Aesthetic, or styling, modifications are made to personalize the vehicle.
- These modifications usually have no effect on vehicle performance.
- Common aesthetic modifications include:
  - Accessory Controls
  - Body Enhancements
  - Wheels and Tires
- In general, aesthetic modifications will have no effect on warranty.
- However, there are exceptions.
- For example, a wheel that moves the tire assembly's center of gravity too far outward may cause undue stress on the bearings or axles.
- This could void the vehicle warranty as it pertains to these components.

ENGINE PERFORMANCE MODIFICATIONS

- Engine performance modifications are made to “enhance” vehicle performance under specific conditions.
- These modifications are usually made to improve the acceleration of the vehicle.
- These modifications increase the engine and drivetrain stresses.
- The introduction of any engine performance modification may void the vehicle warranty for the components they affect.
- Common engine performance modifications include:
  - Fuel and Air Modifications
  - Engine Components
  - Accessory Pulleys
  - Drivetrain Components

Fuel and Air Modifications

- Fuel and air modifications are made to increase the amount of air and fuel entering the engine.
- By increasing the amount of air and fuel entering the engine, engine performance can be increased.
- Common fuel and air modifications include:
  - Intake Air Modifications
  - PCM EEPROMs (also known as “chips”)
  - Camshafts
  - Exhaust Systems

Intake Air Modifications

Air filters

SVTM002-A

Aftermarket Air Flters

- Intake air modifications increase the amount of air that enters the engine by reducing restrictions that are engineered into the system.
- High flow air filters are a common intake air modification.
- These filters increase air flow by one of two methods:
  - Increased Filter Area
  - Larger Filter Gaps
- If a filter uses larger gaps to increase air flow, an increased amount of contaminants will enter the engine and severe damage can result.
  - Evidence of contaminants include pitting of the supercharger and/or scoring of the cylinder walls.
- This type of damage would not be covered by the vehicle warranty.
- If the filter simply increases the filter area, this by itself would not cause damage or void the warranty.
- However, any modification that increases air flow could be an indicator that other, more harmful modifications have been used.
- Some filters contain an oil based solution that they claim helps to remove particulates from the incoming air stream.
  - If this oil comes into contact with the MAF sensors, damage may result.
  - This damage would not be covered under the vehicle warranty.

Oversized mass air flow (MAF) sensors

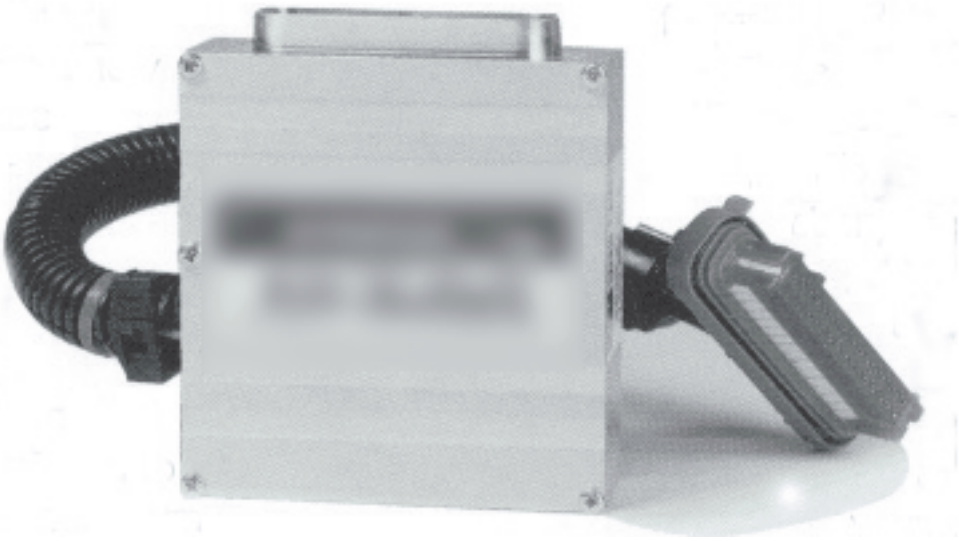
Aftermarket MAF Sensor

- Oversized MAF sensors also increase the amount of air that enters the engine.
- In general, an oversized MAF sensor will not cause engine damage.
- However, if the MAF sensor is incorrectly calibrated, the fuel/air mixture can be leaned considerably raising internal cylinder temperatures and causing preignition.
  - Evidence of preignition include pitting of the cylinder walls and pistons.
- This type of damage would not be covered by the vehicle warranty.

Supercharger pulleys

- Supercharger pulleys are often used to increase engine performance.
- Supercharger pulleys are smaller than the original equipment pulleys.
- This increases the rotational speed of the supercharger and thus increases the amount of air that enters the engine.
- If used without modification to the fuel delivery system, these pulleys can cause the engine to run lean, producing internal engine damage.
- Even with fuel system modifications, these pulleys create internal engine pressures that the engine was not designed to endure and so any engine damage they cause would not be covered under the vehicle warranty.

PCM EEPROMs

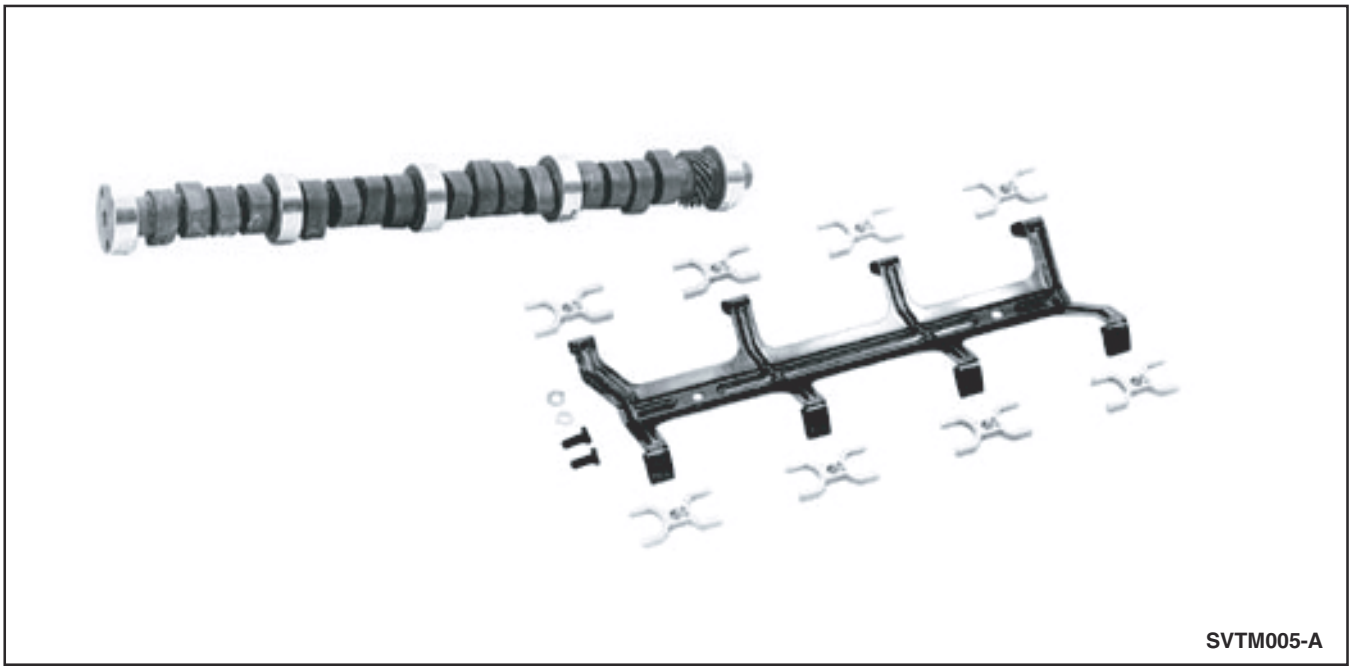


SVTM004-A

Aftermarket PCM with Performance EEPROM

- PCM EEPROMs are used to make changes to the engine performance characteristics.
- EEPROMs can be used to modify the air/fuel ratio, ignition timing curves, and transmission shift patterns.
- The extra engine and drivetrain stresses created by even the best aftermarket EEPROMS can cause engine or drivetrain failure.
- This type of damage is not covered under the vehicle warranty.

Camshafts



Aftermarket Cam and Roller Cam Conversion Kit

- Aftermarket camshaft manufacturers modify the camshaft lobes to increase or decrease valve lift, duration, and overlap.
- Camshaft modifications are usually made to increase engine performance at wide open throttle, resulting in better acceleration.
- Unfortunately, modifying the camshaft in this manner will result in poor engine idle characteristics and increased engine emissions.
- These increased emissions can contaminate the engine oil and severely damage the catalytic converter.
- In addition, severe engine damage can result from the added stress of continuous open throttle operation.
- The damage caused by camshaft modifications is not covered under the vehicle warranty.

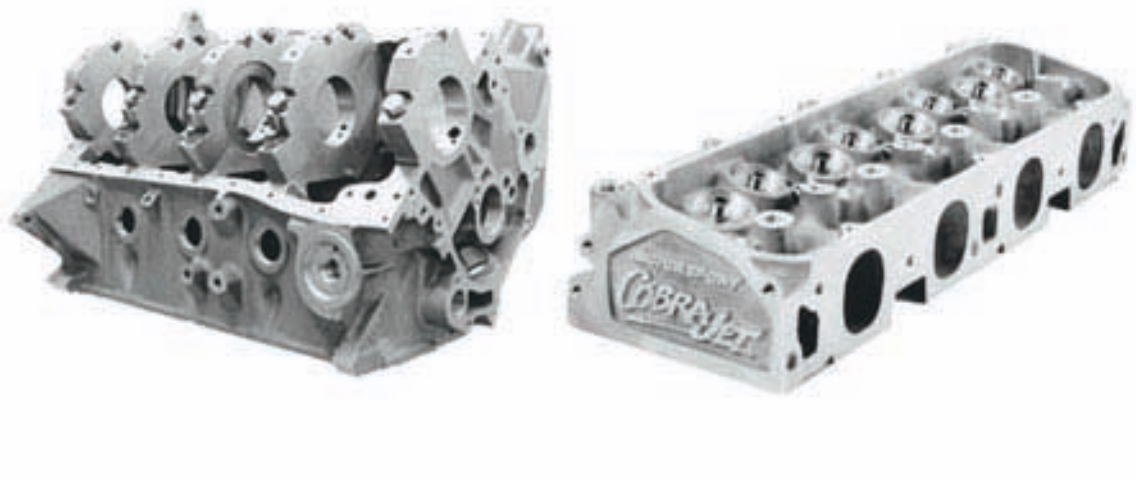
Exhaust Systems

SVTM006-A

Aftermarket Exhaust Components

- Exhaust system modifications are designed to allow the exhaust to flow more freely from the engine.
- This allows more air into the engine because the restriction caused by the exhaust system is reduced.
- Removing the exhaust restriction can increase engine temperatures.
- These increased temperatures can often cause damage to the exhaust valves and other engine components.
- This damage would not be covered under the vehicle warranty.

Engine Components



SVTM007-A

Aftermarket Engine Components

- Engine component modifications can sometimes increase engine performance or improve the life of certain components.
- The most common types of engine component modifications include:
  - Piston Rings
  - Valve Train Components
  - Bearings
- Modifying these components is generally intended to reduce their moving resistance or increase their durability.
- For example, some manufacturers of bearings claim that the reduced drag of their components will increase engine output.
- Some manufacturers also claim that their components are more durable than original equipment components.
- The addition of these components void the engine warranty.

Accessory Pulleys

Aftermarket Pulleys

- A variety of pulleys are used to increase vehicle performance.
- Oversized pulleys are used to slow the speed of engine accessories that may create resistance and reduce engine output.
- These pulleys generally will not affect the vehicle warranty but may reduce the performance and safety of these accessories.
  - For example, an oversized power steering pulley may make the vehicle more difficult to steer but would not harm the steering system.

DRIVETRAIN MODIFICATIONS

- Drivetrain modifications are performed either to increase vehicle performance or component durability.
- The most common drivetrain modifications include:
  - Shift Kits
  - Clutches and Pressure Plates
  - Drive Shafts and U-Joints
  - Differentials

Shift Kits

SVTM009-A

Aftermarket Shift Kit

- Transmission shift kits are used to modify the application of the clutch packs and bands that create the shifts in an automatic transmission.
- They are often used in conjunction with an EEPROM so that shift solenoid times match the characteristics of the kit.
- In some cases, these components claim to increase transmission life.
- In general, shift kits are installed to make the transmission shift faster and harder.
- The extra stress created by a shift kit can cause transmission and drivetrain component failure.
- This damage is not covered under the vehicle warranty.

Clutches

- Different clutch friction materials have different friction characteristics.
- In general, softer clutch materials provide for a smoother shift.
- Harder clutch materials tend to grab faster and are often used in racing applications.
- The extra stress created by harder shifting can damage transmission and driveline components.

Drive shafts and U-Joints

SVTM010-A

Aftermarket Differential Components

- Aftermarket drive shafts are generally installed because their manufacturers claim that they are sturdier or better balanced.
- While Ford neither supports, nor refutes these claims, these components usually do not void the vehicle warranty (Ford will not cover the aftermarket component).
- However, if an aftermarket driveshaft or u-joint creates drivetrain vibration, any damage caused by these vibrations would not be covered by the vehicle warranty.
- Also, if an aftermarket driveshaft or u-joint is installed, it is an indication that other modifications have been made.

Differentials

- Aftermarket differentials are used to change the final drive ratio, usually in an attempt to improve acceleration.
- If an aftermarket differential induces driveline vibrations, any damage caused by increased stress and/or vibrations would not be covered by the vehicle warranty.
- Also, if an aftermarket differential is installed, it is usually an indication that other modifications have been made.

SUSPENSION MODIFICATIONS

SVTM011-A

Aftermarket Spring Kit

- Aftermarket suspension components are typically installed to:
  - improve handling.
  - modify vehicle height.
- The addition of these components generally does not void the vehicle warranty (Ford will not cover the aftermarket component).
- However, abnormal vibrations, and any damage they might cause would not be covered under the vehicle warranty.
- In addition, aftermarket suspension components and changes to vehicle height may induce abnormal stresses into other suspension components, including ball joints, linkages, etc., and drivetrain components, including the u-joints, differential pinion, and the transmission output shaft.
- This stress can cause the seals at the differential pinion and the transmission output shaft to leak.
- Damage caused by modifying the vehicle height and installing aftermarket suspension components is not covered under the vehicle warranty.

WARRANTY PROCEDURES

- Aftermarket modifications can create a difficult situation for the dealership.
- Ford Motor Company and the dealership want their customers to be satisfied with the service they receive on their vehicles.
- However, if the vehicle warranty extended to concerns created by the addition of aftermarket components or to vehicles used in drag racing, the cost of these vehicles would increase tremendously.
- This does not mean that the addition of aftermarket components automatically voids the vehicle warranty.
- Federal law requires that the manufacturer cover vehicle defects under the vehicle warranty unless it can be proved that a customer modification caused the defect.
- This means that the technician must carefully inspect the vehicle and determine whether or not a customer concern is covered under the vehicle warranty.
- In some instances it will be easy to make the distinction between a concern that is covered and one that is not.
  - For example, if a customer has installed a supercharger pulley and a PCM EEPROM, and the head gasket begins to leak, the head gasket would not be a covered repair.
  - However, if this same customer came in with a windshield wiper motor concern, this would be a covered repair.
- But what if this same customer came in to the dealership with a leaking pinion gear seal?
- It is possible that the installation of the PCM EEPROM created stress in the drivetrain and therefore contributed to the leak.
- If a customer has modified a vehicle, bring this fact to the attention of the service manager and provide the service manager with an opinion regarding whether or not the modification contributed to the concern.
- The service manager will make a decision regarding warranty coverage based upon whether the dealership will be reimbursed by Ford Motor Company.
- If the customer is dissatisfied with the decision at the dealership level, they should be instructed to contact the regional customer service representative.
- The customer service representative will make the final decision regarding coverage under the vehicle warranty.

DISCUSSION TOPIC

In some instances, customers will install vehicle modifications but then remove them when it is time to take the vehicle in for service. How can a technician determine if this has occurred?

Ford Motor Company

Dealer Communication

May 2, 2003

To: All Ford and Lincoln Mercury Dealer Principals and Service Managers

Subject: Ford Motor Company Warranty Coverage Clarification

THE FORD MOTOR COMPANY POSITION ON VEHICLE MODIFICATIONS

We all want to do the right thing for our customers, and for the Ford Motor Company – that is why it is important to have a clear policy with regard to warranty administration. For vehicles that are not modified, the warranty policy is clear--we back our products within the guidelines of the new vehicle limited warranty, which is designed to protect the customer from defects in workmanship and/or material. However, in the case of vehicles that have been modified, the modifications may affect warranty coverage. This is because damage or failures of the new vehicle components CAUSED by modifications to the vehicle **are not** defects in "factory supplied" workmanship or material.

STATEMENTS OF COVERAGE

Ford states clearly in the Warranty Information Booklet provided with every new vehicle in the chapter **"WHAT IS NOT COVERED?"**

"Damage Caused By:

- Non-Ford parts installed after the vehicle leaves Ford's control. For example, but not limited to, cellular phones, alarm systems, and automatic starting systems, and performance-enhancing powertrain chips"

And also in the chapter **"OTHER ITEMS AND CONDITIONS NOT COVERED"**

"Your New Vehicle Limited Warranty" also does not cover:

- Non-Ford parts of your vehicle, for example, parts (including glass) installed by body builders or manufacturers other than Ford, or damage to Ford components caused by the installation of non-Ford parts other than "certified" emission parts.

Ford Motor Company will be updating the 2004 model year Warranty Information Booklets with additional language to clarify this information to owners.

TYPICAL MODIFICATIONS THAT MAY CAUSE WARRANTY DENIAL

Some non-Ford modifications that may cause damage to the vehicle for which warranty protection might be denied include:

- Power chips or unauthorized re-programming of the module that modify the original powertrain calibrations, supercharger or turbo-charger installations, under drive pulleys to engine front accessory drives, transmission "shift kits," low restriction air intake and filter systems, low restriction exhaust systems, Nitrous Oxide systems (gas engines) and Propane systems (diesel engines), final drive axle ratio changes, alterations to fuel systems and wiring harnesses.

Ford Motor Company

WARRANTY DENIAL

Although the installation of these non-Ford parts and after-market modifications, by themselves, will not void the New Vehicle Limited Warranty, failures of the vehicle's engine or transmission or other components that **are the result** of these parts and/or modifications may result in a denial of warranty for the Ford component that failed or damage that results.

DEALER INSTALLATION AND MARKETING OF THESE COMPONENTS, CLEAN AIR ACT

Dealers who are installing these power enhancement and unknown performance enhancing devices may incur the liability for the effect on federal and state emission compliance and should make customers aware that the addition of these devices may cause failures of drivetrain components that may not be covered under the Ford New Vehicle Warranty. Section 203(a) of the Clean Air Act defines the prohibition against tampering with vehicle components that may effect emissions. Section 205 of the Clean Air Act defines dealer tampering as subject to civil penalty of up to $31,500 per violation.

Ford Motor Company strongly suggests that dealers do not install or market components that may cause damage to the vehicles components.

EFFECTS OF MODIFICATIONS ON PRIOR APPROVAL

Engine and Automatic transmission assembly replacements for which Ford Motor Company is participating in the repair (Bumper to Bumper, Service Part Warranty, and After Warranty Adjustments) require prior approval by the Ford Technical Service Hotline, with the exception of ESP and FSAs which may require separate approval. The Hotline Service Engineers are skilled and knowledgeable about the various kinds of non-Ford parts (and any parts – Ford or aftermarket - designated for "off road use only") and modifications that can potentially affect engine, transmission and other vehicle systems. Where evidence of such part or modifications exists and the failure or damage is the result of such part or modification – Warranty coverage will likely be denied for the repair.

QUESTIONS

Technical Questions: Contact your Field Service Engineer or the Technical Hotline at 800-826-4694.
Policy Questions: Greg Bolterman at gbolterm@ford.com or phone: 313-845-3752.

Darryl Hazel President, Lincoln Mercury	Kathleen Ligocki Vice President, Ford Customer Service Division	Steve Lyons President Ford Division

SVT CUSTOMERS

Customer Expectations

- SVT Customers are automotive enthusiasts.
- They are passionate about cars, and have more technical knowledge than the average customer.
- Just as SVT customers expect their vehicles to perform above the standards of ordinary mainstream vehicles, they expect premium customer and vehicle service.
  - They also expect above average knowledge from the sales and technical staff.

The SVT Community

- How the SVT customer is treated can have a profound affect on the reputation of both the technician and the dealership.
- SVT customers tend to share their ownership and service experiences more often than the average customer.
  - Because of the vehicles they own, SVT customers instantly become members of a community.
    - In addition to Ford sponsored events, many SVT customers belong to various owners associations throughout the country.
    - Many of these owners groups maintain sites on the world wide web where discussions of their vehicles and their dealership experiences are easily and widely shared.
  - Because SVT customers tend to have greater automotive knowledge, they are more likely to be considered "car experts" by their friends.
    - The experience that an SVT customer has at a dealership is more likely to be communicated to others.
- Treating all customers well and fixing their vehicles right the first time will have a direct effect on the success of a technician's career.

Build a Lasting Relationship

- As with all customers, it is important that the technician and the dealership build a trusting relationship with the customer.
- There are many ways to build this relationship:
  - Get to know the customer by name.
  - Remember how the customer uses their vehicle (for example, do they race?)
  - When asking a customer about the cause of a concern, notice the terminology the customer uses.
    - The use of more complex terminology in the customer's reply indicates that a customer may have a good understanding of vehicle and systems operation.
- When speaking with customers regarding the operation of their vehicle, it is important to gauge their level of technical knowledge.
  - This information can be used to determine how to speak with the customer.
  - Also use this information to determine how much information the customer needs to make an informed choice regarding any concerns they may have about their vehicle.

PREMIUM SERVICE PLAN

In an ongoing effort to enhance the ownership experience of Ford Special Vehicle Team customers, SVT is pleased to introduce ***SVT Premium Servic***e. Beginning with the launch of the 2001 SVT F-150 Lightning and Mustang Cobra, 2001 and newer SVT vehicles will receive ***SVT Premium Service***.

SVT Premium Service provides owners with a loaner vehicle when their SVT vehicle is serviced at a dealership. In addition, SVT will reimburse the dealership to wash and vacuum the vehicle prior to being returned to the owner. ***SVT Premium Service*** was tested during 2000 and was extremely well received by owners.

Program Details

Eligible Vehicles: Any 2001 model year or newer SVT product (includes the 2001 and newer F-150 Lightning, 2001 and newer Mustang Cobra, and 2002 and newer SVT Focus).

Program Duration: Normal warranty coverage – three-years/36,000-miles from the date of purchase.

Loaner Vehicle: Dealers are requested to provide a mid-sized or comparable vehicle. An SVT vehicle is not expected to be available as a loaner vehicle.

Covered Services: Any time an SVT vehicle is brought to the dealership for a warranty or retail service visit (excludes oil change-only service).

Coverage Starts: The loaner vehicle is available the first day the vehicle is dropped off for service.

Reimbursement: Dealers will be reimbursed for a loaner vehicle, washing and vacuuming of the vehicle. (Cobra - 0.3 hours; Lightning - 0.4 hours). Always make sure that the customer will allow the dealership to wash the vehicle.

Contact SVT Headquarters at 1-800-FORD-SVT with any program questions.

WORKSHEET A
AT WORKSTATION 1
IDENTIFY SVT SPECIFIC COMPONENTS
STUDENT'S ANSWER SHEET

NAME: _____

OBJECTIVE: The technician will accurately identify SVT-specific components on the F-150 SVT Lightning.

DIRECTIONS: The instructor has placed 10 numbered tags on SVT specific components on the vehicle. Write the name of each component next to the corresponding number on the Student Worksheet.

CUSTOMER CONCERN: None

NUMBER	COMPONENT
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

THIS PAGE INTENTIONALLY LEFT BLANK

WORKSHEET B
AT WORKSTATION 2
IDENTIFY SVT SPECIFIC COMPONENTS
STUDENT'S ANSWER SHEET

NAME: _____

OBJECTIVE: The technician will accurately identify SVT-specific components on the SVT Focus.

DIRECTIONS: The instructor has placed 10 numbered tags on SVT specific components on the vehicle. Write the name of each component next to the corresponding number on the Student Worksheet.

CUSTOMER CONCERN: None

NUMBER	COMPONENT
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

THIS PAGE INTENTIONALLY LEFT BLANK

WORKSHEET C
AT WORKSTATION 1
DIAGNOSE A LOW POWER CONCERN ON THE SVT LIGHTNING
STUDENT'S ANSWER SHEET

NAME: _____

OBJECTIVE: Using the workshop manual and the required diagnostic tools, the technician will accurately diagnose a concern on the SVT Lightning.

DIRECTIONS: Follow the correct steps listed in the correct workshop publication for the diagnostic concern. In the left column of table below, write each diagnostic step listed in the workshop publication. Then, in the column on the right, write the result of each diagnostic step. Continue on to the next step based on the test results until the concern has been diagnosed.

CUSTOMER CONCERN: The customer states that the vehicle has a low power concern. The vacuum gauge works but the boost gauge does not.

DIAGNOSTIC STEP	RESULT

THIS PAGE INTENTIONALLY LEFT BLANK

WORKSHEET D
AT WORKSTATION 2
DIAGNOSE INSTRUMENT CLUSTER ILLUMINATION CONCERN ON SVT FOCUS
STUDENT'S ANSWER SHEET

NAME: _____

OBJECTIVE: Using the workshop manual and the required diagnostic tools, the technician will accurately diagnose an instrument cluster illumination concern on the SVT Focus.

DIRECTIONS: Follow the correct steps listed in the correct workshop publication for the diagnostic concern. In the left column of table below, write each diagnostic step listed in the workshop publication. Then, in the column on the right, write the result of each diagnostic step. Continue on to the next step based on the test results until the concern has been diagnosed.

CUSTOMER CONCERN: The customer states that the instrument cluster only illuminates the oil pressure and oil tempurature gauges.

DIAGNOSTIC STEP	RESULT

THIS PAGE INTENTIONALLY LEFT BLANK

WORKSHEET E
AT WORKSTATION 2
DIAGNOSE A ROUGH IDLE CONCERN ON A SVT FOCUS
STUDENT'S ANSWER SHEET

NAME: _____

OBJECTIVE: Using the workshop manual and the required diagnostic tools, the technician will accurately diagnose a hesitation concern on the SVT Focus.

DIRECTIONS: Follow the correct steps listed in the correct workshop publication for the diagnostic concern. In the left column of table below, write each diagnostic step listed in the workshop publication. Then, in the column on the right, write the result of each diagnostic step. Continue on to the next step based on the test results until the concern has been diagnosed.

CUSTOMER CONCERN: The customer states that the vehicle stalls.

DIAGNOSTIC STEP	RESULT

THIS PAGE INTENTIONALLY LEFT BLANK

WORKSHEET F
AT WORKSTATION 3
REPLACE THE ACCESSORY BELT
STUDENT'S ANSWER SHEET

NAME: _____

OBJECTIVE: Using the workshop manual and the required diagnostic tools, the technician will accurately replace the accessory belt on the SVT Cobra.

DIRECTIONS: Follow the correct steps listed in the correct workshop publication for the repair. In the table below, write each repair step listed in the workshop publication as it is performed. If the repair requires more than ten steps, continue in the column on the right.

CUSTOMER CONCERN: Accessory belt is worn.

REPAIR STEP	CONTINUED
1.	11.
2.	12.
3.	13
4.	14.
5.	15.
6.	16.
7.	17.
8.	18.
9.	19.
10.	20.

THIS PAGE INTENTIONALLY LEFT BLANK

WORKSHEET G
AT WORKSTATION 4
REPLACE THE TIMING BELT
STUDENT'S ANSWER SHEET

NAME: _____

OBJECTIVE: Using the workshop manual and the required diagnostic tools, the technician will accurately replace the timing belt on the SVT Focus.

DIRECTIONS: Follow the correct steps listed in the correct workshop publication for the repair. In the table below, write each repair step listed in the workshop publication as it is performed. If the repair requires more than ten steps, continue in the column on the right.

CUSTOMER CONCERN: Timing belt needs maintenance replacement.

REPAIR STEP	CONTINUED
1.	11.
2.	12.
3.	13
4.	14.
5.	15.
6.	16.
7.	17.
8.	18.
9.	19.
10.	20.

THIS PAGE INTENTIONALLY LEFT BLANK

WORKSHEET H
AT WORKSTATION 5
IDENTIFY SVT SPECIFIC COMPONENTS
STUDENT'S ANSWER SHEET

NAME: _____

OBJECTIVE: The technician will accurately identify SVT-specific components on the SVT Cobra.

DIRECTIONS: The instructor has placed 10 numbered tags on SVT specific components on the vehicle. Write the name of each component next to the corresponding number on the Student Worksheet.

CUSTOMER CONCERN: None

NUMBER	COMPONENT
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

THIS PAGE INTENTIONALLY LEFT BLANK

WORKSHEET I
AT WORKSTATION 3
REMOVE AND REPLACE COBRA SUPERCHARGER, CHARGE AIR COOLER, AND INTAKE MANIFOLD
STUDENT'S ANSWER SHEET

NAME: _____

OBJECTIVE: Using the workshop manual and the required diagnostic tools, the technician will accurately diagnose an instrument cluster illumination concern on the SVT Focus.

DIRECTIONS: Follow the correct steps listed in the correct workshop publication for the diagnostic concern. In the left column of table below, write each diagnostic step listed in the workshop publication. Then, in the column on the right, write the result of each diagnostic step. Continue on to the next step based on the test results until the concern has been diagnosed.

CUSTOMER CONCERN: The customer states that the instrument cluster only illuminates the oil pressure and oil tempurature gauges.

DIAGNOSTIC STEP	RESULT

THIS PAGE INTENTIONALLY LEFT BLANK

WORKSHEET J
AT WORKSTATION 2
DIAGNOSE A LOW POWER CONCERN ON THE SVT FOCUS
STUDENT'S ANSWER SHEET

NAME: _____

OBJECTIVE: Using the workshop manual and the required diagnostic tools, the technician will accurately diagnose a concern on the SVT Focus.

DIRECTIONS: Follow the correct steps listed in the correct workshop publication for the diagnostic concern. In the left column of table below, write each diagnostic step listed in the workshop publication. Then, in the column on the right, write the result of each diagnostic step. Continue on to the next step based on the test results until the concern has been diagnosed.

CUSTOMER CONCERN: The customer states that the vehicle has a low power concern.

DIAGNOSTIC STEP	RESULT

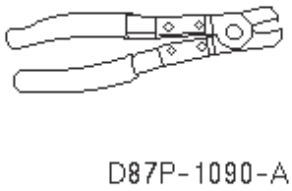
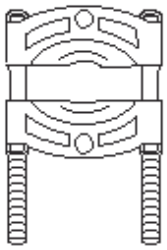
THIS PAGE INTENTIONALLY LEFT BLANK

2002 FOCUS HALFSHAFT REPAIR PROCEDURE

SECTION 205-04: Front Drive Halfshafts *2001 Focus Workshop Manual*
DISASSEMBLY AND ASSEMBLY

Halfshaft LH

Special Tool(s)

	Pliers Boot Clamp or equivalent 205-D066 (D87P-1090-A)
	Putter, Bearing 205-D064 (D84L-1123-A)
	Remover/Installer, Front Wheel Hub 204-069 (T81P-1104-C)

Material

Grease - inner joint	XS41-M1C230BA
Grease - outer joint	XS41-M1C230AA

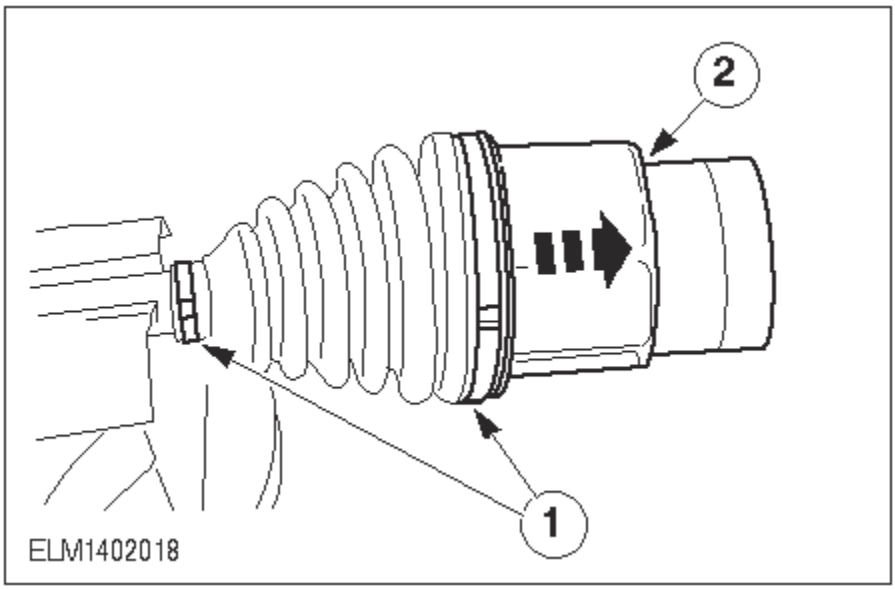
Disassembly

1. **CAUTION: The inner joint must not be bent at more than 18 degrees; the outer joint must not be bent at more than 45 degrees.**

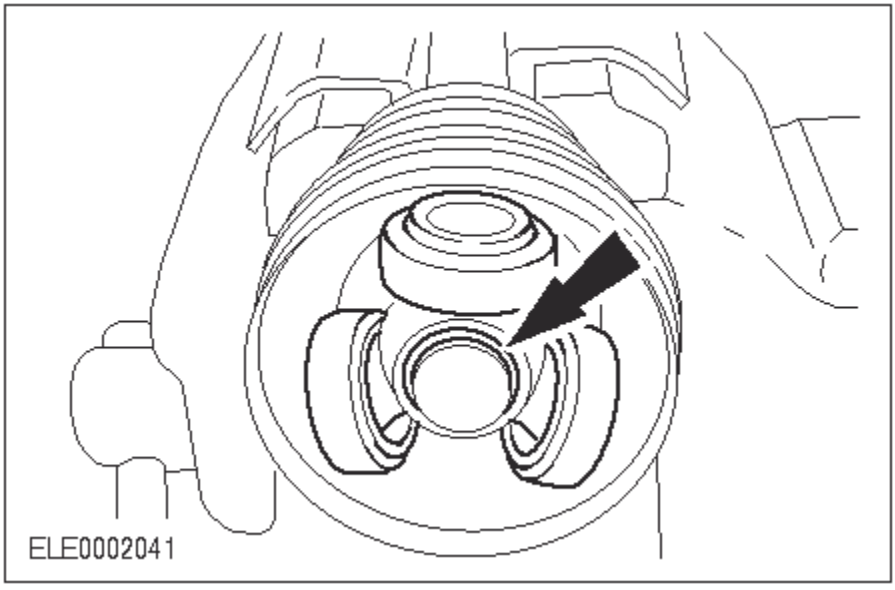
   NOTE: Use protective covers.

   Disconnect the driveshaft at the transaxle end.
   - Hold the front driveshaft in a clamp.
2. Separate and discard the clamping straps. Push back the boot along the shaft.
3. Pull apart the tripode joint.

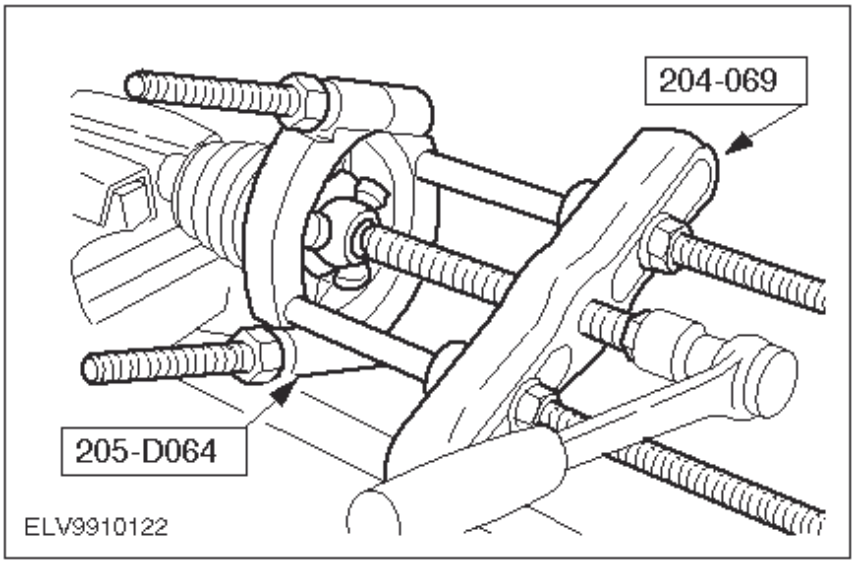
- Remove all the grease.



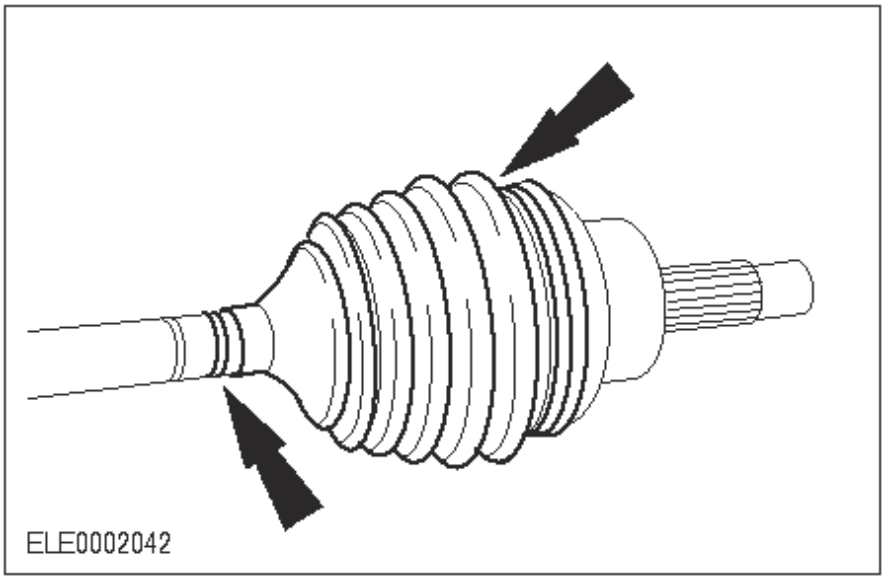
2. Remove the tripode.
   - Remove the snap ring.



3. Remove the tripode (continued).
   - Using the special tool remove the tripode.
   - Remove the boot.



4. Detach the boot at the wheel end.
   - Separate and discard the clamping straps.
   - Remove the boot over the transaxle side.
   - Remove the accessable grease.



Assembly

CAUTION: The inner joint must not be bent at more than 18 degrees; the outer joint must not be bent at more than 45 degrees.

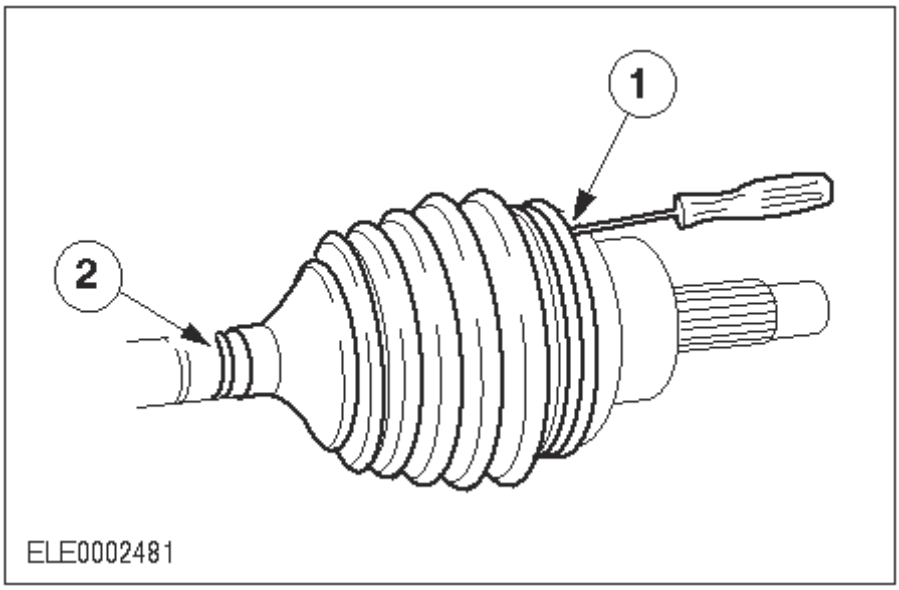
1. **NOTE:** Install the wheel-side boot over the transaxle side.

   NOTE: To determine the amount of grease, refer to Specifications for fill capacities.

   Install the boot at the wheel end.

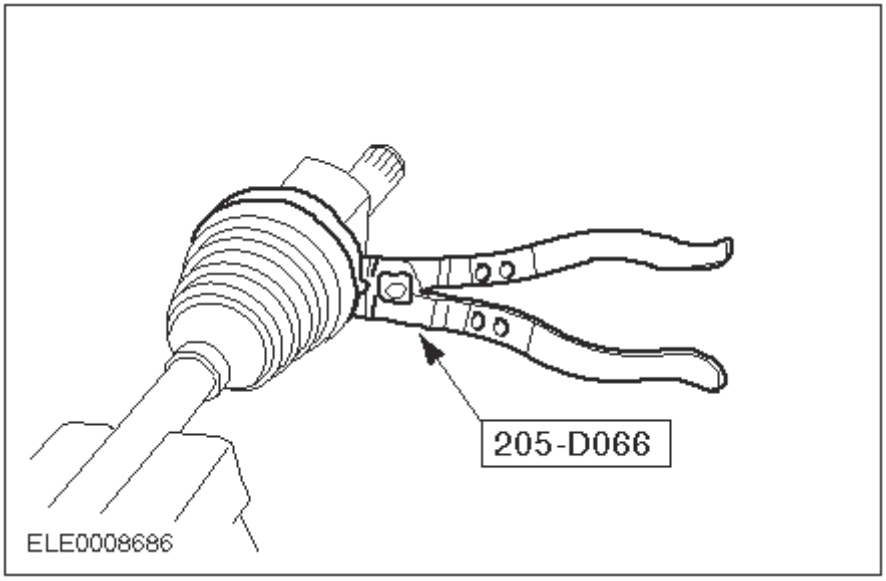
- Inject the specified amount of grease into the outer joint.

2. Slide a suitable tool under the boot seat to allow the air to escape.
3. Locate the boot in position and remove the suitable tool.

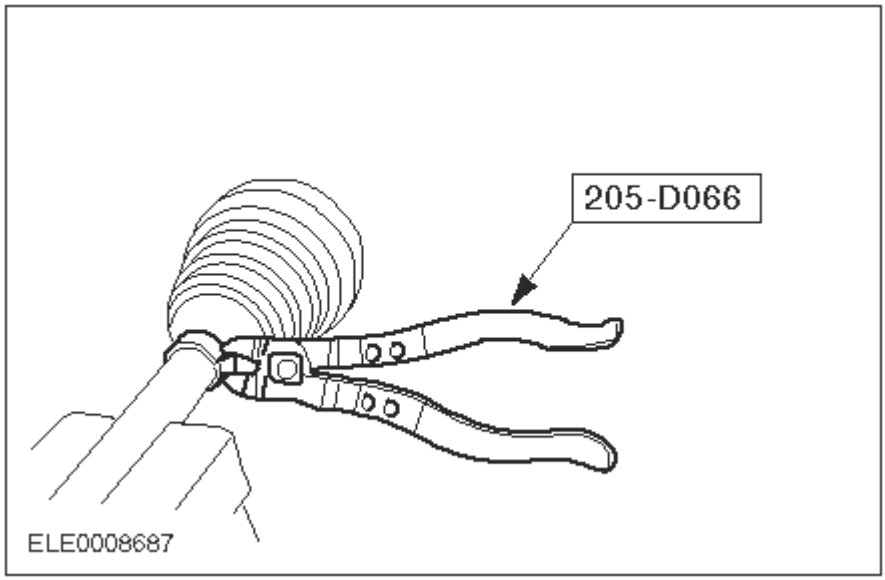


2. **NOTE:** Install new clamping straps.

   Using the special tool install the clamping straps in the boot ring grooves.



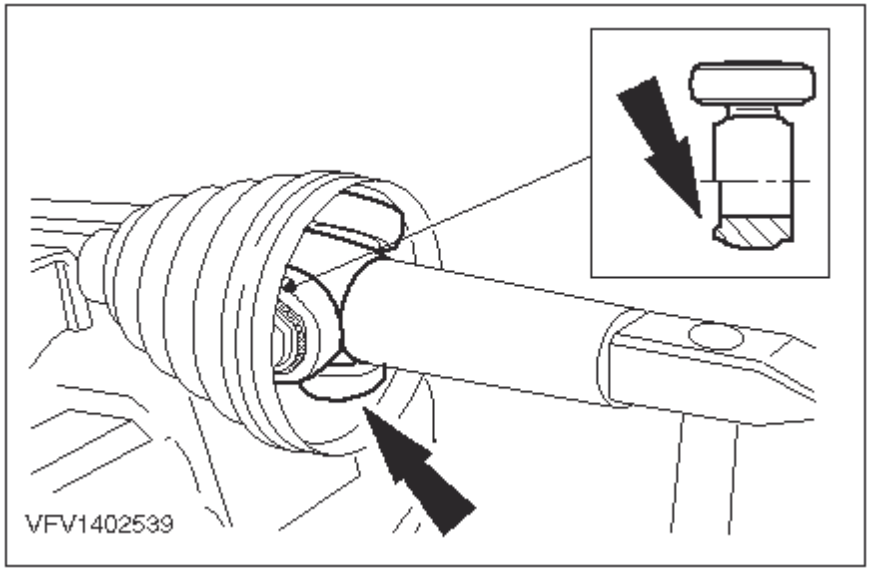
3. Install the boot at the transaxle end.
   - Insert the clamping strap in the boot ring groove and tighten it using the special tool.



4. **CAUTION: Do not damage the universal joint rollers.**

Install the tripode.

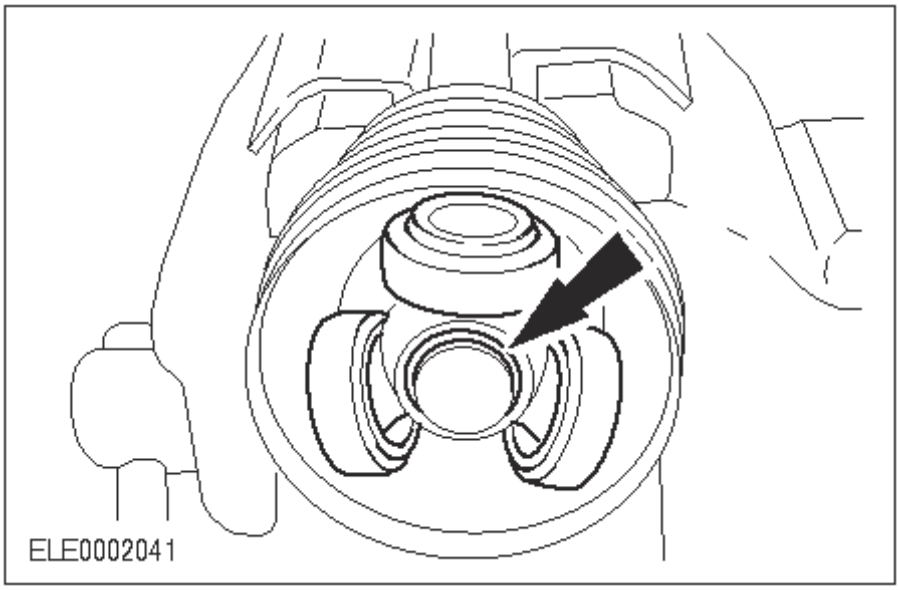
- Using the special tool, push the tripode onto the front drive halfshaft as far as it will go.



5. **NOTE:** Install a new snap ring.

Install the tripode (continued).

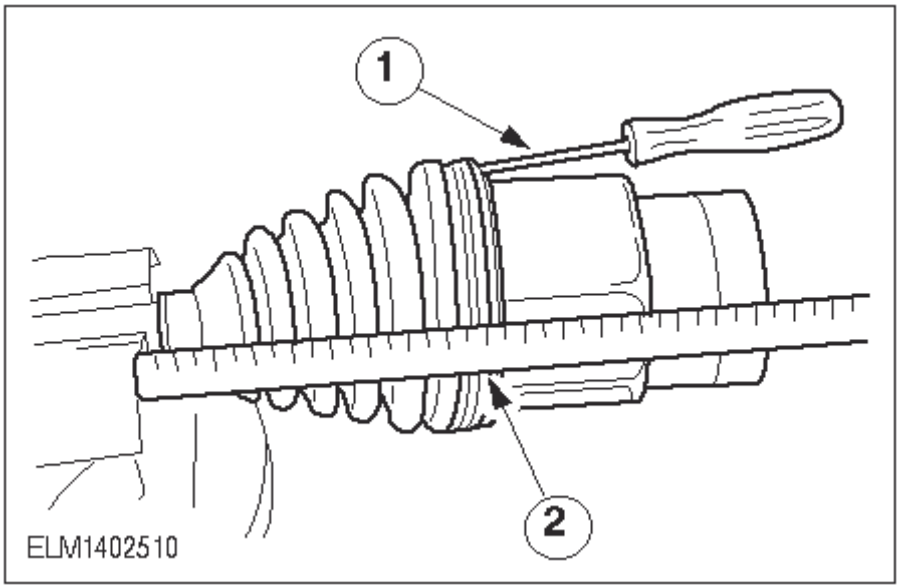
- Install the snap ring.



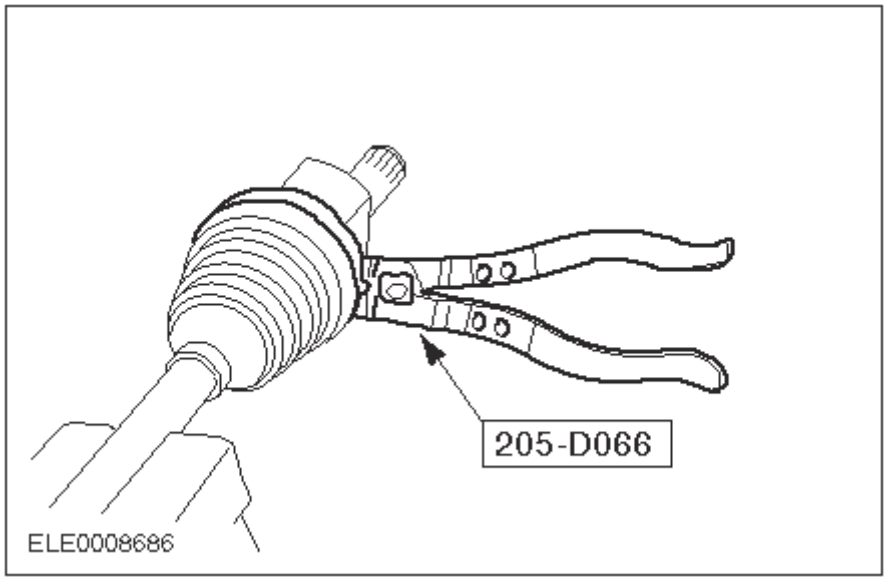
6. **NOTE:** To determine the amount of grease, refer to Specifications for fill capacities.

   Inject half of the specified amount of grease into the transaxle side of the tripode joint. Inject the other half amount of grease into the boot.

7. Install the driveshaft at the transaxle end.
   1. Insert a suitable tool under the boot seat to allow the air to escape.
   2. Slide the tripode joint in as far as the stop, then pull it out 20 mm.
      - Remove the suitable tool.



8. Insert the clamping strap in the boot ring groove and tighten with the special tool.


205-D066
ELE0008686

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Transmission fluid - iB5 manual transaxle	WSD-MC200-C
Transmission fluid - MTX 75 manual transaxle	ESD-M2C186-A
MERCON V® Automatic transmission fluid	MERCON V® XT-5-QM
Grease, outer constant velocity joint	XS41-M1C230-AA
Grease, innter tripode joint	XS41-M1C230-BA

Capacities

	Litres
Transmission fluid - iB5 manual transaxle	2.8 litres (10 - 15 mm below the lower edge of the level check bore
Transmission fluid - MTX 75 manual transaxle	2.75 (0 - 5 mm below the lower edge of the oil level check bore)
Grease, outer constant velocity joint	1/2 of sachet
Grease, inner tripode joint, iB5 manual transaxle	3/4 of sachet
Grease, inner tripode joint, MTX 75 manual transaxle and FN automatic transaxle	Full sachet

Torque Specifications

Description	Nm	Lb-Ft	Lb-In
Suspension arm to spindle carrier	47	35	
Intermediate shaft bearing	25	18	
Halfshaft stub nut	290	214	
Wheel nut	128	94	
Suspension strut nut	48	35	
Gaiter clamps	21	15	

FOCUS TIMING BELT

Timing Belt

Special Tool(s)

	Plate, Camshaft Alignment 303-465 (T94P-6256-CH)
	Timing Peg, Crankshaft TDC 303-574 (T97-P6000-A)

Material

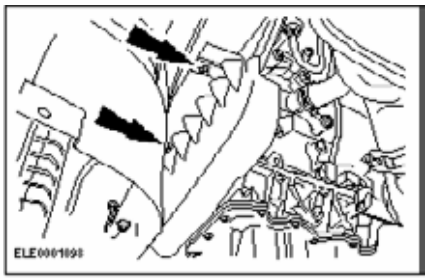
Never Seeze	WSD-M13P8-A1
Silicone grease	A960-M1C171-AA

Removal

1. General Instructions.
   - The positions of the engine mounting and the engine roll restrictor are described looking from the transmission towards the engine.
   - If necessary, use Special Tool 412-108 to remove coolant and ventilation hoses.
   - Owing to special model variants, some steps do not apply to all vehicles. These are clearly marked in the text.
   - If necessary, cut the cable ties and install new cable ties on installation.
2. Remove the battery cover.
3. **CAUTION: Disconnect the battery negative cable.**

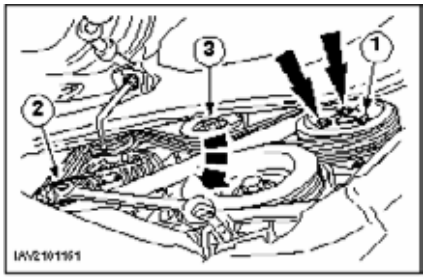
   Raise and support the vehicle. For additional information, refer to Section 100-02 .
4. Detach the drive belt cover.

5/9/02

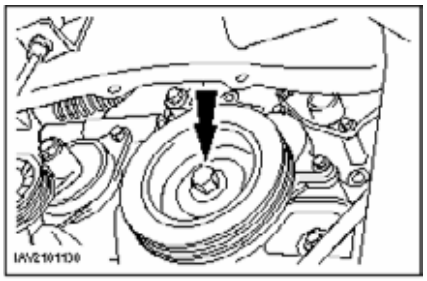


5. **NOTE:** Mark the drive belt running direction.

   Remove the drive belt.
   1. Loosen the bolts on the coolant pump pulley.
   2. Slacken the drive belt by turning clockwise and remove it.
   3. Detach the multi-groove belt idler pulley.
      - Detach the coolant pump belt pulley.



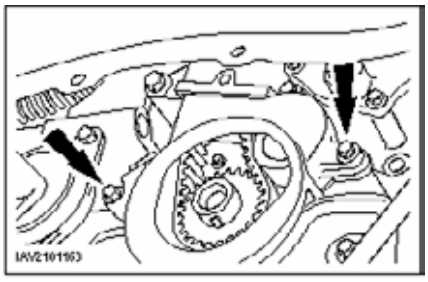
6. Remove the crankshaft pulley.



7. **CAUTION: The removal of the lower part of the engine front cover is necessary to avoid damage to the timing belt.**

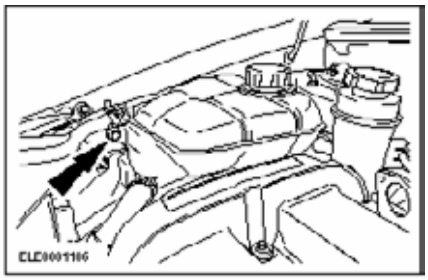
   Detach the lower timing belt cover.

5/9/02

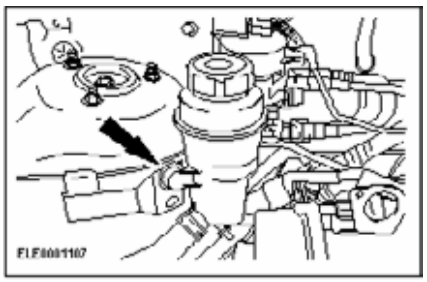


8. Lower the vehicle.

9. Detach the coolant expansion tank and position it to one side.



10. Detach the PAS reservoir and position it to one side.



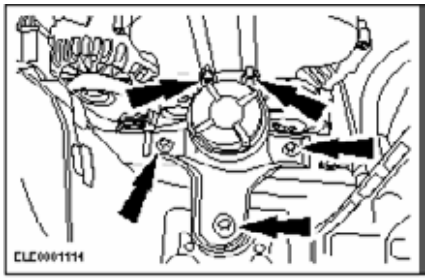
11. **CAUTION: Insert a suitable wooden block between the oil pan and the hydraulic jack.**

    Position the hydraulic jack with the wooden block under the oil pan and raise so that the engine front mount is free from load.

12. **NOTE:** Mark the position of the engine front mount.

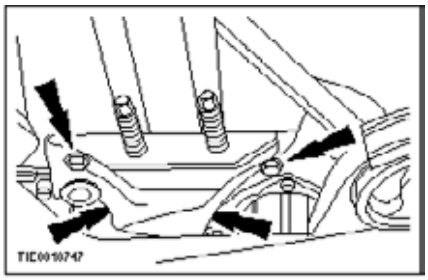
    Remove the engine front mount.

5/9/02



13. Detach the timing belt upper cover.
    - Leave the timing belt cover in its installed position.

14. Remove the engine front mount bracket.
    - Remove the timing belt upper cover.



15. Remove the electronic ignition (EI) coil cover.

16. Remove the engine upper cover.

17. **CAUTION: Do not pull the cable when removing the spark plug connectors. If necessary, remove the ignition cables from the ignition coil to avoid kinking the cables. Turn the spark plug connectors slightly before removing to loosen the seal.**

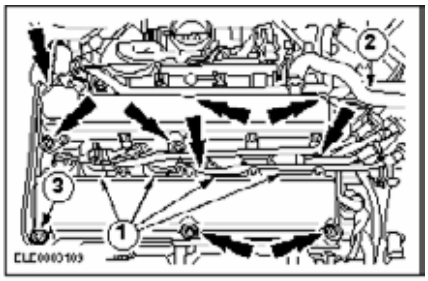
    CAUTION: Pull off the spark plug connectors in line with the spark plugs.

    NOTE: Loosening sequence: from the outside to the inside, working diagonally.

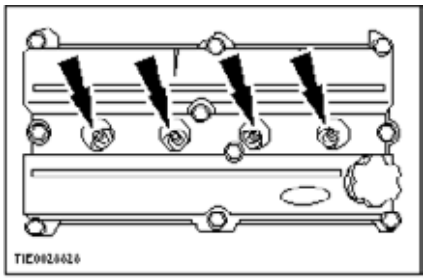
5/9/02

Remove the valve cover.

1. Disconnect the spark plug connectors.
2. Detach the positive crankcase ventilation (PCV) hose.
3. Remove ten bolts.

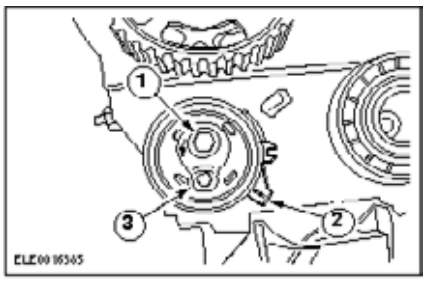


18. Remove the spark plugs.



19. Turn the engine to TDC on cylinder number 1.

20. Detension the timing belt (timing belt removed for clarity).
    1. Loosen the bolt four turns.
    2. Position the tensioner so the locating tab is at approximately the 4 o'clock position.
    3. Line up the hexagonal key slot in the tensioner adjusting washer with the pointer that is located behind the pulley.

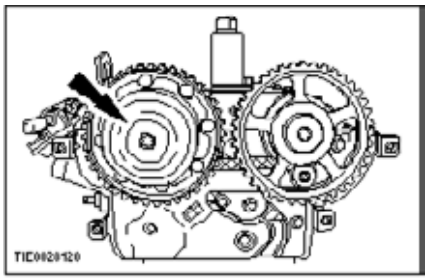


21. Remove the timing belt.

22. **NOTE:** Use an open ended wrench to prevent the camshaft rotating from rotating.

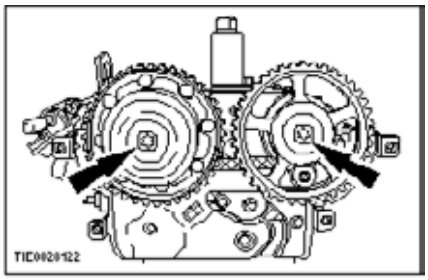
    Remove the intake camshaft pulley blanking plug.

5/9/02



23. **NOTE:** Use an open ended wrench to prevent the camshaft rotating from rotating.

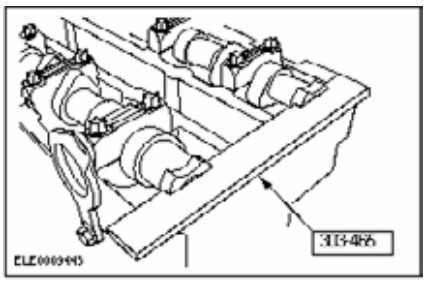
    Loosen the camshaft pulley retaining bolts.



Installation

1. **NOTE:** Do not tighten the bolts. The camshaft timing pulleys must be able to turn freely on the camshafts.

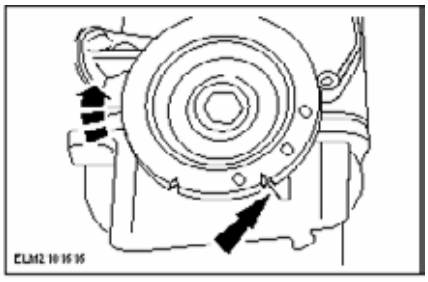
   Turn the camshafts to ignition position on cylinder number 1 and insert the special tool into the camshafts.



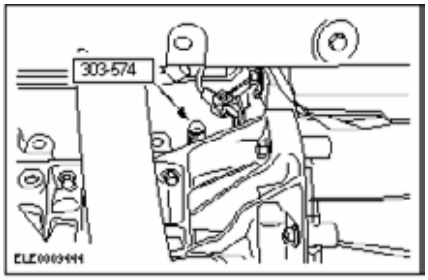
2. **NOTE:** Rotate the crankshaft clockwise.

   Rotate the crankshaft to TDC on cylinder number 1.

5/9/02



3. Remove the blanking plug, install the special tool.



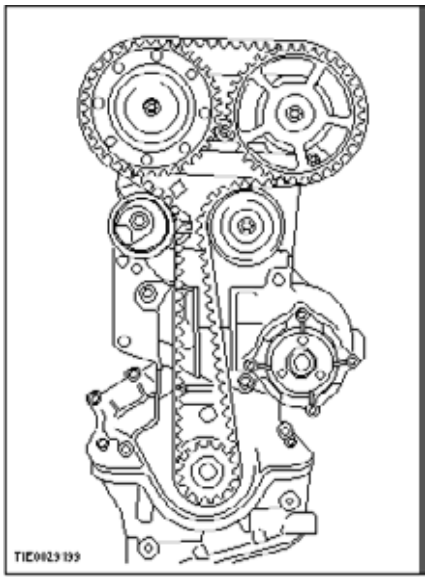
4. **CAUTION: Do not kink the timing belt (do not bend the timing belt less than a diameter of 35 mm).**

   CAUTION: Do not rotate the crankshaft, check that it is still resting against the timing pin.

   NOTE: The lug of the belt tensioner must not be hooked into the sheet metal cover during timing belt installation.

   Install a new timing belt.
   - Starting from the crankshaft timing belt pulley and working counterclockwise install the timing belt, keeping it under tension.

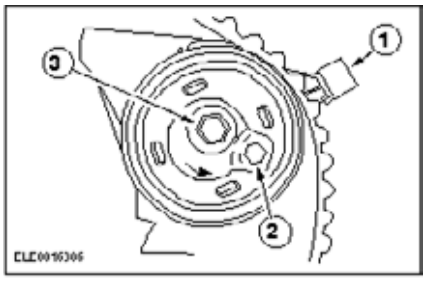
5/9/02



5. **CAUTION: Incorrect timing belt tension will result in incorrect valve timing.**

Pretension the timing belt.

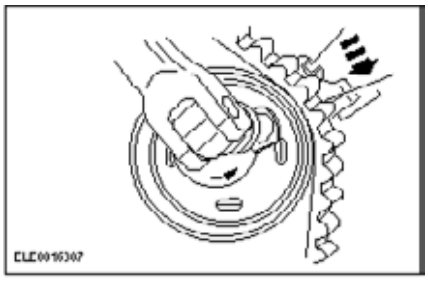
1. Rotate the tensioner locating tab counterclockwise and insert the locating tab into the slot in the rear timing cover.
2. Position the hexagonal key slot in the tensioner adjusting washer to the 4 o'clock position.
3. Tighten the attaching bolt enough to seat the tensioner firmly against the rear timing cover, but still allow the tensioner adjusting washer to be rotated using a 6 mm hexagonal key.



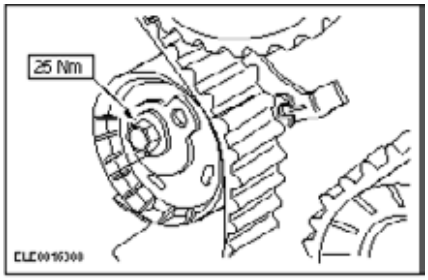
6. **CAUTION: Tension the timing belt, working counterclockwise.**

Using the hexagonal key, rotate the adjusting washer counterclockwise until the notch in the pointer is centered over the index line on the locating tab (the pointer will move clockwise during adjustment).

5/9/02

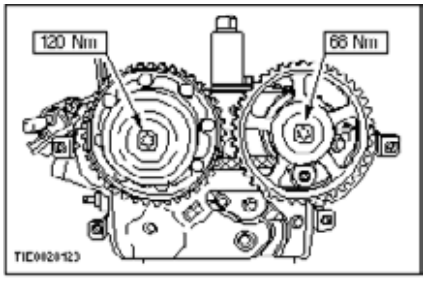


7. Tighten the bolt, while holding the adjusting washer in position.



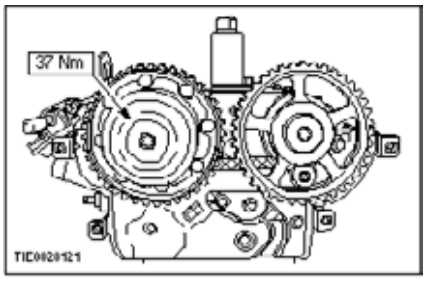
8. **NOTE:** Use an open ended wrench to prevent the camshaft rotating from rotating.

   Tighten the camshaft pulley retaining bolts.



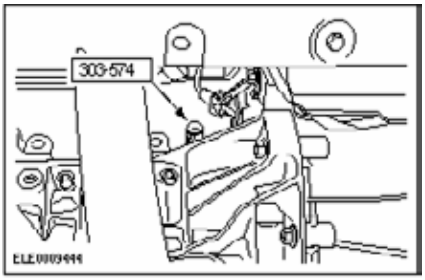
9. **NOTE:** Use an open ended wrench to prevent the camshaft rotating from rotating.

   Install the intake camshaft pulley blanking plug.



5/9/02

10. Remove the special tool.

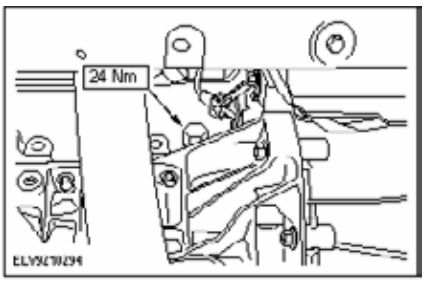


11. Remove the special tool 303-465 from the camshafts.

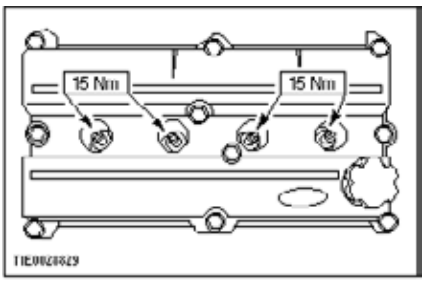
12. **NOTE:** Turn the crankshaft two revolutions in the normal direction of rotation.

    Check the valve timing by inserting the special tool. Correct it if necessary.
    - Install the special tool and make sure that the it is contact with the crankshaft.
    - Install the special tool into the camshafts; if necessary loosen the timing pulleys and correct the camshaft alignment.
    - Remove the special tools.

13. Install the blanking plug.



14. Install the spark plugs.



15. **CAUTION: Use a blunt object (a plastic cable tie) to apply the silicone grease, to avoid damaging the spark plug connectors.**

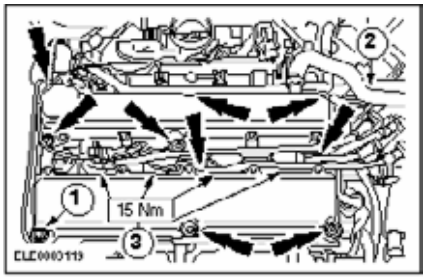
5/9/02

CAUTION: Push on the spark plug connectors, keeping them in line with the spark plugs.

NOTE: Coat the inside of the spark plug connectors with silicone grease to a depth of 5-10 mm.

Install the vavle cover.

1. Tighten the bolts in two stages.
   - Stage 1: 2 Nm
   - Stage 2: 7 Nm
2. Attach the PCV hose to the valve cover.
   - Connect the VCT actutator electrical connector.
3. Coat the spark plug thread with Never Seeze, screw in the spark plugs and push in the spark plug connector until it engages.

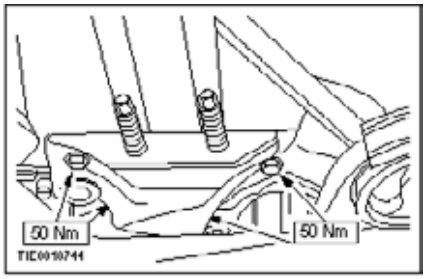


16. Install the engine upper cover.

17. Install the electronic ignition (EI) coil cover.

18. **NOTE:** Position the upper timing belt cover and the center timing belt.

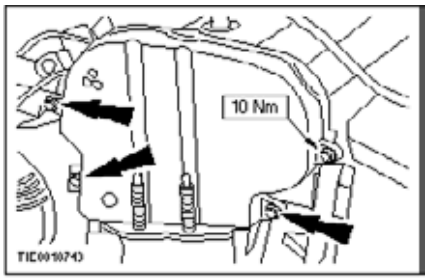
    Install the engine front mount bracket.



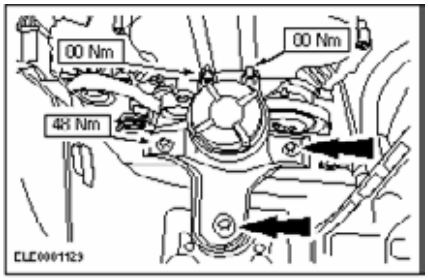
19. **NOTE:** Check the seating of the timing belt upper cover gasket and correct as necessary.

    Attach the timing belt upper cover.

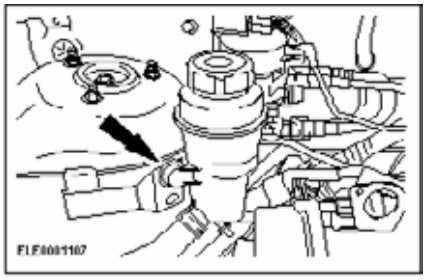
5/9/02



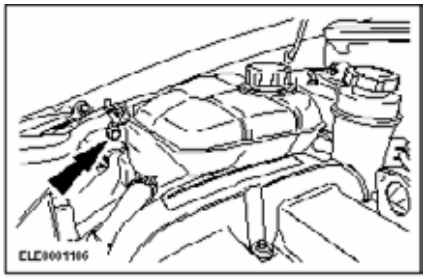
20. Install the engine front mount.



21. Attach the PAS reservoir.



22. Attach the coolant expansion tank.

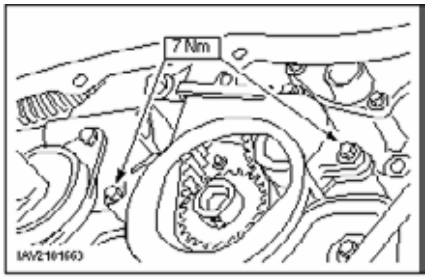


23. Remove the hydraulic jack and wooden block.

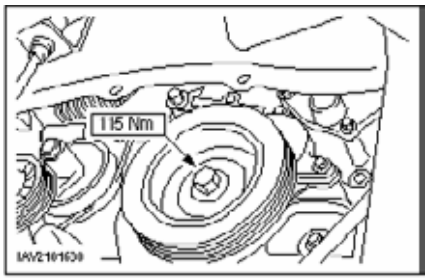
24. Raise and support the vehicle. For additional information, refer to Section 100-02 .

5/9/02

25. Attach the lower timing belt cover.

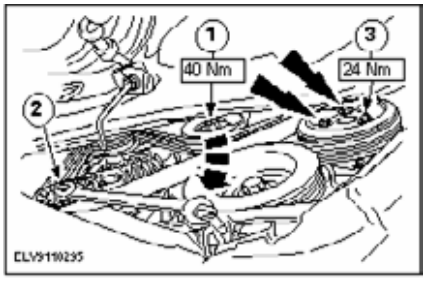


26. Install the crankshaft pulley.



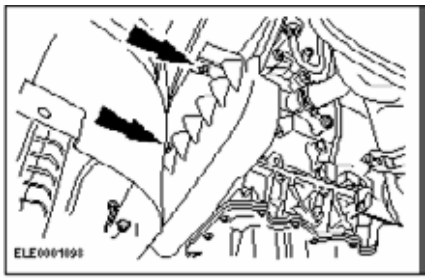
27. **NOTE:** Direction of travel on a used drive belt.

    Install the drive belt.
    1. Attach the multi-groove belt idler pulley.
        - Attach the coolant pump pulley. Do not tighten the bolts at this stage.
    2. Install the drive belt by turning clockwise and tension it.
    3. Tighten the bolts on the coolant pump pulley.



28. Attach the drive belt cover.

5/9/02



29. Lower the vehicle.

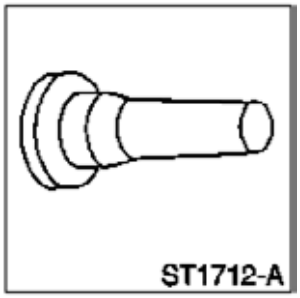
30. **NOTE:** When the battery has been disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 miles) or more to relearn the strategy.

    Standard finishing operations:
    - Connect the battery negative cable.
    - Install the battery cover.
    - Check fluid levels and correct if necessary.
    - Check the routing of vacuum hoses and cables and secure them with cable ties.

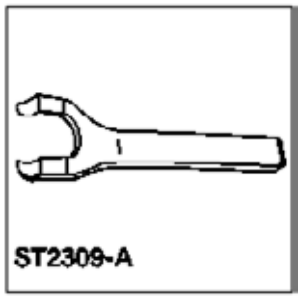
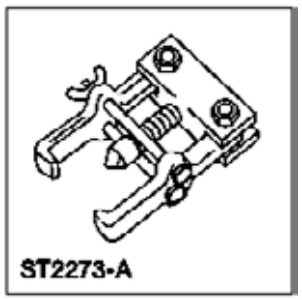
5/9/02

COBRA REAR HALFSHAFT - REMOVE AND REPLACE

Halfshaft

	Differential Plug 205-294 (T89P-4850-B)
	Differential Seal Protector 205-461
	Front Hub Remover 205-D070 (D93P-1175-B) or Equivalent
	Halfshaft Removal Tool 205-475

5/9/02

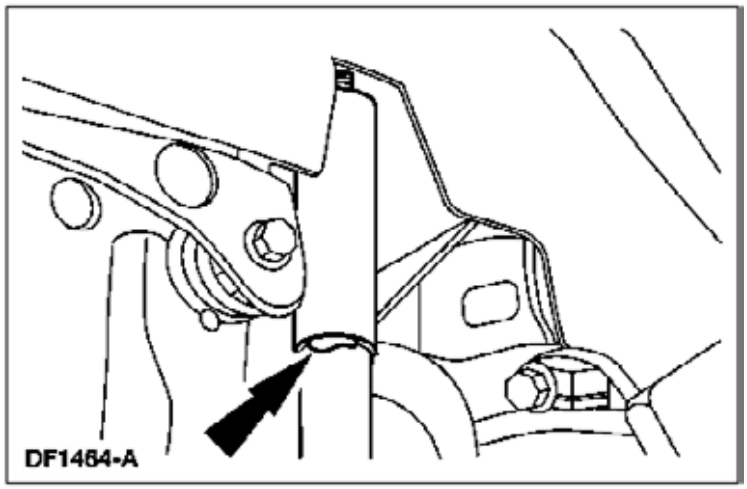
 ST2309-A	
 ST2273-A	Steering Arm Remover 211-003 (T64P-3590-F)

Removal

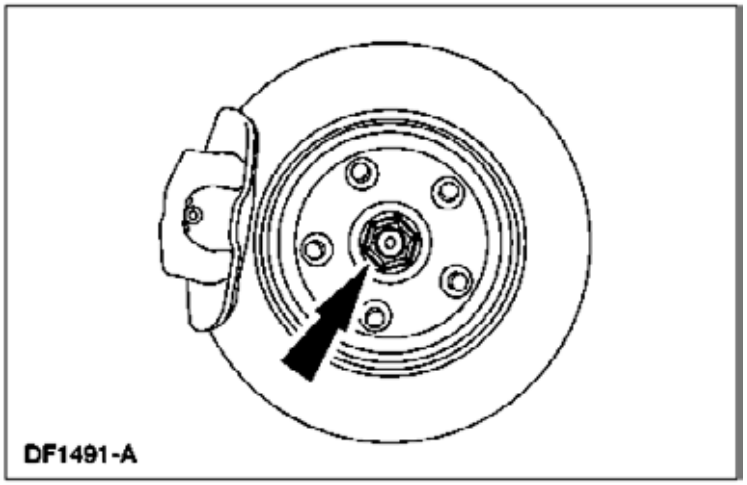
NOTE: This procedure applies to both the LH and RH halfshafts.

1. **CAUTION: The vehicle must be on level ground and at curb height.**

   Mark the rear shock absorber relative to the protective sleeve.
   - During installation, raise the suspension to this reference mark before tightening the

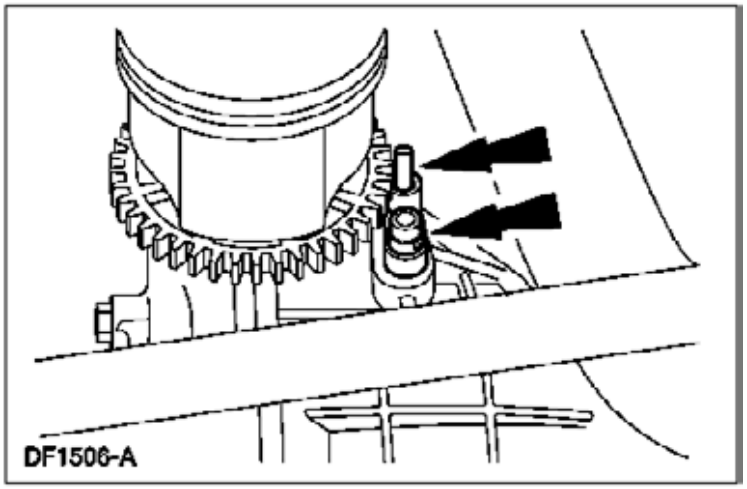


5/9/02



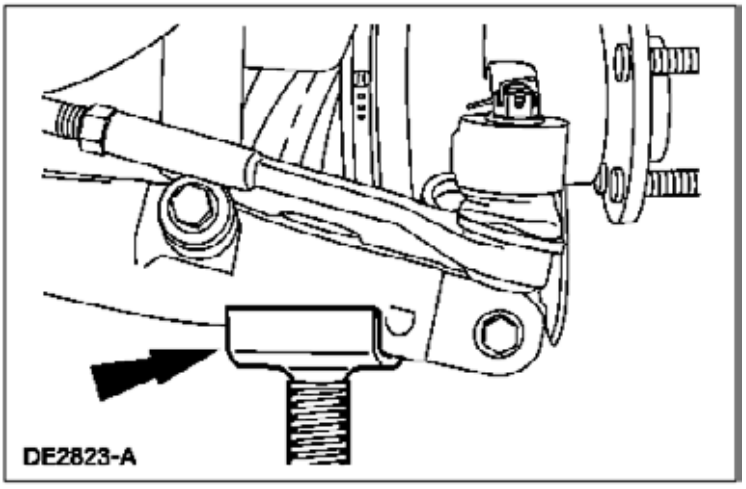
-04 .

6. Remove the rear brake anti-lock sensor and position aside.

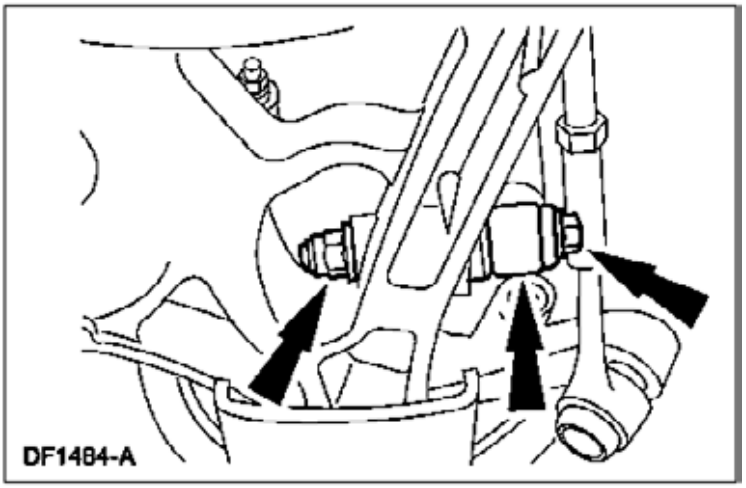


7. Support the suspension lower arm and bushing. This will ease removal of the lower shock absorber

5/9/02

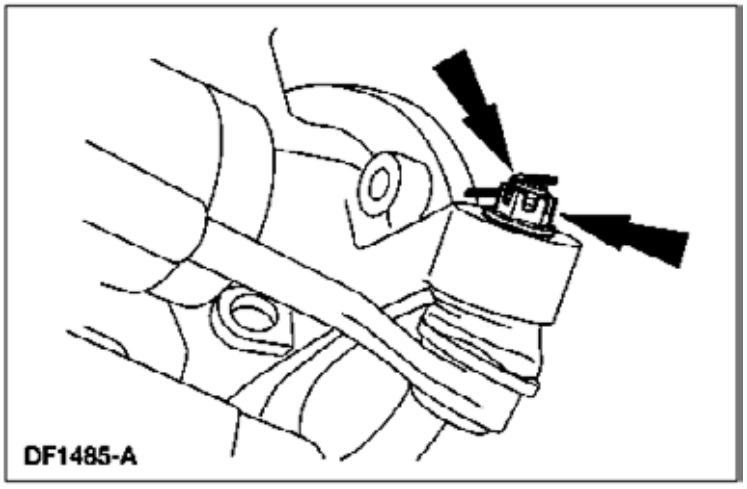


8. Disconnect the shock absorber at the suspension lower arm and bushing. Discard the nut and the

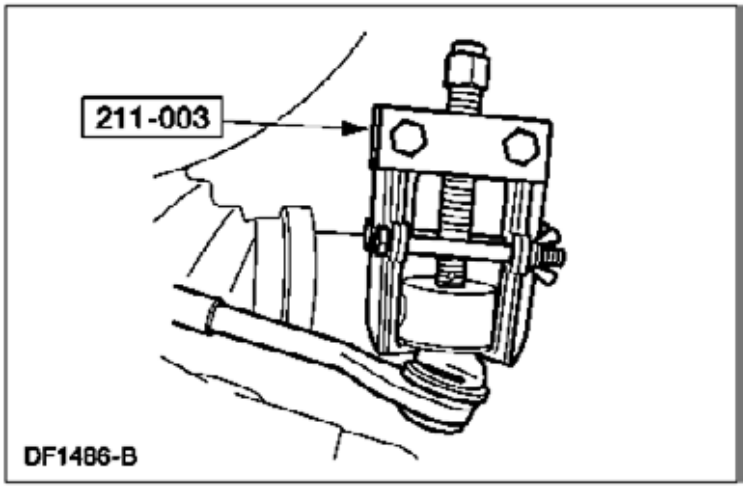


9. Remove and discard the cotter pin and the nut.

5/9/02

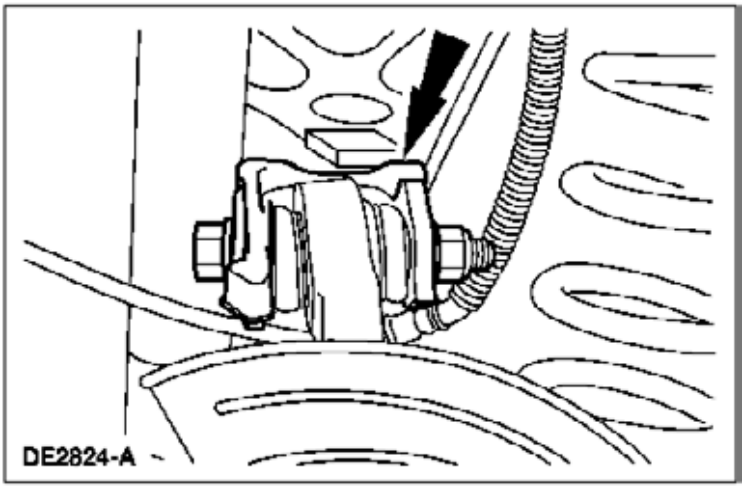


10. Using the special tool, disconnect the tie-rod link at the knuckle.

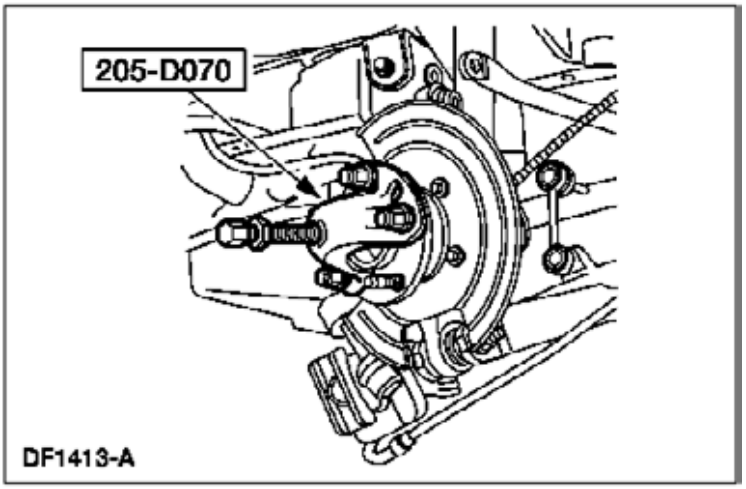


11. Disconnect the suspension upper arm and bushing at the knuckle. Discard the nut and the bolt.

5/9/02



12. Using the special tool, press the outboard CV joint until it is loose in the hub.



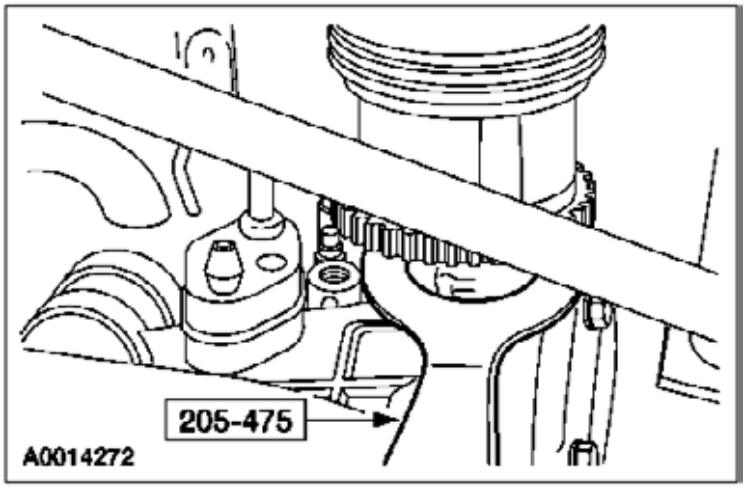
13. **CAUTION: Do not over-angulate the outboard CV joint or damage the boot.**

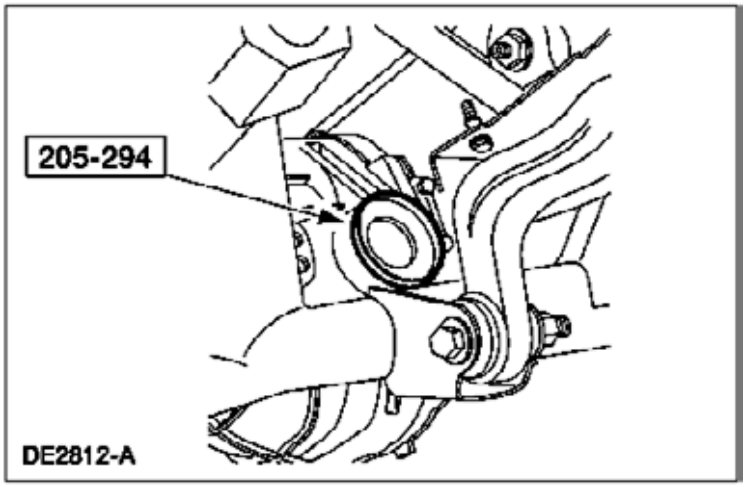
While lowering the knuckle, remove the CV joint from the hub.

14. **CAUTION: The crown on the tool forks must face away from the axle housing. Position the special tool correctly between the CV joint and the axle housing so as not to damage the**

Using the special tool, exert enough pressure to overcome the circlip and separate the CV joint

5/9/02

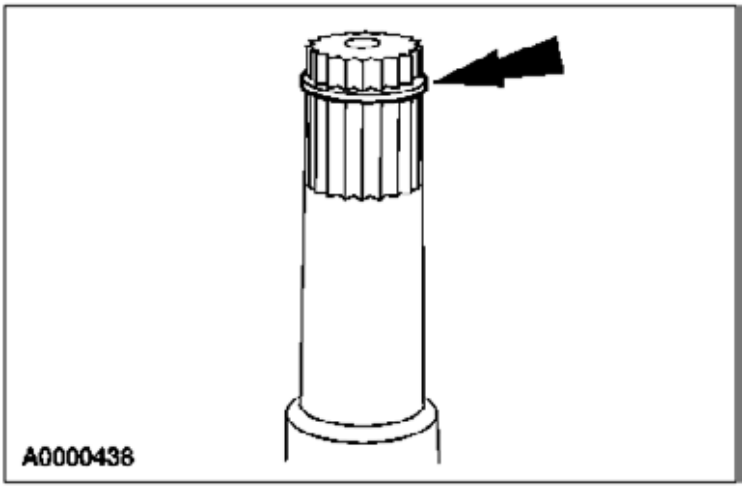




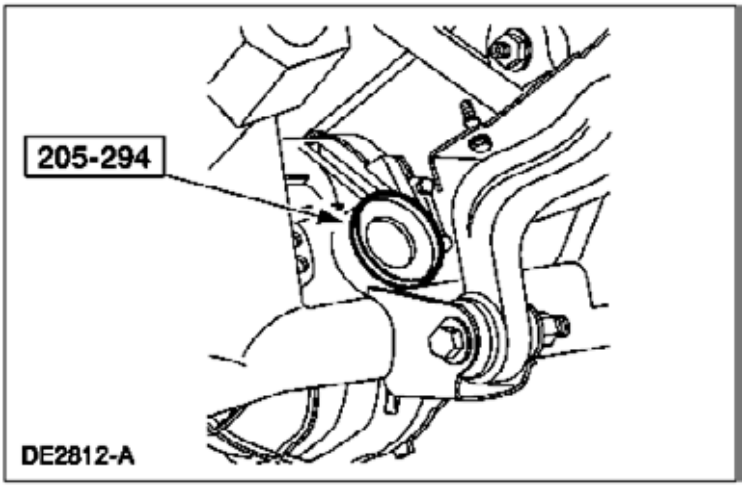
1. This procedure applies to both the LH and RH halfshafts.

Install a new driveshaft bearing retainer circlip.

5/9/02



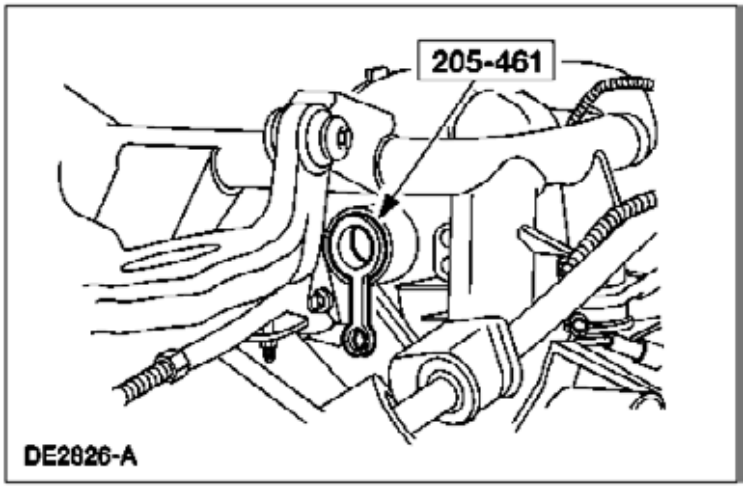
2. Remove the special tool.



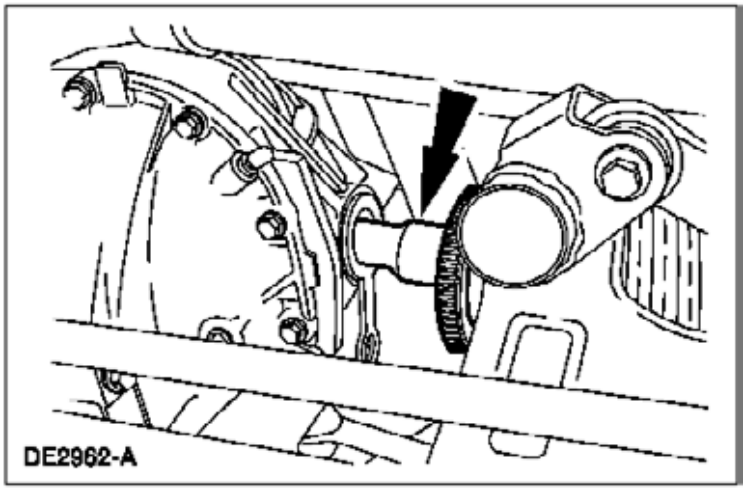
3. **CAUTION: Differential seal damage will occur if installing the halfshaft without the**

Install the special tool.

5/9/02



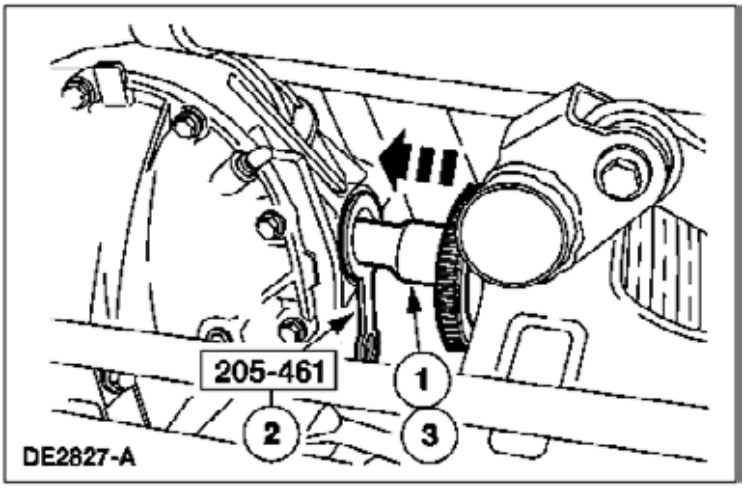
4. Position the halfshaft for installation.



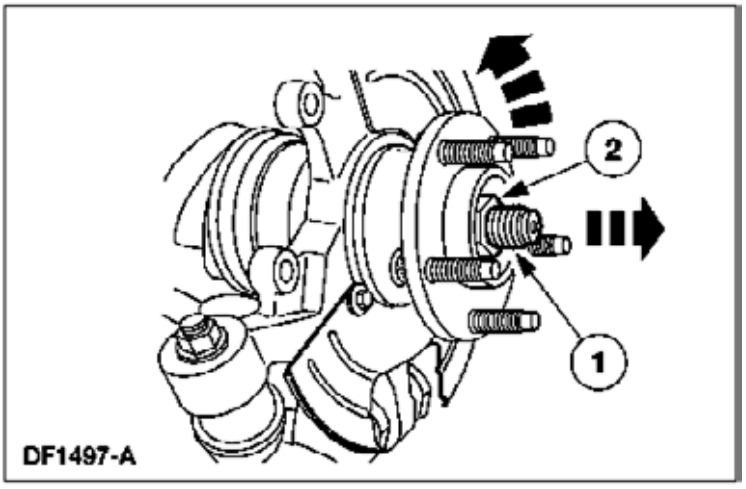
5. Seat the CV joint stub shaft in the differential side gear.
    1. Slide the stub shaft into the axle housing until the shaft splines are past the differential seal.
    2. Remove the special tool.
    3. Align the stub shaft splines and the side gear splines, and slide the stub shaft into the gear

        - When seated, the axle circlip will lock the stub shaft in the differential side gear. Check the circlip engagement by attempting to pull the inboard CV joint out of the differential side gear. If the circlip has not seated, push the CV joint inward until the circlip is fully engaged in the differential side gear.

5/9/02

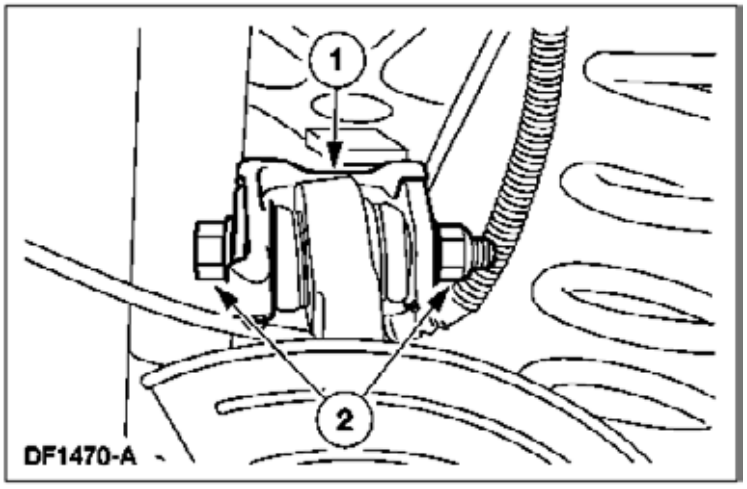


6. Connect the axle shaft to the hub.
    1. Making sure the serrations on the shaft line up with the serrations in the hub, install the axle
    2. Install a new retainer. Do not tighten the retainer at this time.

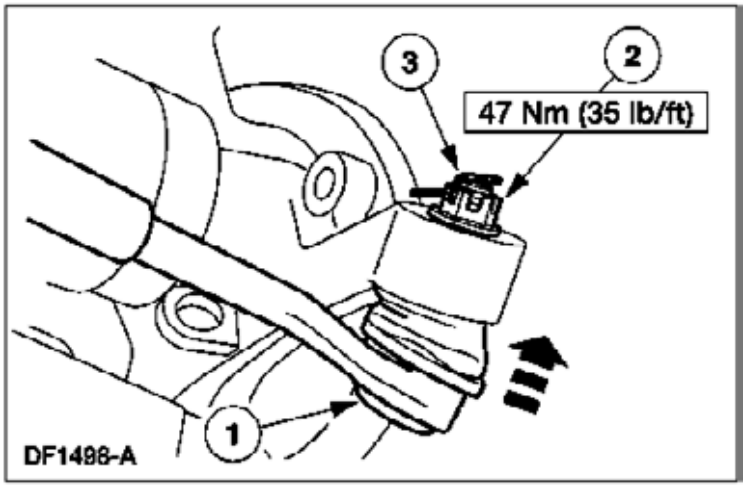


7. Connect the suspension upper arm and bushing to the knuckle.
    1. Position the suspension upper arm and bushing on the knuckle.
    2. Install the new bolt and a new nut. Do not tighten the nut at this time.

5/9/02

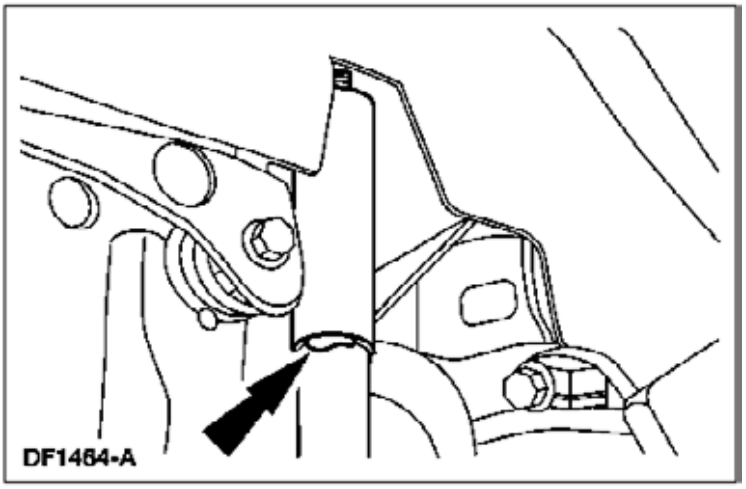


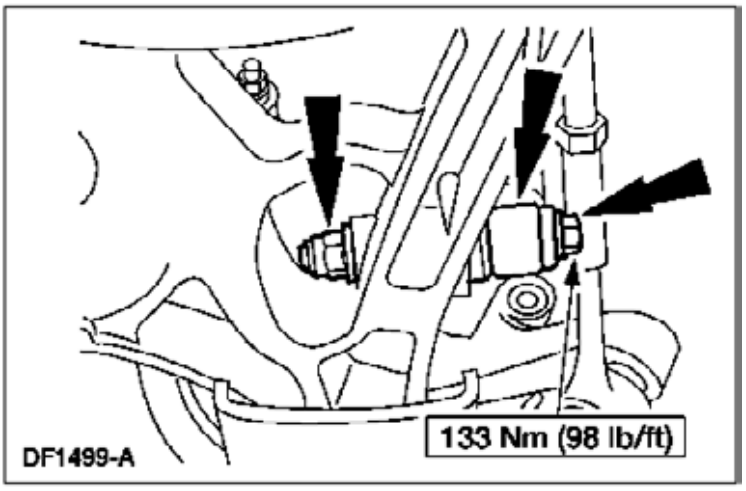
8. -rod end to the knuckle.
   1. -rod link in the knuckle.
   2. Install a new nut.
   3. Install a new cotter pin.



9. Raise the suspension until the shock absorber is compressed to the previously established alignment

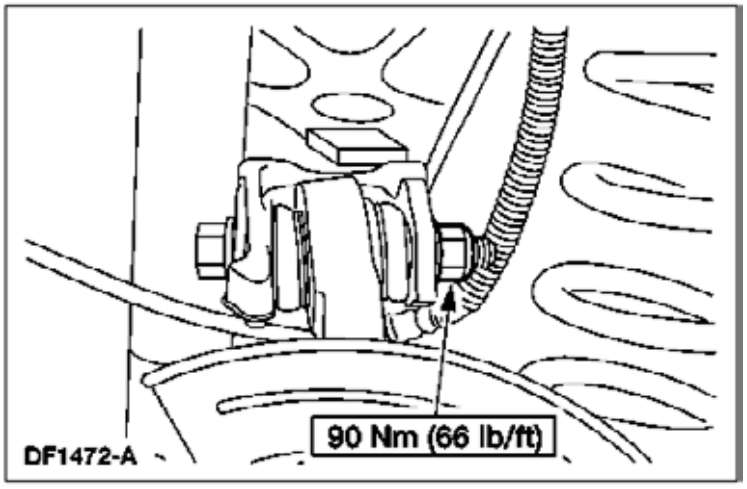
5/9/02

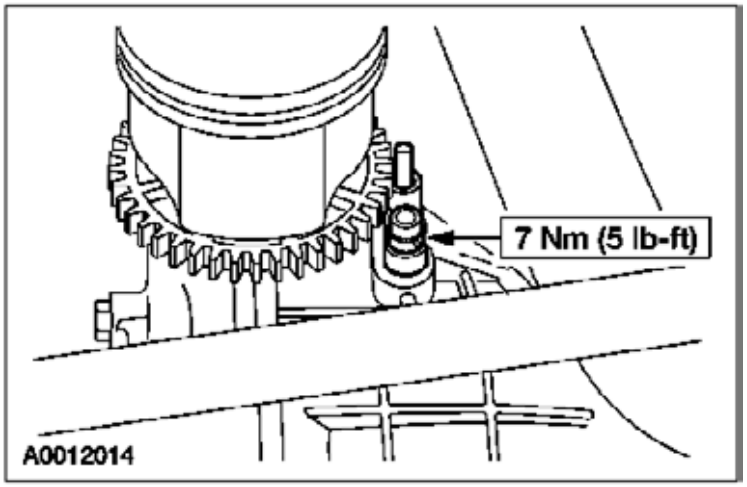




11. Tighten the nut.

5/9/02

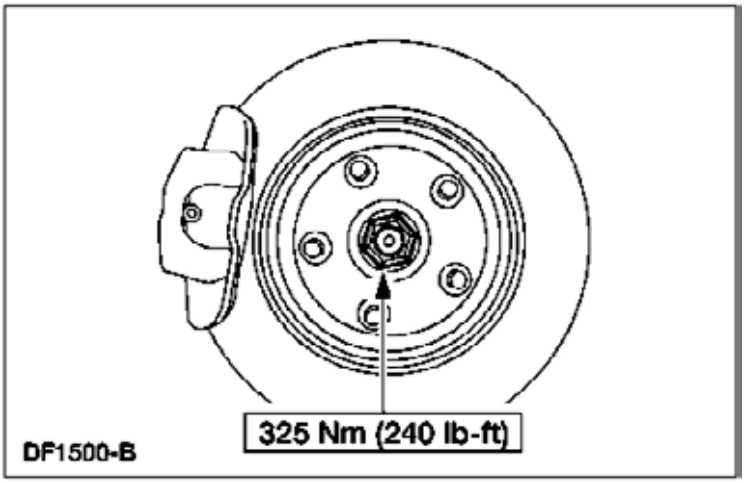




-04 .

15. Tighten the retainer.

5/9/02



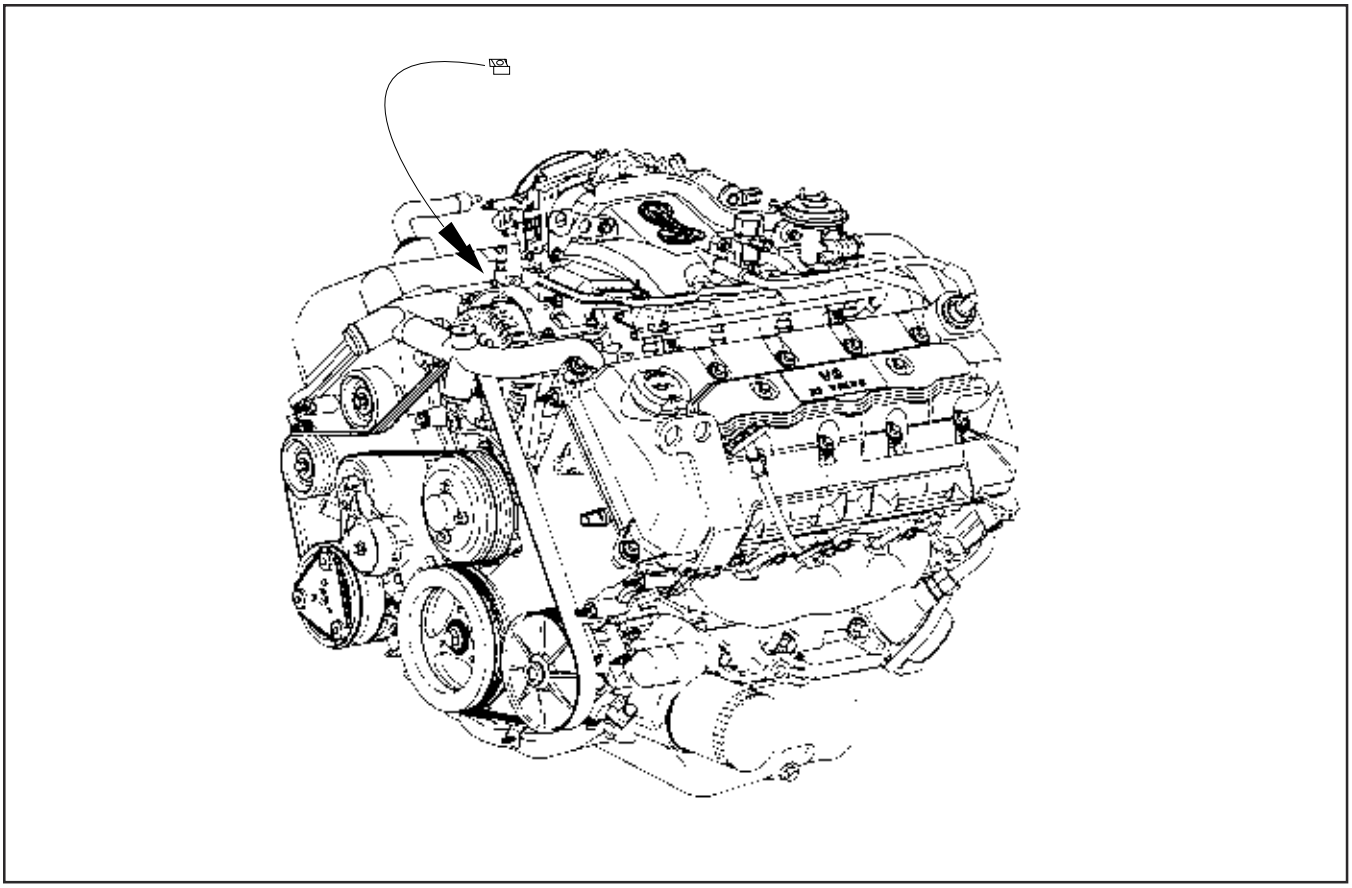
-00 .

5/9/02

THIS PAGE INTENTIONALLY LEFT BLANK

COBRA CONCERNS

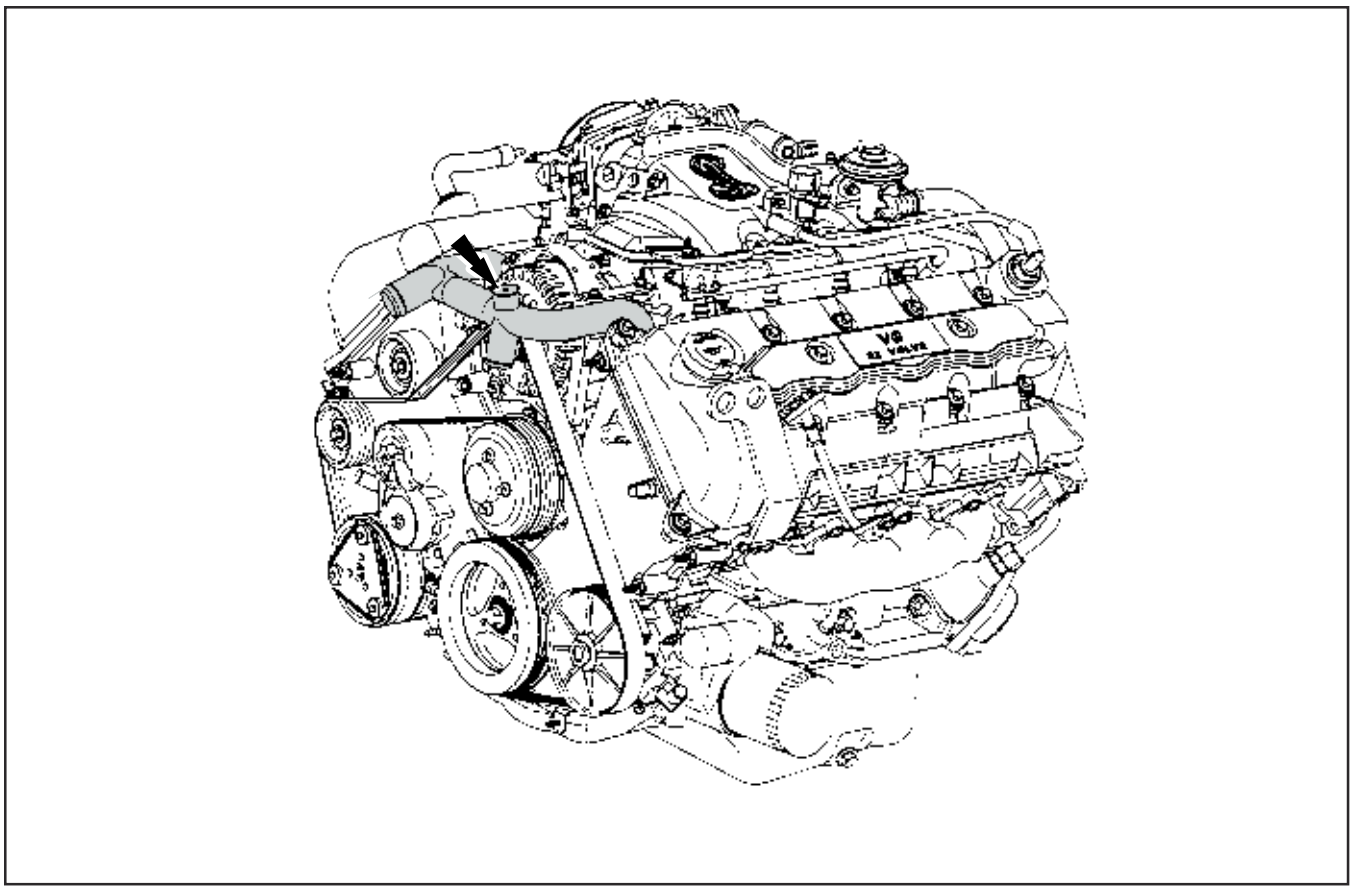
Spring Clamp Retainer



Heater Core Spring Clamp Retainer

- When the Cobra is assembled at the plant there are retainers on the clamps that hold the hoses to the heater core.
  - The spring clamp retainers might fly off during the installation of the hoses and land on top of the engine.
- Before removing the intake manifold ensure that the perimeter of the intake manifold is clean of all debris that may fall into the intake ports when the manifold is removed.
  - The spring clamps are used on the 1999 Cobra.
  - 2001 and newer Cobras use a quick disconnect fitting.

Coolant Fill Procedure



Coolant Fill Procedure

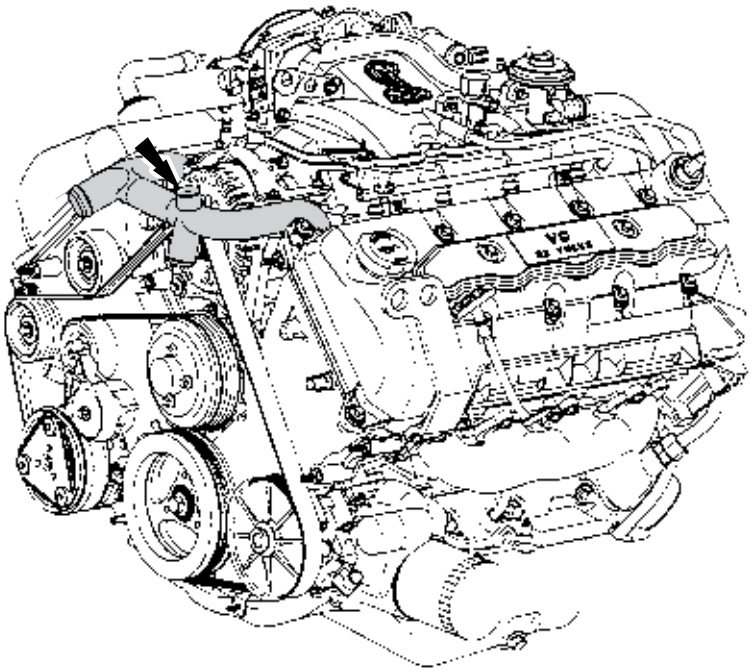
- To fill the cooling system:

1. Check all the hose clamps for proper tightness and make sure that the radiator draincock is closed.
2. Place the heater temperature selector in maximum heat position.
3. Remove the cooling system fill plug from engine water bypass tube.

- To prevent overheating and damage to the engine, coolant must be added to the engine through the fill port in the crossover tube.

CAUTION: Filling through the radiator and/or radiator coolant recovery reservoir traps a pocket of air in the engine block resulting in overheating and damage to the engine.

- If coolant is spilled on the drive belt or pulleys, the drive belt and pulleys must be removed and cleaned with clear water.
  - Coolant causes belt squeal and early belt fatigue.



Add Coolant To the Engine

4. Add coolant into the fill neck on the water bypass.

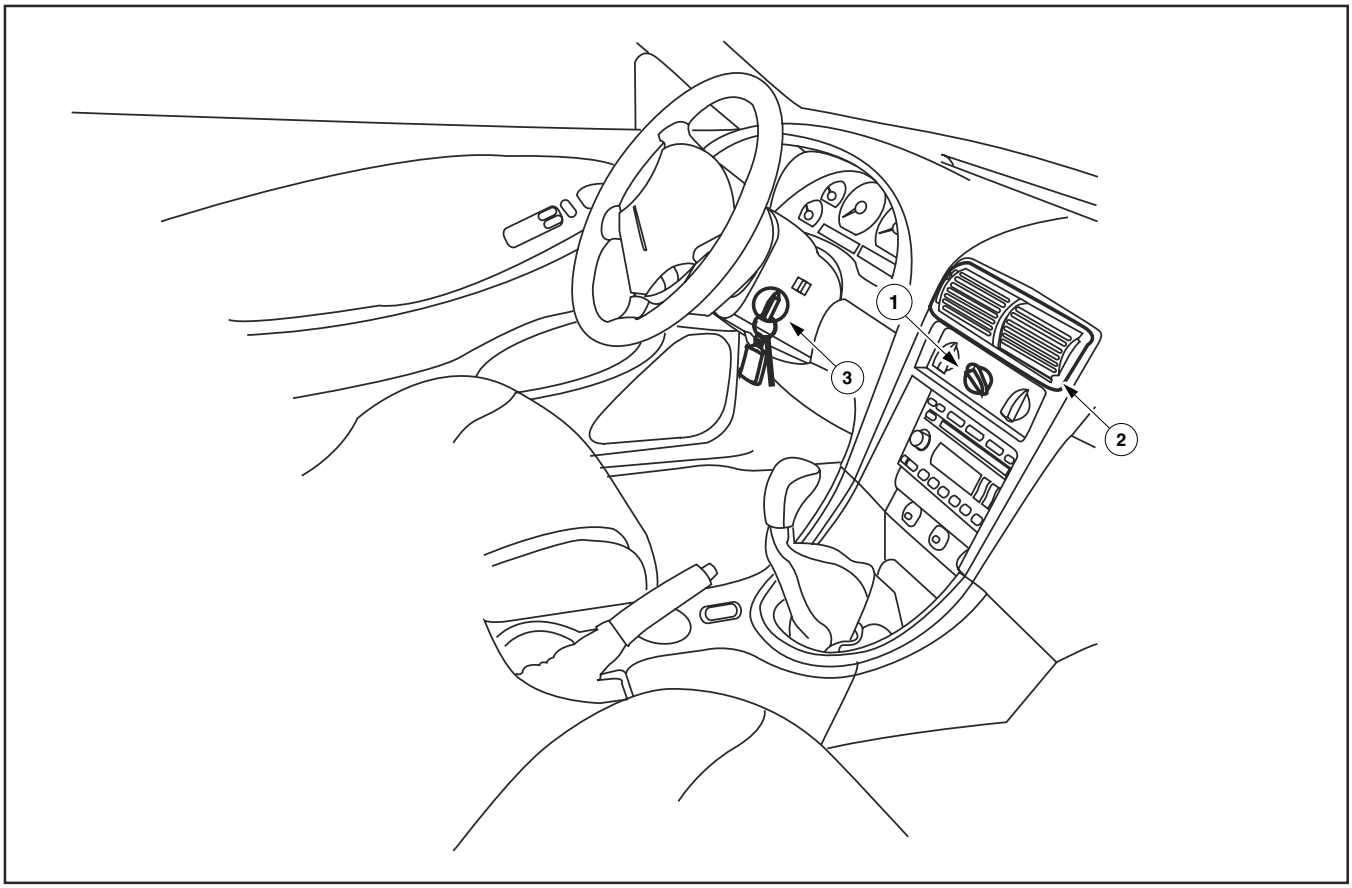
5. When the coolant reaches the "FULL" mark on the radiator coolant recovery reservoir, reinstall the pressure relief cap.

6 Slowly continue to fill cooling system at water bypass tube fill neck.

7 Start the engine and run at idle. Add coolant (50/50 mixture of approved coolant and water) until the cooling system is completely full.

8 Reinstall water bypass tube fill plug. Tighten fill plug to 15-18 Nm (11-13 lb-ft).

Cooling system bleed procedure



Cooling system bleed procedure

- Use the following procedure to bleed the air from the cooling system.

1. Select maximum heater temperature and fan speed settings. (1) Position control to discharge air at A/C registers in instrument panel (2).
2. Start the engine and allow the engine to idle (3). Allow the engine to idle until normal operating temperature is reached. Hot air should discharge from A/C registers.

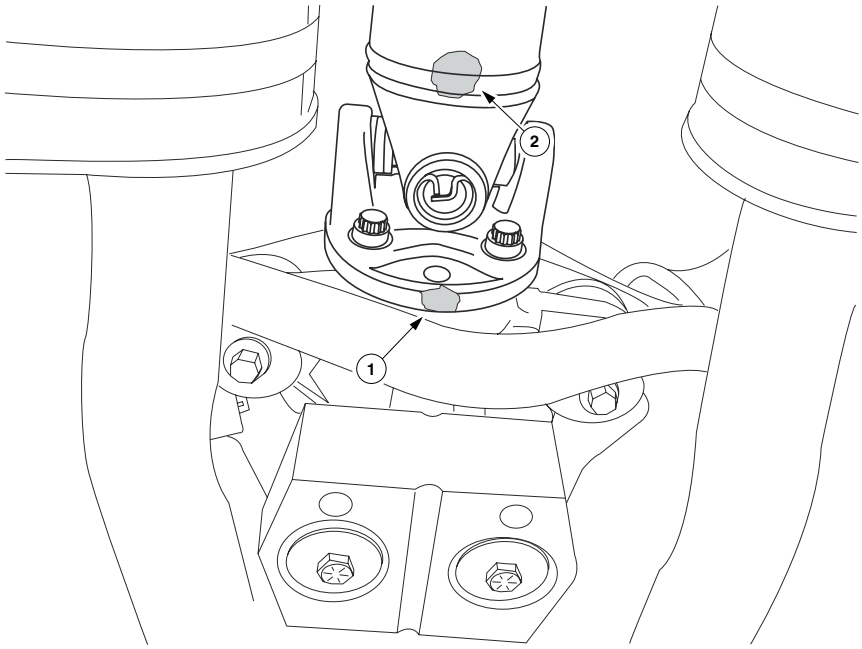
- The engine temperature gauge should maintain a stabilized reading in the middle of the "NORMAL" range and the lower radiator hose should feel hot to the touch.
- If the air discharge remains cool and the engine temperature gauge does not move:
  - Stop the engine.
  - Allow the engine to cool.
  - Follow the cooling system fill procedure.

3. Shut off the engine and allow it to cool. Visually check the engine for coolant leaks.
4. Check the coolant level in the radiator coolant recovery reservoir and fill as necessary.

High-Speed Vibration

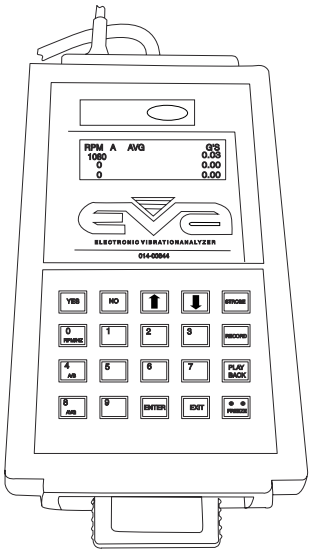
- Due to the performance-oriented nature of the Mustang Cobra, correct driveline alignment and balance are critical to preventing Noise, Vibration and Harshness (NVH) concerns.
- At speeds above 65 MPH (105 KPH) a driveline that is out of balance may cause an NVH concern.

Balance the driveline:



Driveshaft Indexing To Axle

- When the axle is assembled, the pinion flange run-out is measured and the point of maximum run-out is marked with a yellow paint dot (1). The point of maximum run-out, is the heaviest point on the pinion flange.
  - The driveshaft is also marked with a yellow dot at the light side of the driveshaft (2).
- When the driveshaft is assembled to the axle with the marks lined up, the maximum run-out of the axle flange is countered by light side of the driveshaft, balancing the driveline.
  - NVH concerns occur if the paint dots are not correctly aligned.



Connection of the Electronic Vibration Analyzer (EVA)

1. Connect the Electronic Vibration Analyzer (EVA).
   - Install the pick-up sensor of the EVA to the vibration damper bracket with the magnet included in the EVA kit.

Caution: The sensor cable for the EVA is expensive. Take care to prevent the cable from touching the exhaust system or being pinched in the door or suspension. Do not route the cable in a way that may be pinched by the hoist when lifting the vehicle.

2. Initialize the EVA.
   - Plug the EVA power cord into the accessory port.
   - The EVA defaults to Revolutions Per Minute (RPM). Press "0" to set the EVA to Hertz.
3. Road test the vehicle and record the frequency and amplitude of the vibration at 65, 70 and 75 MPH (if the speed limit permits).

Vehicle Speed	Frequency	Driveshaft RPM
65 MPH	46-48 Hz	2760-2880
70 MPH	50-52 Hz	3000-3120
75 MPH	54-56 Hz	3240-3360

Disregard frequencies that appear but are not within these ranges.

Driveline Vibration Analysis Worksheet

Dealer _____

Vehicle _____

Date _____

Technician _____

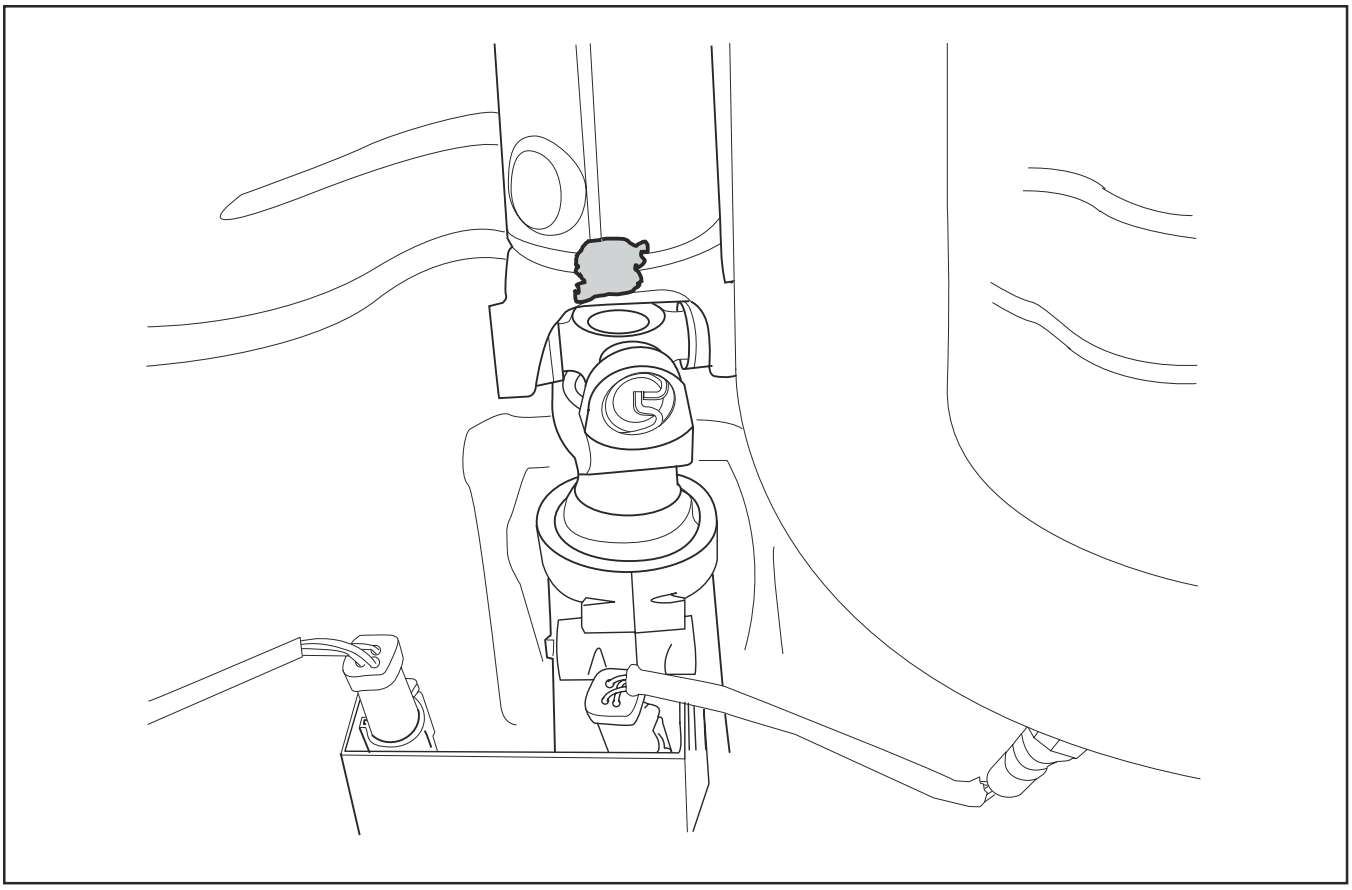
	MPH	65	70	75
	Frequency	46-48 Hz	50-52 Hz	54-56 Hz
Baseline as received from the customer	G's			
1. Index driveshaft 90˚	G's			
2. Index driveshaft 180˚	G's			
3. Index driveshaft 270˚	G's			

Frequency readings between 46-56 Hz are related to driveline vibration at speeds between 65 and 75 MPH.

Readings outside of the 46-56 Hz range do not indicate a driveline vibration and should be disregarded for this worksheet.

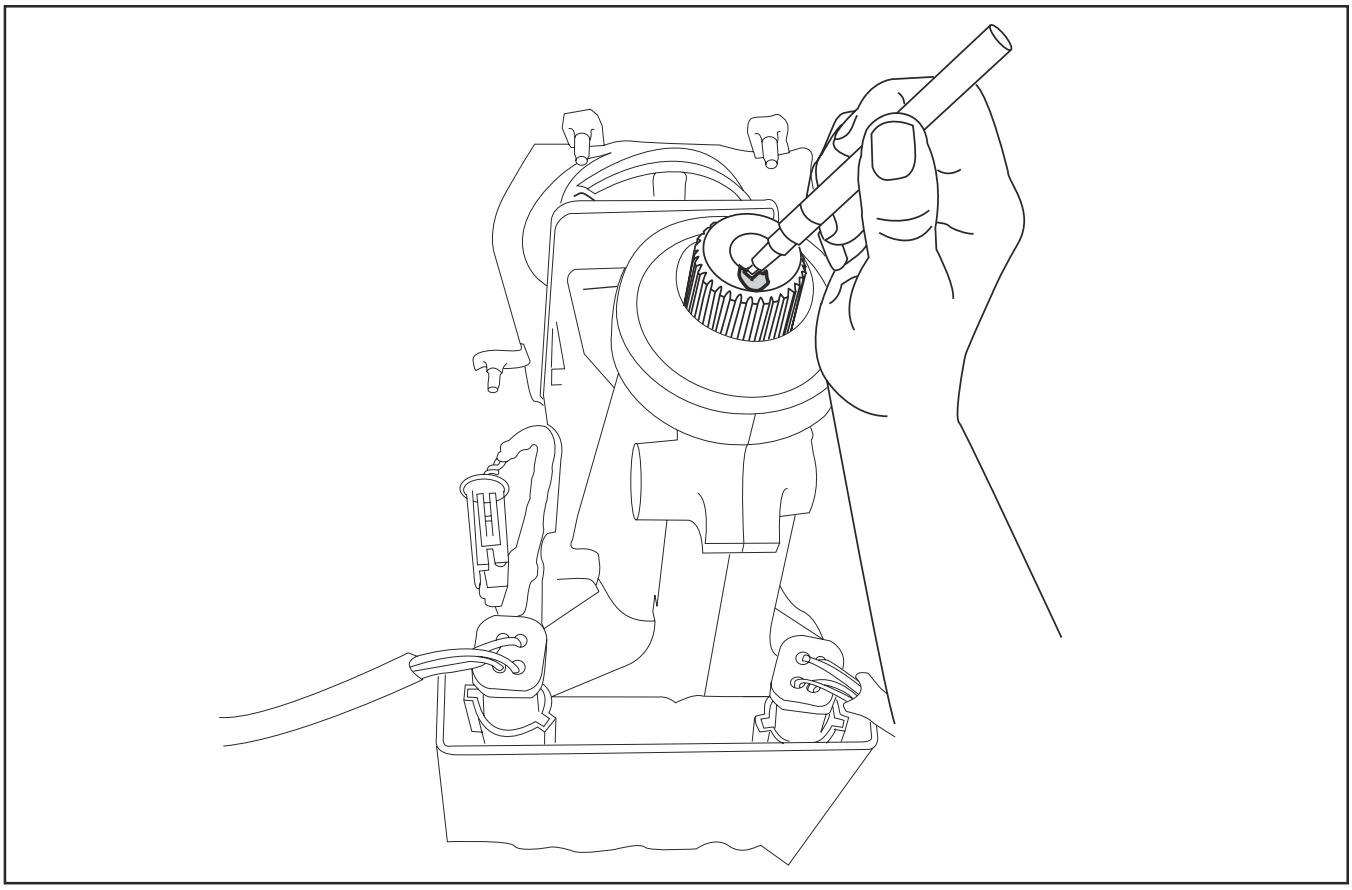
The G reading on the EVA indicates the amplitude (severity) of the vibration.

Measure and record the G readings at the specified speed (where allowed by law) for each of the driveshaft index positions.



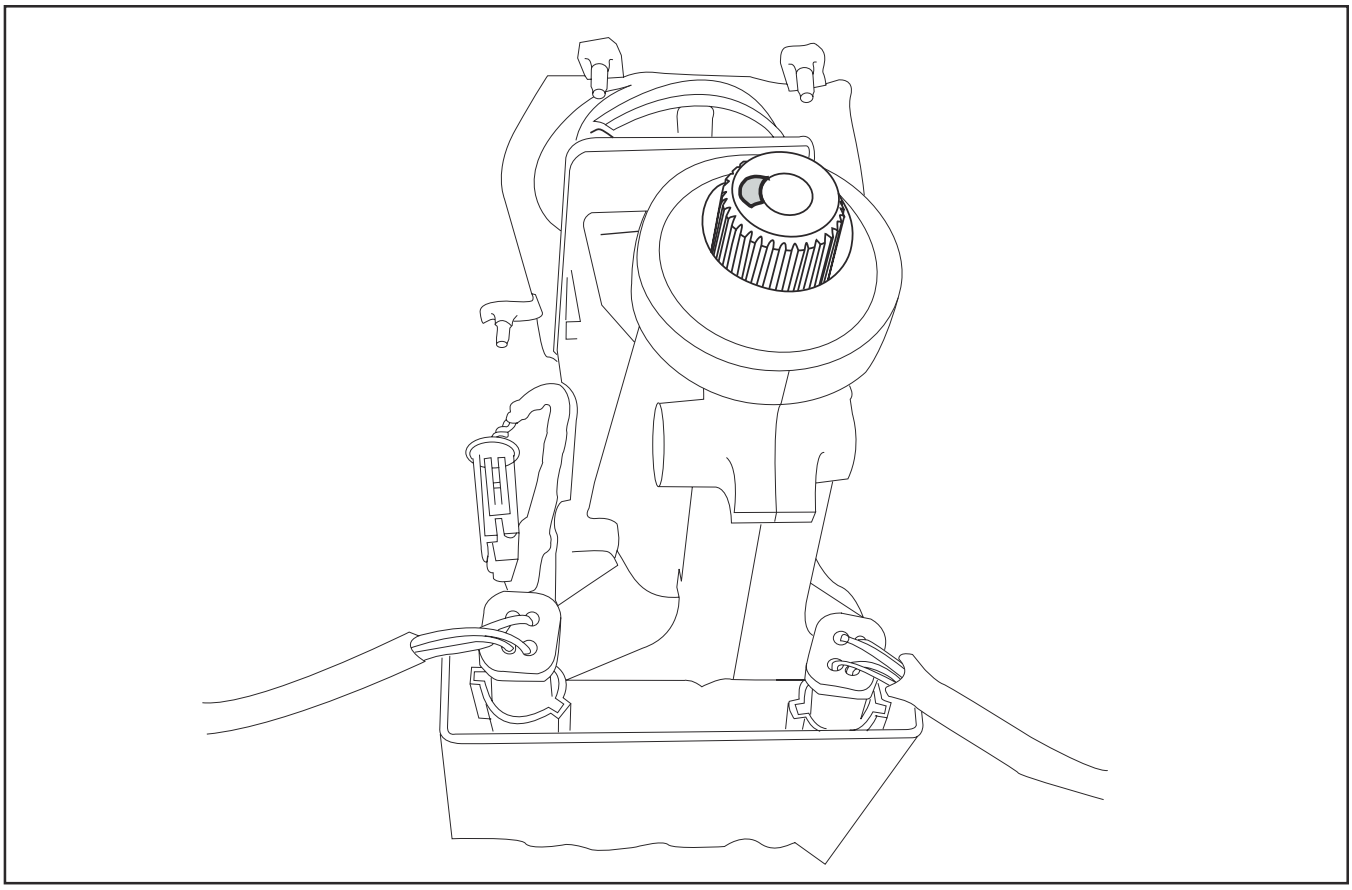
Index the Driveshaft to the Transmission Output Shaft

4. Locate the yellow paint dot at the front of the driveshaft near the yoke.
5. Use a 12mm 12-point socket to remove the 4 bolts that connect the driveshaft to the axle flange. Do not remove the driveshaft at this time.
6. Rotate the driveshaft until the paint mark is down (6 o'clock position). Without turning the driveshaft, remove the driveshaft from the vehicle.



Mark the Transmission Output Shaft

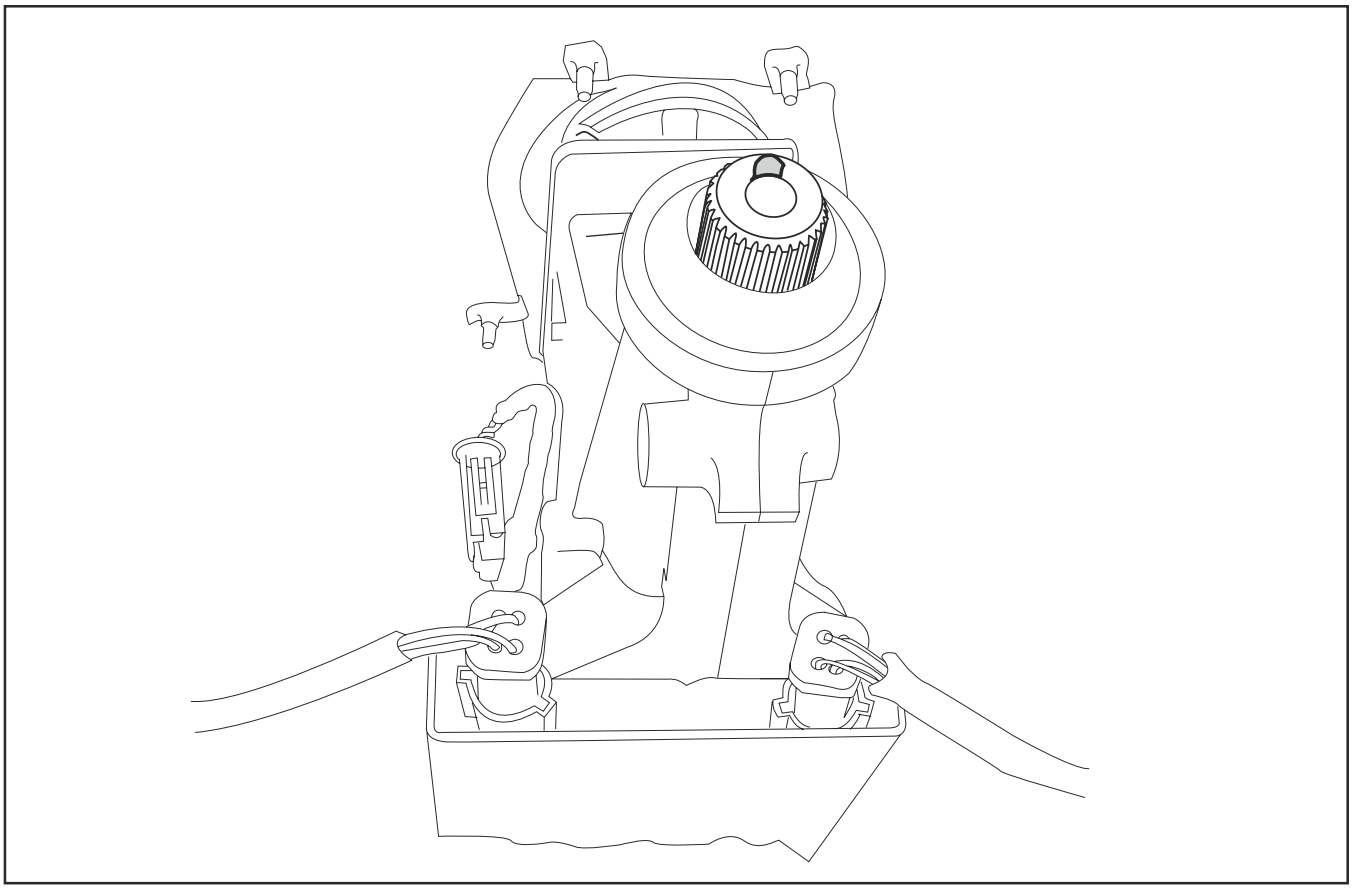
7. Clean and dry the transmission output shaft. Use a paint pen to mark the transmission output shaft at the bottom (6 o'clock) position.



Re-Index the Driveshaft to the Transmission Output Shaft 90°

8. Rotate the transmission output shaft 90° (1/4 turn).

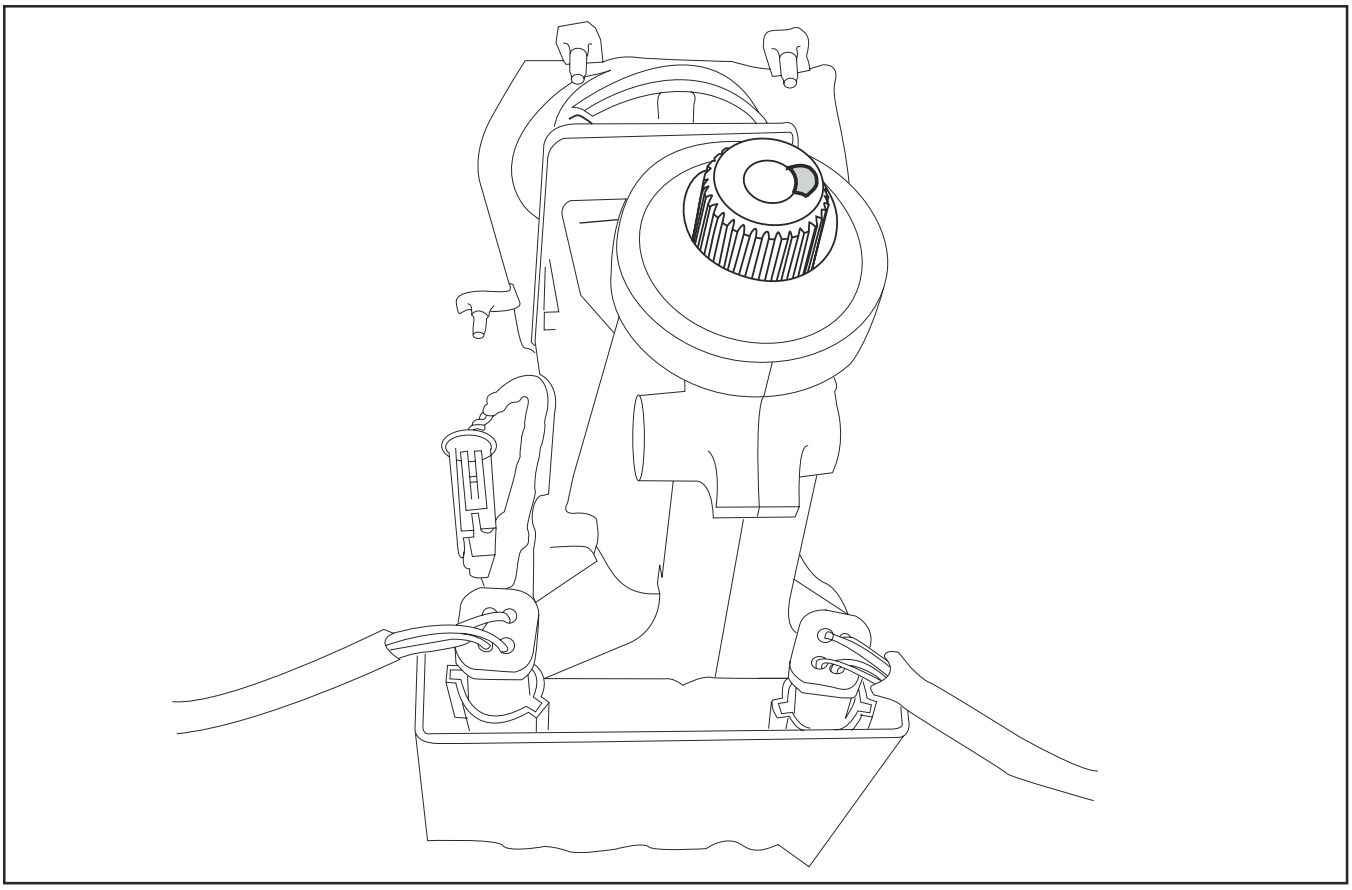
- Reinstall the driveshaft with the paint mark at the bottom (6 o'clock) position.
- Road test the vehicle at the concern speeds.
- Use the driveline vibration analysis worksheet (page 4-11) to record the vibration amplitude (G's) at the concern speeds and frequencies. (65,70,75 MPH).



Re-index the Driveshaft to the Transmission Output Shaft 180°

9. Remove the driveshaft and rotate the transmission output shaft another 90° (to 180°)

- Reinstall the driveshaft with the paint mark at the bottom (6 o'clock position).
- Road test the vehicle at the concern speeds.
- Use the driveline vibration analysis worksheet (page 4-11) to record the vibration amplitude (G's) at the concern speeds and frequencies. (65,70,75 MPH).



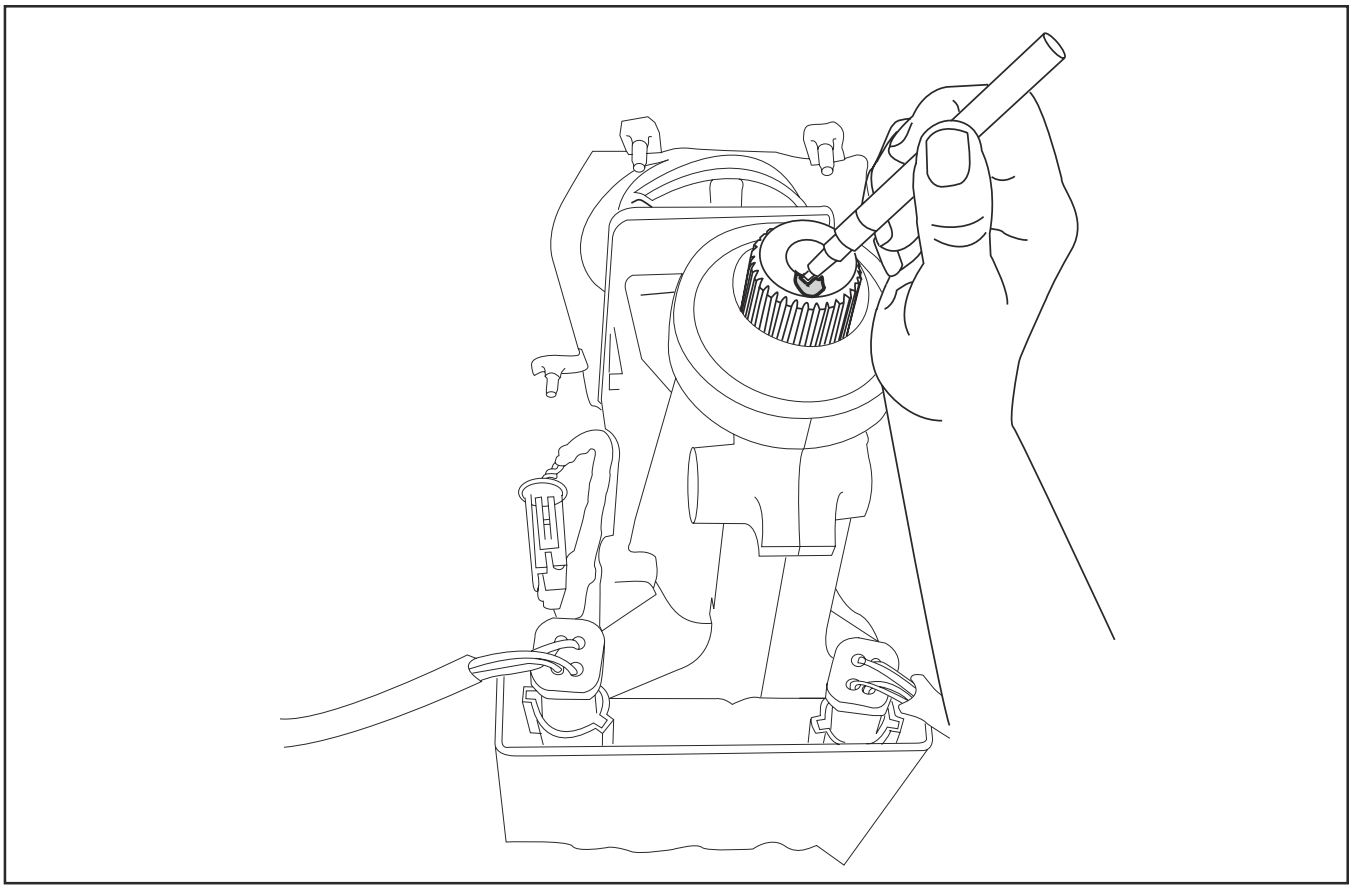
Re-index the Driveshaft to the Transmission Output Shaft 270°

10. Remove the driveshaft and rotate the transmission output shaft another 90° (to 270°).

- Reinstall the driveshaft with the paint mark at the bottom (6 o'clock position).
- Road test the vehicle at the concern speeds.
- Use the driveline vibration analysis worksheet (page 4-11) to record the vibration amplitude (G's) at the concern speeds and frequencies. (65,70,75 MPH).

11. Compare the readings from each road test to identify which output shaft postion causes the least NVH (Lowest G reading on the EVA).

12. Remove the driveshaft one more time and rotate the transmission output shaft to the position with the lowest vibration level (G reading).



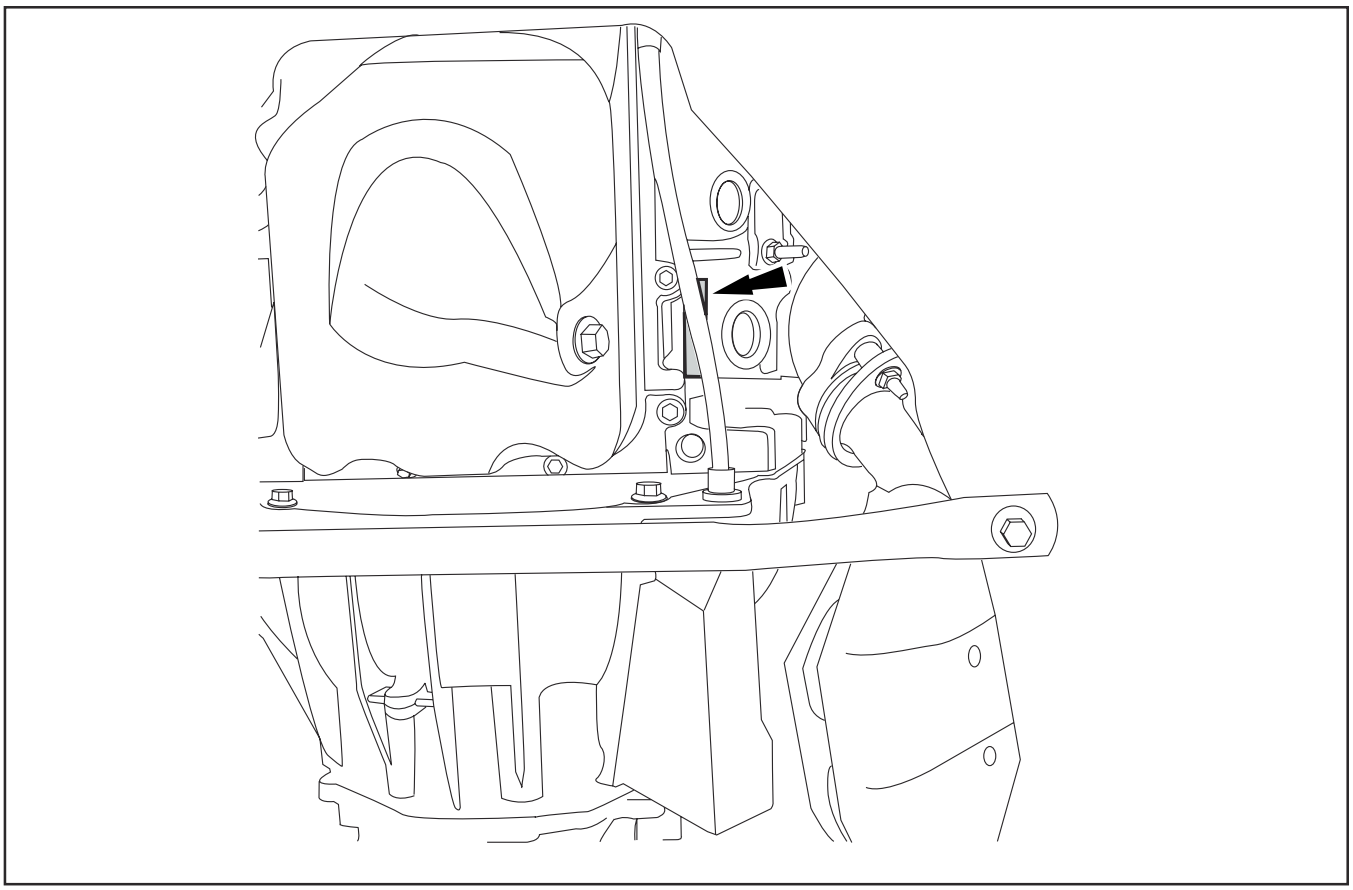
Final Mark Of The Transmission Output Shaft

13. Remove the mark from the transmission output shaft (unless the 6 o'clock position was the least vibration level).
14. Mark the output shaft at the bottom (6 o'clock position) and reinstall the driveshaft with the mark on the driveshaft at the 6:00 o'clock position. This step ensures the driveshaft and transmission output shaft are correctly marked for future disassembly.
15. Road test the vehicle at the concern speeds to verify the repair.

MEASURING DRIVELINE ANGLES AND SETTING THE PINION ANGLE

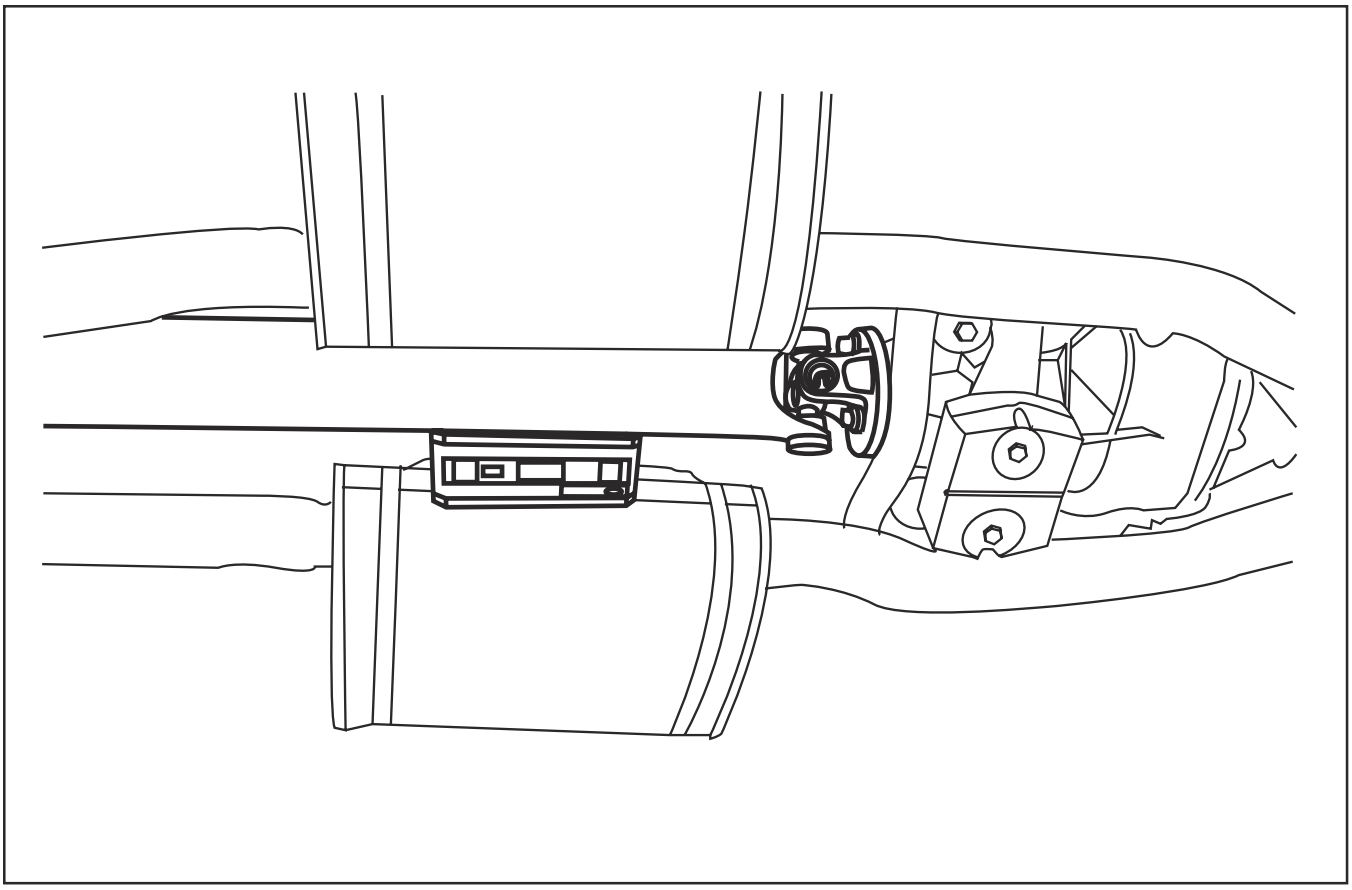
- When the driveline angles are out of specification on the Cobra, an NVH concern may occur between 35-45 MPH (56-72 km/h) in third gear.
  - Correcting the driveline angles eliminates this NVH concern.
- Use a digital inclinometer (Rotunda Anglemaster #164-R2402) to measure the driveline angles (axle, driveshaft, and engine).
- To preserve the accuracy of the measurements, the anglemaster must be zeroed before the first measurement (set the baseline), and all three measurements taken from the same baseline.
- Since all measurements are made with the vehicle at ride height, it is critical to use a drive-on hoist.

Third Gear 35-40 MPH Vibration



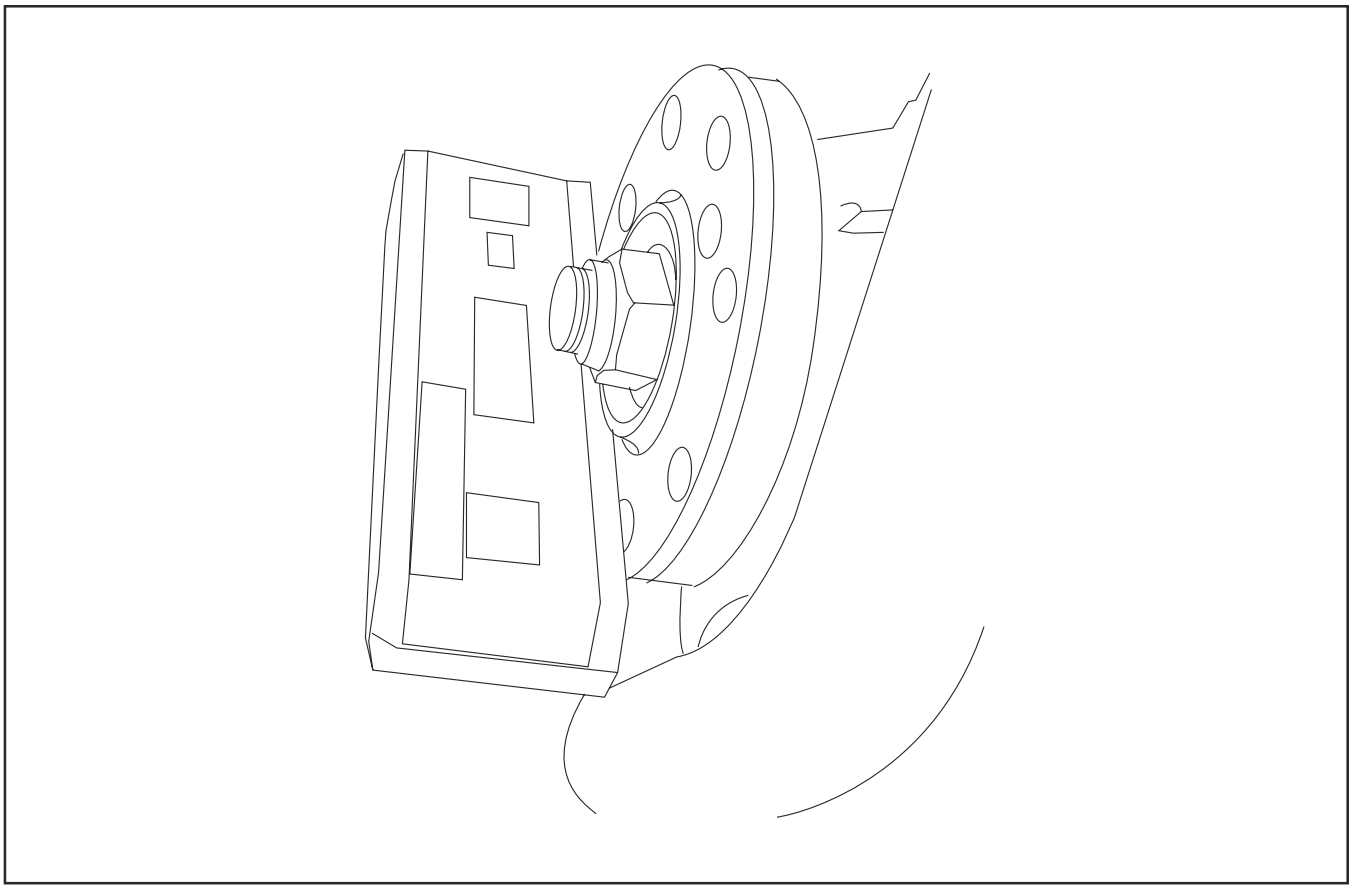
Check The Engine Angle

- Use the Rotunda Anglemaster to measure the angle of the engine.
- To measure the angle of the engine, place the Anglemaster on the machined surface next to the oil pan.
  - If a barcode label covers the machined surface, use a plastic scraper to remove the label before measuring the angle of the engine.
  - Record the angle.



Check The Driveshaft Angle

- Use the Anglemaster to measure the angle of the driveshaft.
  - Record the angle.

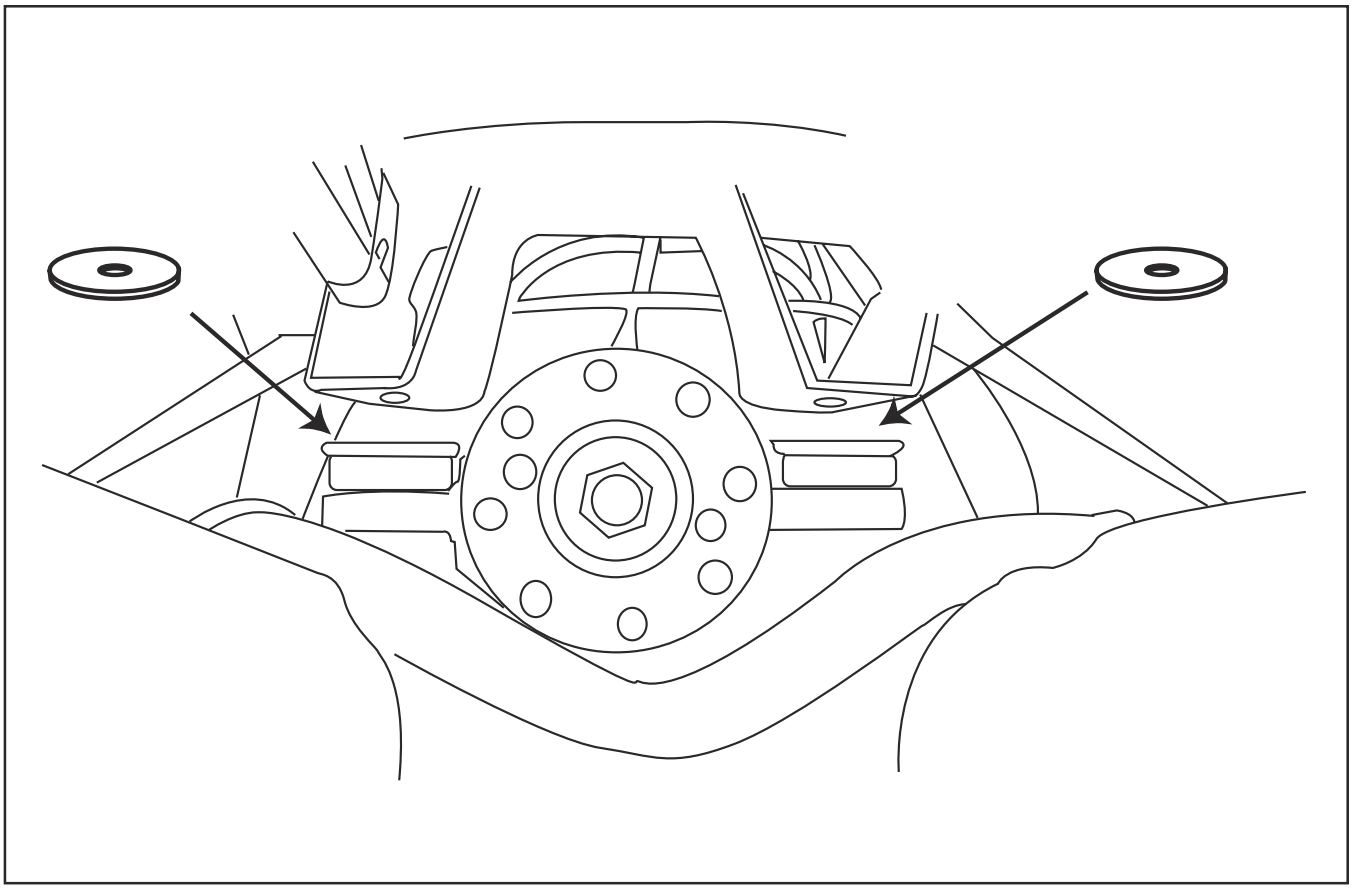


Check The Axle Pinion Angle

- Use the Anglemaster to measure the angle of the pinion at the flange.
- With the vehicle on a drive on hoist, remove the drveshaft bolts. Do not remove the driveshaft from the transmission.
- Place the Anglemaster on the front of the pinion flange and record the angle. Adjust the measurement from 90°.
  - If the reading is 89° the measurement is 1°.
  - If the reading is 91° the measurement is -1°.

Calculate the Driveline Angles and Compare to Specifications

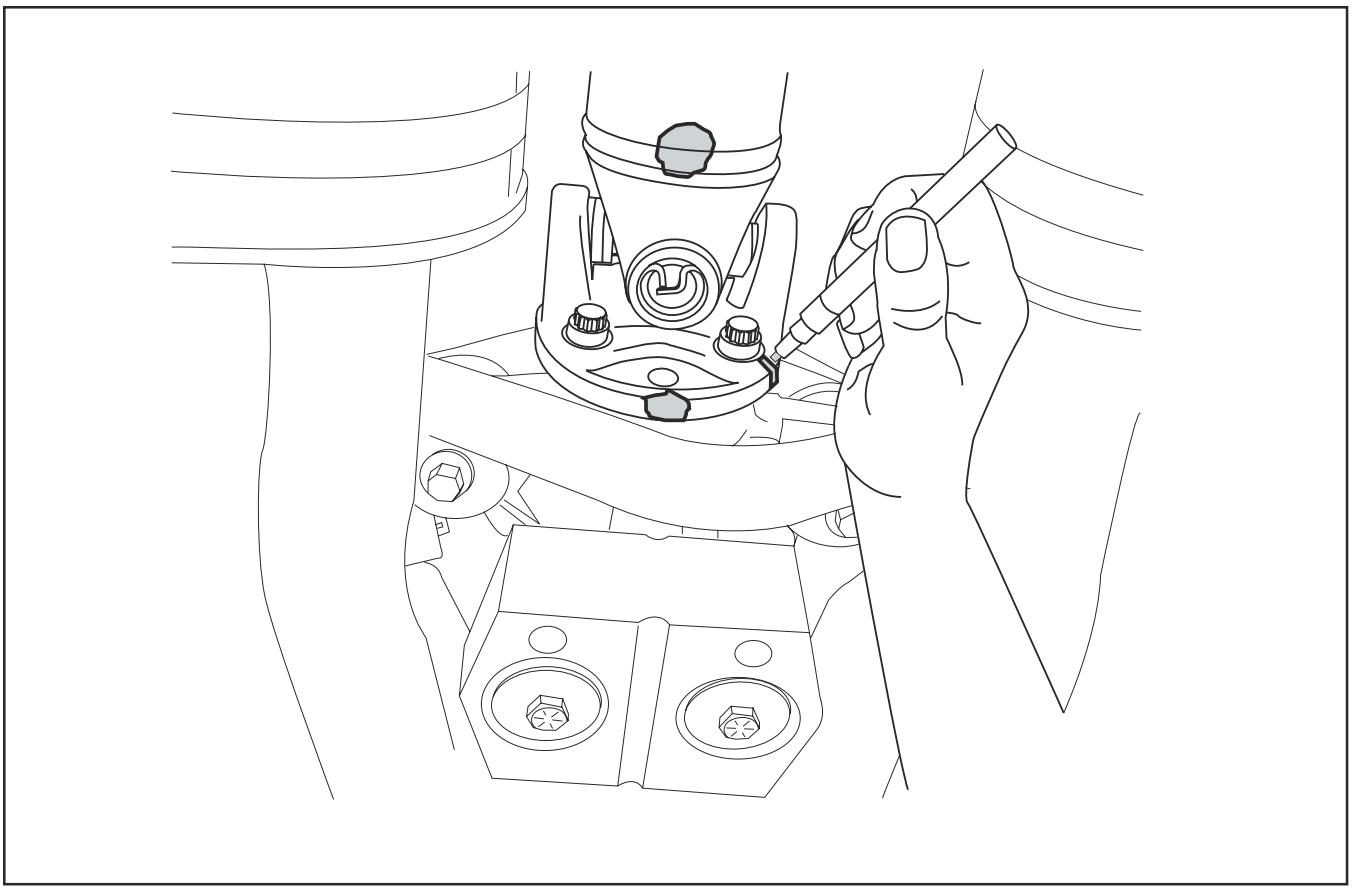
- Engine Angle - Driveshaft Angle = Front u-joint operating angle.
- Driveshaft angle + Axle Angle = Rear u-joint operating angle.
- The correct driveline angle for the Cobra is to have .5° more angle at the rear u-joint than at the front u-joint.
  - The driveline angle difference adjusts to 0° during acceleration.
- If the rear angle is greater than 1° or less than .5° adjust the pinion angle.



Set The Pinion Angle

- To set the pinion angle, the front two axle mounting points must be raised or lowered by adding or removing shims from the top of the front axle mounts.
- To reduce the pinion angle, remove the 3mm factory spacers and replace with one or two 1mm spacers.
  - The correct number of spacers depends on the angle required.
- To increase the pinion angle, leave the 3mm factory spacers installed and add one or two 1mm spacers.
- Verify all three angles after each adjustment.
- Road test the vehicle to verify the repair.

Driveshaft Balance



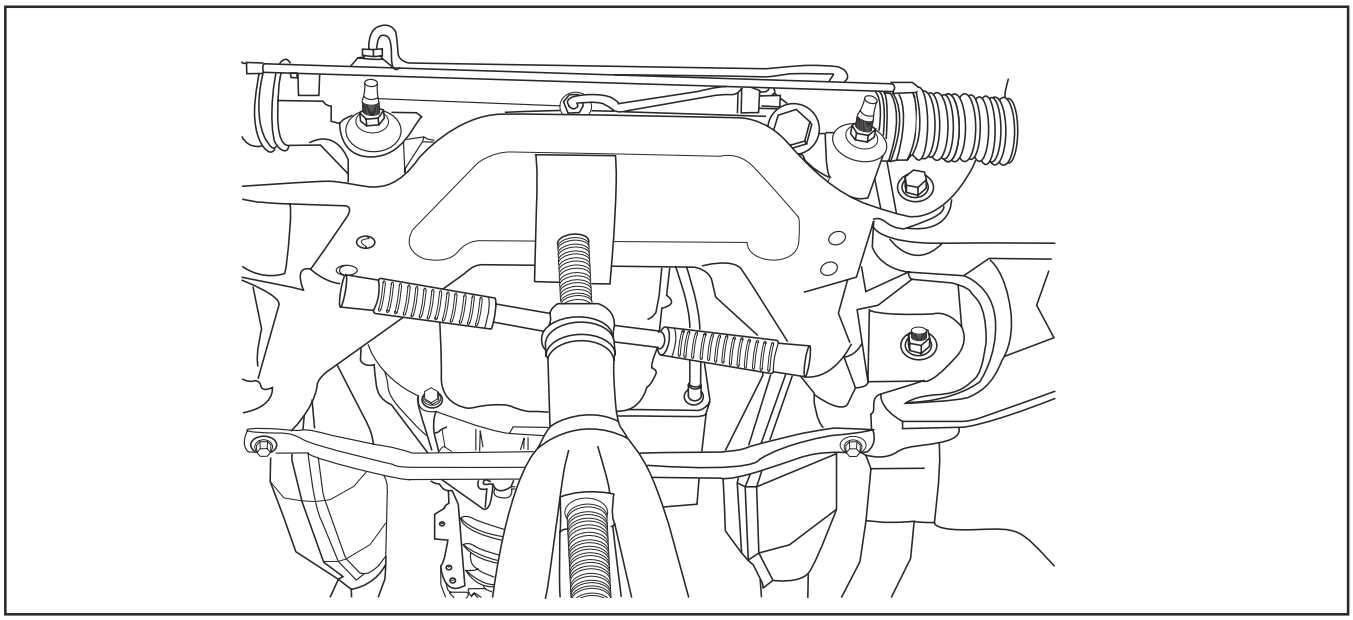
Driveshaft Balance

- Occasionally, even when the driveline is correctly balanced, a harmonic vibration (drone or “wub wub wub” sound) results.
  - The harmonic vibration is the result of two or more frequencies resonating together.
  - To remove the harmonic vibration one (or both) of the frequencies must be eliminated or altered.

To remove the harmonic drone:

1. Raise the vehicle on a hoist. (Do not use a drive-on hoist for this repair).
2. Turn the driveshaft so that the paint mark is down.
3. Mark the bolt closest to the paint mark to indicate the starting point for this procedure.
4. Remove the pinion flange bolt closest to the paint mark and install a flat washer under the head of the bolt (to add weight).
5. Road test the vehicle at the concern speed and listen to see if the drone improves.
6. Remove the washer and place the washer on the next bolt.
7. Road test the vehicle at the concern speed and listen to see if the drone improves.
8. Repeat procedure until all bolts are complete.
9. Identify the location where the washer reduced or eliminated the drone, and install the washer in that location.
   - If two bolt locations reduce vibration equally, install washers in both locations.
10. Road test the vehicle and verify the repair.

Rear Subframe Removal

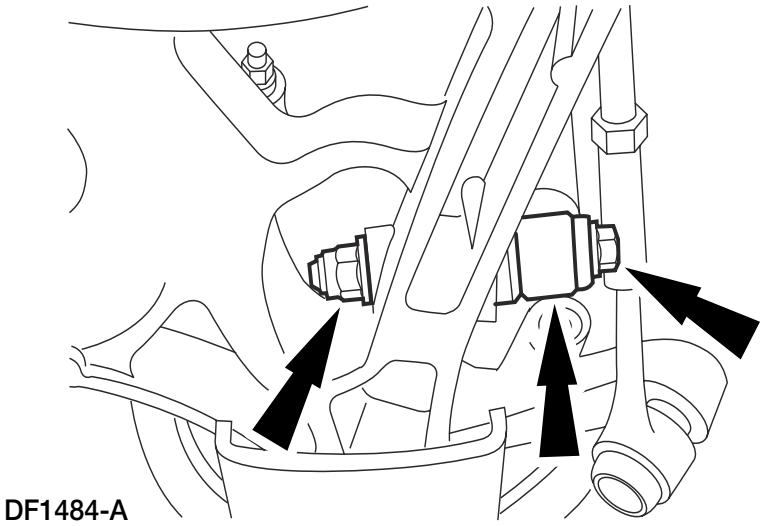


WARNING: REMOVAL OF THE REAR SUBFRAME IS A COMPLEX PROCEDURE. FOLLOW THE WORKSHOP MANUAL PROCEDURE WHEN PERFORMING THIS VEHICLE REPAIR.

CAUTION: Suspension fasteners are critical because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. If substitution is necessary, the part must be of the same finish and property class. Torque values must be used as specified during reassembly to make sure of the correct retention of these parts.

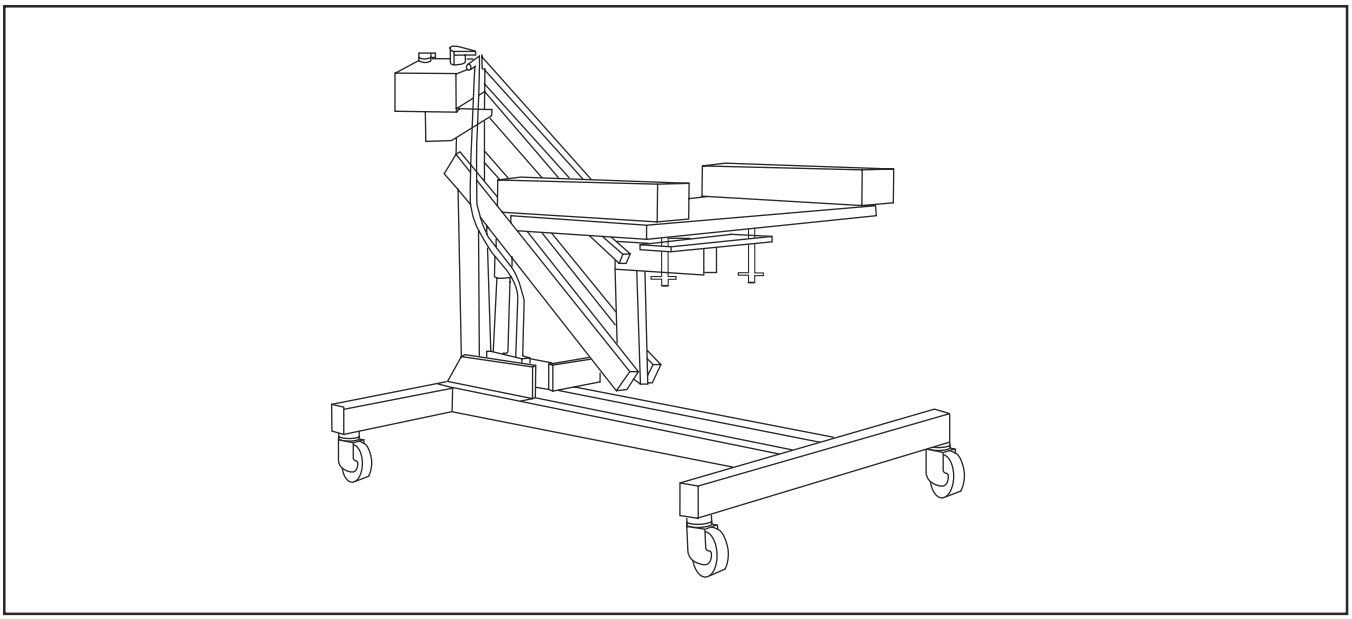
The following steps are an overview of the procedure to remove the rear subframe assembly:

- Raise the vehicle on a hoist and remove the rear wheels, tires, and brake discs.
- Support the No. 1 crossmember with a jack stand.
- Remove:
  - mufflers
  - driveshaft (mark for re-installation)
  - parking brake components
  - rear brake lines
  - ABS sensors



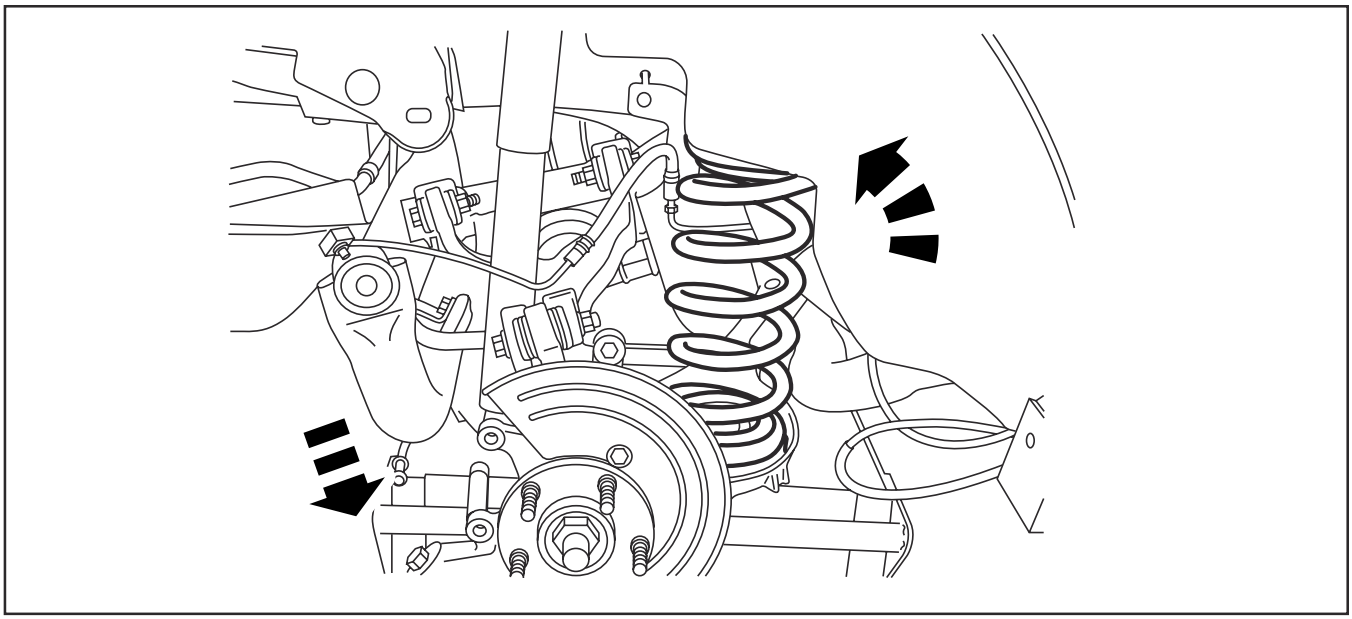
Compressing Spring to Remove the Shock Absorber

- Support the lower suspension arms with jack stands.
- Remove the lower shock absorber bolts and nuts.
- Lower the suspension arms and remove the jack stands.



Rotunda Powertrain Lift

- Support the rear subframe using the special tool 014-00765.
- Remove and discard the front subframe nuts.
- Remove and discard the rear subframe bolts.



Removing the Springs

- Lower the subframe with the special tool 014-00765, allowing the subframe to pivot on the front bolts.
- Remove the springs and the spring insulators.
- Raise the rear subframe with the special tool 014-00765
- Remove and discard the front subframe bolts.
- Lower the rear subframe away from the vehicle.

DRIVEABILITY—MALFUNCTION INDICATOR LAMP (MIL) ILLUMINATED—DIAGNOSTIC TROUBLES CODES (DTCS) P1381/P0011 AND/OR P1383/P0012—ROUGH IDLE, REDUCED POWER CONDITION, AND/OR STALL AT IDLE—FOCUS SVT MODEL ONLY	Article No. 03-6-7

FORD: 2002-2003 FOCUS

ISSUE

Some SVT Focus vehicles may exhibit the Malfunction Indicator Lamp (MIL) illuminated with Diagnostic Troubles codes (DTCs) P1381/P0011 Variable Cam Timing over-advanced (Bank 1) and/or P1383/P0012 Variable Cam Timing over-retarded (Bank 1) stored in memory. The vehicle may also exhibit a rough idle, reduced power condition, and/or stall at idle. This may be caused by:

- Variable Camshaft Timing (VCT) control system stuck
- Intake camshaft CMP trigger wheel mispositioned or loose
- Engine Cam timing incorrect
- Electrical conditions

ACTION

Refer to the following Service Procedure to verify the Cam Timing, Intake Camshaft CMP Trigger wheel position, and VCT solenoid operation, then service as necessary.

SERVICE PROCEDURE

1. Verify camshaft timing.
   a. Rotate the crankshaft clockwise so that the second timing mark in rotation on the crankshaft damper is aligned with the raised mark on the oil pan (Figure 1).
   b. Locate timing peg installation hole, remove plug, and install TDC timing peg tool T97P-6000-A (Global Number 303-574) (Figure 2) with timing peg installed verify the crankshaft will not rotate in a clockwise direction.
   c. Remove Engine Camshaft Cover and Timing Cover, per Workshop Manual Section 303-01C - Timing Belt, perform only the steps of the procedure that are necessary to remove the camshaft cover and timing cover.

NOTE

IN ORDER TO REMOVE THE TIMING COVER IT IS NECESSARY TO REMOVE THE WATER PUMP PULLEY AND ACCESSORY DRIVE IDLER PULLEY AFTER REMOVING THE CRANKSHAFT DAMPENER.

   d. Attempt to install the Camshaft Alignment Timing Tool T94P-6256-CH (Global Number 303-465), into the slots in the rear of the camshafts.
      (1) If the alignment tool does insert into the slots, Engine Base Timing is correct. Proceed to Step 2.
      (2) If the alignment tool does not insert into the slots, the Base Engine Timing may be incorrect, proceed to Step 1e.
   e. Remove the crankshaft timing peg.
   f. Rotate the crankshaft clockwise one revolution.
   g. Reinstall the timing peg, verify that the engine will not rotate in a clockwise direction.
   h. Attempt to install the Camshaft Alignment tool. If the Camshaft Alignment tool will now insert, engine timing is correct proceed to Step 2.

Article No. 03-6-7 Cont'd.

i. If the alignment tool will not insert, then base engine timing is off. Reset camshaft timing per Workshop Manual section 303-01C - Timing belt, perform only the steps of the procedure that are necessary to reset the camshaft timing - Continue to Step 3.

NOTE
TO AVOID VALVE DAMAGE ROTATE THE CRANKSHAFT COUNTERCLOCKWISE 1/3 OF A TURN, TO LOCATE ALL CYLINDERS OFF OF TDC, BEFORE LOOSENING THE CAMSHAFT PULLEY RETAINING BOLTS, OR USE AN OPEN ENDED WRENCH TO PREVENT THE CAMSHAFT FROM ROTATING AFTER THE BOLTS ARE LOOSENED.

2. Inspect the intake camshaft position sensor trigger wheel alignment. With camshaft alignment tool, and crank timing peg installed, there should be 15-16mm between the top edge of the CMP sensor and the CMP trigger wheel tooth (Figures 3 and 4).

   a. If trigger wheel alignment does not appear to be correct, replace the intake camshaft. Refer to Workshop Manual, Section 303-01C - Camshafts.

   b. If trigger wheel alignment does appear correct, verify VCT Solenoid Wiring and connections. If OK, replace the VCT Solenoid assembly, torque the VCT Solenoid retainer bolt to 88 Lb-in. (10 N•m).

3. Reassemble. Refer to Workshop Manual Section 303-01C - Timing Belt, perform only the steps of this procedure that are necessary to reassemble the engine.

NOTE
WHEN TORQUING THE INTAKE AND EXHAUST CAMSHAFT PULLEYS IT MAY BE NECESSARY TO USE LOCKING PLIERS TO INSURE THE CAMS DO NOT MOVE. ALSO REMOVE THE CAMSHAFT ALIGNMENT BAR DURING THIS PROCEDURE TO PREVENT CAMSHAFT BREAKAGE.

NOTE
REINSTALL THE WATER PUMP PULLEY, TORQUE BOLTS TO 18 Lb-ft (25 N•m) AND ACCESSORY DRIVE IDLER PULLEY, TORQUE BOLT TO 29 Lb-ft (40 N•m) AFTER REINSTALLING THE TIMING COVER AND BEFORE THE CRANKSHAFT DAMPENER.

4. Start the engine and monitor VCTADVERR PID using WDS, or CAMERR PID using NGS Tester, the PID should equal 0 ±1 degree at idle.

OTHER APPLICABLE ARTICLES: NONE
WARRANTY STATUS: Eligible Under The Provisions Of Bumper To Bumper Warranty Coverage and Emissions Warranty Coverage

OPERATION	DESCRIPTION	TIME
030607A	Check And Adjust Engine Timing (Includes Time To Monitor PIDS After Repair)	1.5 Hrs.
030607B	Check Engine Timing. If Correct Inspect Camshaft Trigger Wheel Alignment And Clearance. If Incorrect Replace Intake Camshaft (Includes Time To Monitor PIDS After Repair)	3.0 Hrs.
030607C	Check Engine Timing If Correct Inspect Camshaft Trigger Wheel Alignment And Clearance If Correct Verify VCT Solenoid Wiring And Repair As Necessary (Includes Time To Monitor PIDS After Repair)	1.5 Hrs.
030607D	Check Engine Timing If Correct Inspect Camshaft Trigger Wheel Alignment And Clearance If Correct Verify VCT Solenoid Wiring And Replace VCT Solenoid (Includes Time To Monitor PIDS After Repair)	1.3 Hrs.

PAGE 2

Article No. 03-6-7 Cont'd.

DEALER CODING

BASIC PART NO.	CONDITION CODE
6250	12

OASIS CODES: 607000, 607400, 608000, 608400, 611000, 611500, 698298

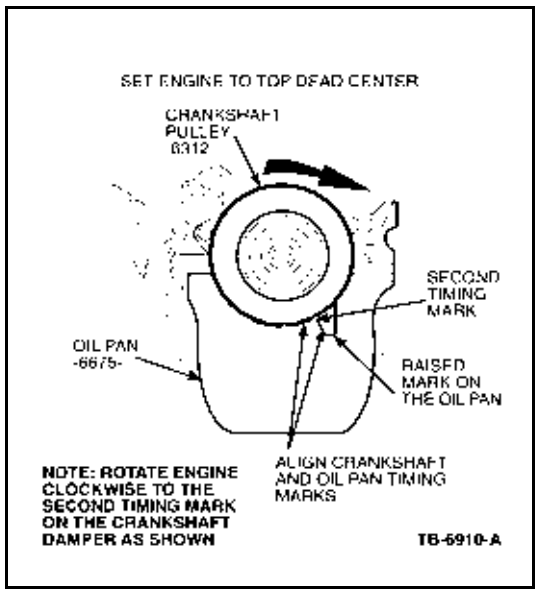


Figure 1 - Article 03-6-7

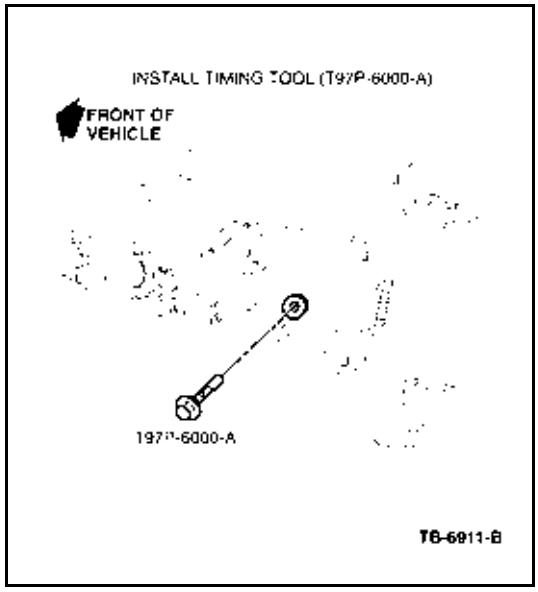


Figure 2 - Article 03-6-7

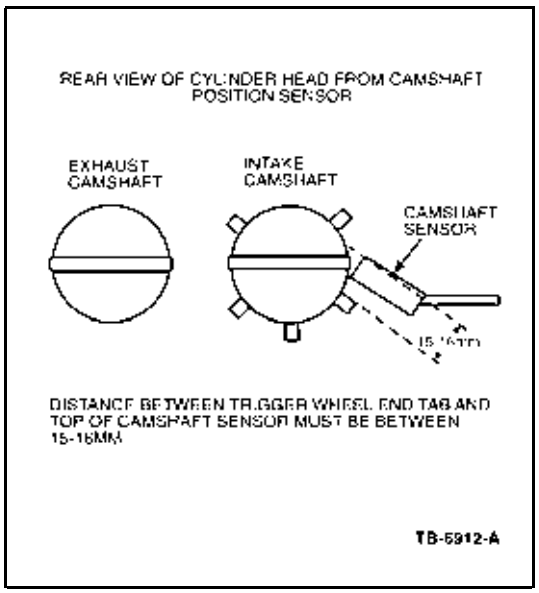


Figure 3 - Article 03-6-7

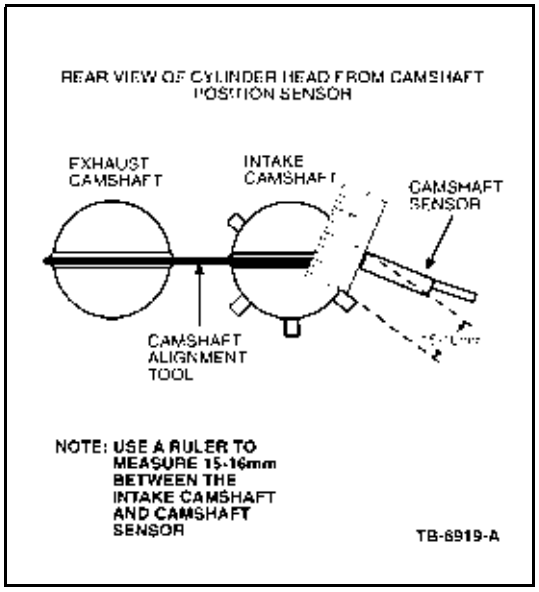


Figure 4 - Article 03-6-7

PAGE 3

NOTES

• **DRIVEABILITY—ROUGH, ROLLING, OR HIGH IDLE OR STALL—MAINLY AFTER COLD START—SVT MODELS ONLY** • **ENGINE—INTAKE SEPARATION AT RUBBER BOOTS—SVT MODELS ONLY**	**Article No. 03-4-4**

FORD: 2002 FOCUS

ISSUE

Some 2002 SVT Focus vehicles may exhibit a rough idle, rolling idle, stall, high idle, or backfire mainly after a cold start. Some vehicles may also exhibit a hesitation or surge at steady cruise, or MIL (Malfunction Indicator Lamp) illuminated condition. In some cases the intake manifold may separate at the rubber boots. This may be caused by PCM (Powertrain Control Module) calibration and/or poor intake clamp sealing. A revised PCM calibration and intake boot clamp replacement procedure has been developed for these conditions.

ACTION

If the vehicle exhibits a rough idle, rolling idle, stalls, high idle, backfire, hesitation, surge, or MIL lamp illuminated concern, refer to the following Service Procedure for details.

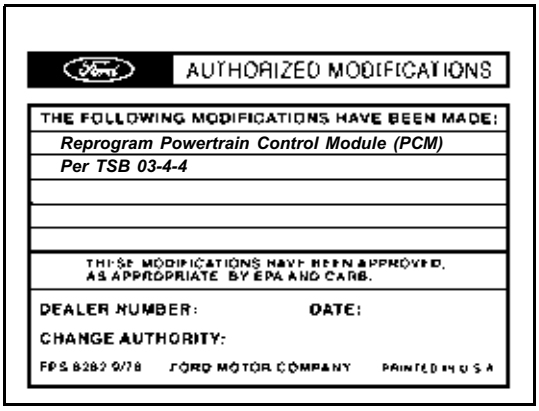
SERVICE PROCEDURE

1. For all drivability concerns thoroughly inspect the intake manifold boots and boot clamps. If they are loose, mis-positioned, or separated, perform Step 2, if the intake boot clamps are OK proceed to Step 3. For MIL lamp concerns perform all relevant Workshop Manual and/or PC/ED Manual Diagnosis and repairs. Once these are complete follow Step 3.
2. Replace the boot clamps. Remove the fuel rail as described in Workshop Manual Section 303-04C - Fuel Injection Supply Manifold (remove fuel rail and injectors as one unit, ensuring that no dirt contaminates the sealing surfaces or gets into the intake ports. Replace the injector O-rings.
   a. Release the eight (8) hooking clips that are clamping the rubber boots to the manifold. Unhook the clamp to open completely to remove from around boot.
   b. Unscrew the worm drive clamps (W525939-S300) completely and open them up very carefully into a C shape. Place the new clamps around the boots in the same place as the hooking clips (Figure 1).
   c. Torque the clamps to 35 ± 4 Lb-in. (4 ± 0.5 N•m).
   d. Reinstall fuel rail with injectors as described in Workshop Manual Section 303-04C - Fuel Injection Supply Manifold.
   e. Visual check that the boots are seated to both sides of the intake manifolds properly, and that the PCV hose and all vacuum hoses are connected.
   f. Pressurize fuel rail with key on to ensure there are no fuel leaks. Continue on to Step 3.
3. Using WDS with the latest software version reprogram the PCM. Verify that the PCM Part Number updates to 2S4Z-12A650-AFF after the reprogram is complete.

Article No. 03-4-4 Cont'd.

PCM CALIBRATION INFORMATION							
Application	Old Part Number (-12A650-)	Old Tear Tag	New Part Number (-12A650-)	New Tear Tag	Old Calibration	New Calibration	NGS/WDS Qualifier
2002 SVT Focus	2S4A-AFA	RLA1	2S4Z-AFF	RLA6	2AK2SZ0507	2AK2SZ0507	WDS B23.7 Release or Later
2002 SVT Focus	2S4A-AFB	RLA2	2S4Z-AFF	RLA6	2AK2SZ0510	2AK2SZ0510	WDS B23.7 Release or Later
2002 SVT Focus	2S4A-AFC	RLA3	2S4Z-AFF	RLA6	2AK2SZ0511	2AK2SZ0511	WDS B23.7 Release or Later

Obtain an Authorized Modifications Decal (FPS 8262 - obtainable through DOES II, 25/pkg) and list the date, dealer number, and summary of modifications performed. Select a prominent place adjacent to the Vehicle Emission Control Information Decal suitable for installing the Authorized Modifications Decal. Clean the area, install the decal, and cover it with a clear plastic decal shield.



PART NUMBER	PART NAME
W525939-S300	Clamp (8 Per Pkg.)

OTHER APPLICABLE ARTICLES: NONE

WARRANTY STATUS: Eligible Under The Provisions Of Bumper To Bumper Warranty Coverage And Emissions Warranty Coverage

OPERATION	DESCRIPTION	TIME
030404A	Reprogram Powertrain Control Module Inspect And Replace Clamps On Intake Manifold (Includes Time To Replace Fuel Injector To Intake Manifold O-Rings)	1.2 Hrs.
030404B	Reprogram Powertrain Control Module (Includes Time To Inspect Intake Manifold Boots And Clamps)	0.4 Hr.

PAGE 2

Article No. 03-4-4 Cont'd.

DEALER CODING

BASIC PART NO.	CONDITION CODE
9424	33

OASIS CODES: 603300, 607000, 608000, 608400, 610000, 610600, 611000, 611500, 612000, 612600, 613000, 613500, 618400, 619400, 698298

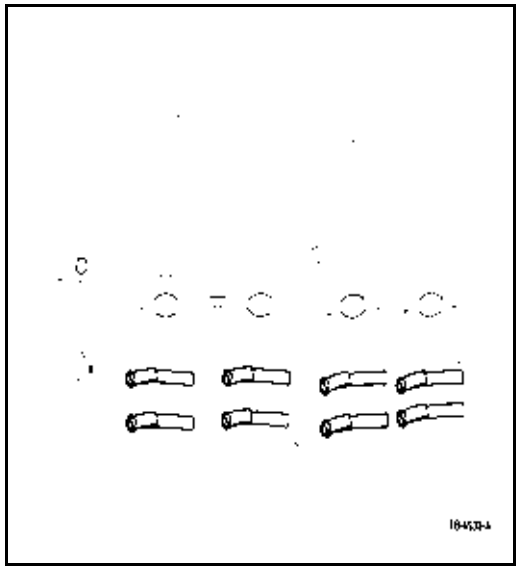


Figure 1 - Article 03-4-4

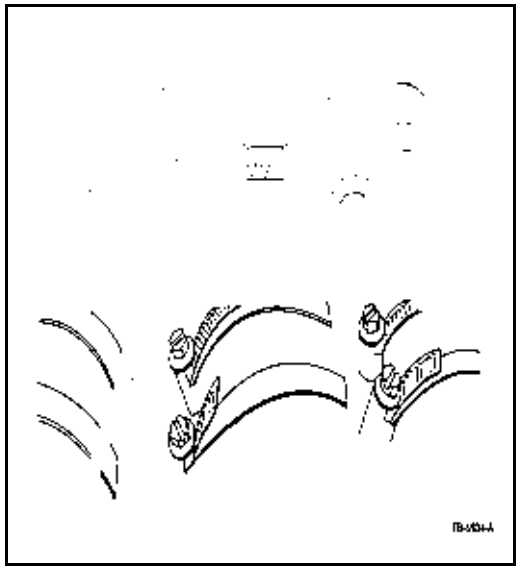


Figure 2 - Article 03-4-4

PAGE 3

NOTES

SPECIAL SERVICE MESSAGE 16459

16459 2003 MUSTANG COBRA SUPERCHARGED - LACK OF POWER AND NO BOOST, LOW MILES
SOME 2003 COBRA VEHICLES EQUIPPED WITH THE 4.6L SUPERCHARGED ENGINE MAY EXHIBIT A LACK OF POWER AND NO BOOST WHEN THE VEHICLE IS INITIALLY DELIVERED TO THE DEALERSHIP. THE VEHICLES AFFECTED WILL HAVE VERY LOW MILES AND THE CONCERN WILL TYPICALLY BE NOTICED DURING THE PRE-DELIVERY INSPECTION. IF THE VEHICLE HAS NO BOOST AND LACK OF POWER, CLEAR THE KEEP ALIVE MEMORY AND RETEST. THE ALTERNATIVE CALIBRATION IS USED DURING THE ASSEMBLY PROCESS TO DISABLE BOOST AND PREVENT PLUG FOULING. BY CLEARING THE KEEP ALIVE MEMORY OR DRIVING THE VEHICLE FOR AT LEAST FIVE CONTINUOUS MILES, THE VEHICLE WILL REVERT BACK TO THE BASE CALIBRATION AND BOOST WILL BE ENABLED.

VIBRATION—FELT THROUGH SEAT, FLOOR AND/OR STEERING WHEEL AT HIGHWAY SPEEDS WHILE IN 4TH OR 5TH GEAR—COBRA MODEL ONLY	Article No. 01-8-3

FORD: 1999 MUSTANG

This article is being republished in it's entirety to update the service parts and to update the service procedure.

ISSUE

A vibration may be felt through the seat, floor and/or steering wheel at approximately 65 mph in 4th or 5th gear on some Mustang Cobra vehicles. This may be caused by a driveline vibration that is not properly isolated.

ACTION

Install a revised rear axle damper and road test to verify condition has been corrected. Re-indexing the driveshaft may also be necessary based on the road test results. Refer to the following Service Procedure for details.

SERVICE PROCEDURE

NOTE
DO NOT USE THIS SERVICE PROCEDURE TO REPAIR OTHER CONDITIONS THAT DO NOT MEET THE ABOVE DESCRIPTION.

NOTE
DO NOT CONFUSE DRIVELINE VIBRATION WITH A WHEEL AND TIRE VIBRATION OR CONVERTIBLE SHAKE WHICH STARTS AT A LOWER SPEED AND CAN BE FELT THROUGH THE STEERING WHEEL.

NOTE
INSTALLING THE DAMPER WITHOUT INDEXING THE DRIVESHAFT MAY NOT COMPLETELY ELIMINATE THE VIBRATION.

NOTE
THIS SERVICE PROCEDURE REQUIRES THE USE OF AN ELECTRONIC VIBRATION ANALYZER (EVA) ROTUNDA PART NUMBER 014-00344.

Road test the vehicle with the customer if necessary to verify the condition. If the suspect vibration can be felt, perform the following procedure.

DAMPER INSTALLATION:

1. Raise vehicle on a hoist.
2. Support the rear differential with a screw type jack stand and remove the two differential mount insulator bolts from the front of the rear differential. Discard the insulators (Figure 1).
3. Install new damper (1R3Z-4A263-AA) and new differential mount insulators (2 upper F3SZ-4B424-A, 2 lower F3SZ-4B431-B). Torque bolts to 70 N•m (52 lb-Ft) (Figure 2).

CHECK FOR DRIVELINE VIBRATION:

1. Install the magnet on the EVA pickup sensor and place the sensor on the damper bracket as shown (Figure 3).
2. Route the sensor wire into the passenger compartment, making sure it is away from the exhaust system and the drive shaft. Connect the sensor wire to the meter at the port marked "A".
3. Connect the EVA power cord into the cigarette lighter and press the Hz button (button #0) to set the meter to the Hertz (Hz) scale.
4. Drive the vehicle on an interstate highway in 5th gear at 65 mph. Allow a few seconds for the EVA readings to stabilize. Look for a frequency reading of 46-48 Hz. If a 46-48 Hz reading is present, record the amplitude (G's) of the vibration.
5. Repeat the test at 70 mph, (50-52 Hz) and at 75 mph, (54-56 Hz) Record the vibration amplitude at these speeds. Disregard any frequencies that are not within the 46-52 Hz range. They are not driveline related.

NOTE
IF AN AMPLITUDE READING (G'S) HIGHER THAN 0.17 IS DETECTED AT ANY OF THESE 3 SPEEDS, THE DRIVESHAFT MUST BE INDEXED ON THE TRANSMISSION OUTPUT SHAFT.

Article No. 01-8-3 Cont'd.

INDEXING THE DRIVESHAFT TO THE TRANSMISSION OUTPUT SHAFT:

1. Verify that the yellow paint dot at the rear of the driveshaft is in alignment with the yellow paint dot on the axle flange. If it is not, align it and road test the vehicle again (Figure 2).
2. Locate the yellow paint dot at the front of the driveshaft near the slip yoke.
3. Remove driveshaft bolts and rotate the driveshaft so that the front yellow dot is on the bottom (6 o'clock position) (Figure 4).
4. Pull the driveshaft out of the transmission.
5. Use a paint pencil or office correcting fluid (White-out) to paint a reference mark at the end of the transmission output shaft at the 6 o'clock position and allow a few minutes to dry (Figure 5).
6. Rotate the transmission output shaft 1/4 of a turn (90 degrees) so that the dot is at the 9 o'clock position (Figure 6).
7. Re-install the driveshaft into the transmission, maintaining the yellow dot at the 6 o'clock position.
8. Re-install the driveshaft at the rear axle. Make sure rear dots are in alignment.
9. Road test the vehicle again and record the amplitude of the vibration, compare the new readings to the previous.
10. Continue re-indexing the driveshaft at the transmission output shaft until the lowest level of vibration is identified. Return the driveshaft to the position of the lowest amplitude reading. Paint a new mark on the transmission output shaft to align with the driveshaft yellow dot for future reference (Figure 7).
11. Road test the vehicle to verify the repair.

PART NUMBER	PART NAME
1R3Z-4A263-AA	Damper - Rear Axle
F3SZ-4B424-A	Insulator - Rear Axle Upper - 2 Required Per Vehicle
F3SZ-4B431-B	Insulator - Rear Axle Lower - 2 Required Per Vehicle

OTHER APPLICABLE ARTICLES: NONE
SUPERSEDES: 99-23-9
WARRANTY STATUS: Eligible Under The Provisions Of Bumper To Bumper Warranty Coverage

OPERATION	DESCRIPTION	TIME
010803A	Replace Rear Axle Damper (Includes Time To Test And Re-index Driveshaft)	3.9 Hrs.

DEALER CODING

BASIC PART NO.	CONDITION CODE
4A263	42

OASIS CODES: 703000, 703300

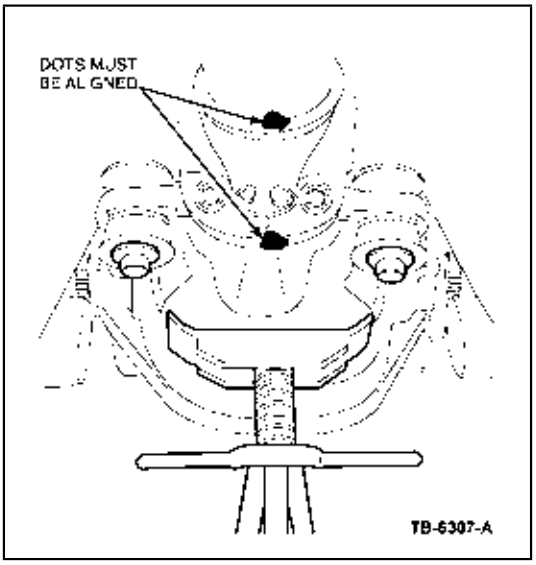


Figure 1 - Article 01-8-3

PAGE 2

Article No. 01-8-3 Cont'd.

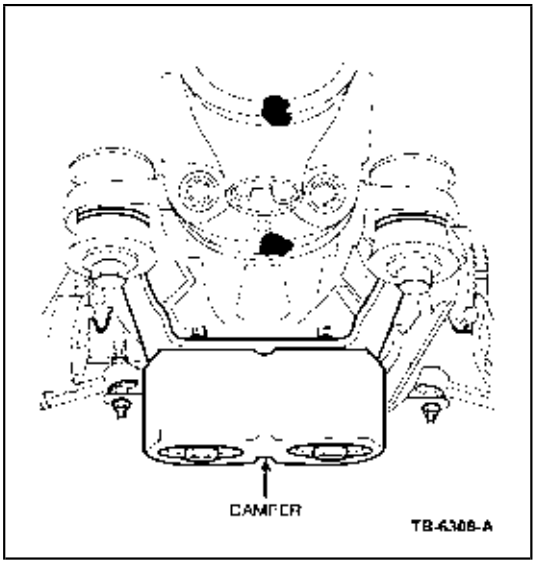


Figure 2 - Article 01-8-3

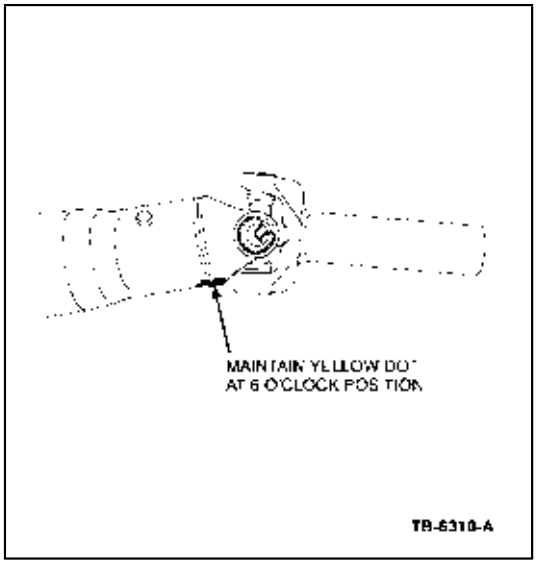


Figure 4 - Article 01-8-3

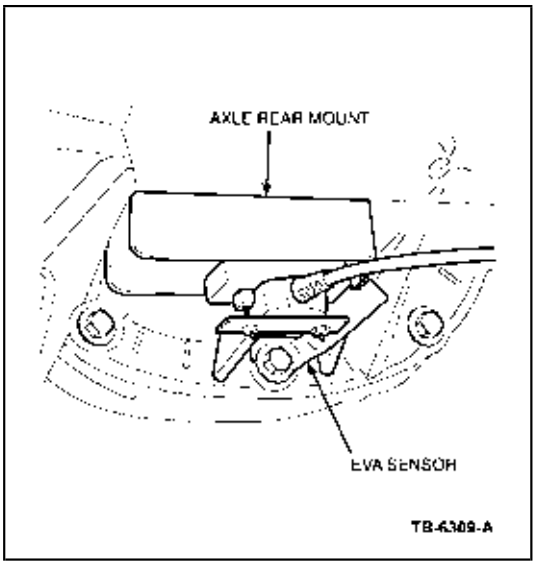


Figure 3 - Article 01-8-3

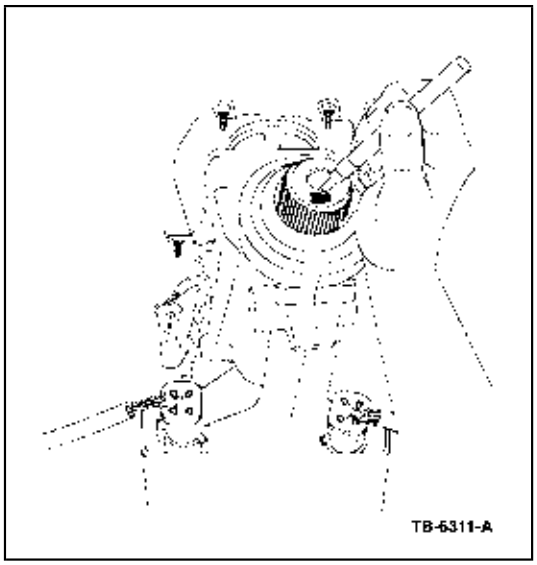


Figure 5 - Article 01-8-3

Article No. 01-8-3 Cont'd.

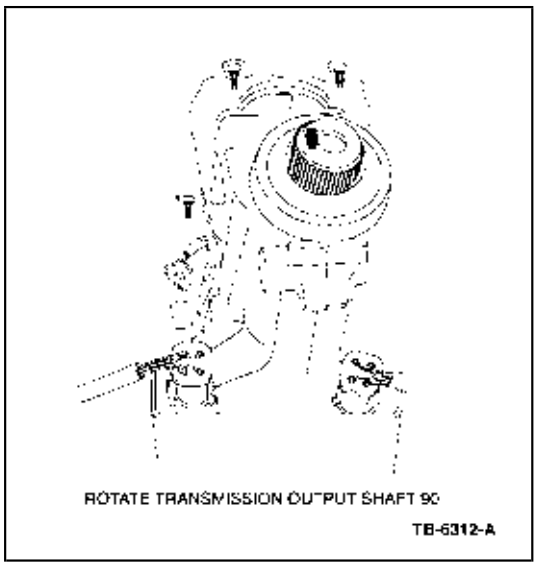


Figure 6 - Article 01-8-3

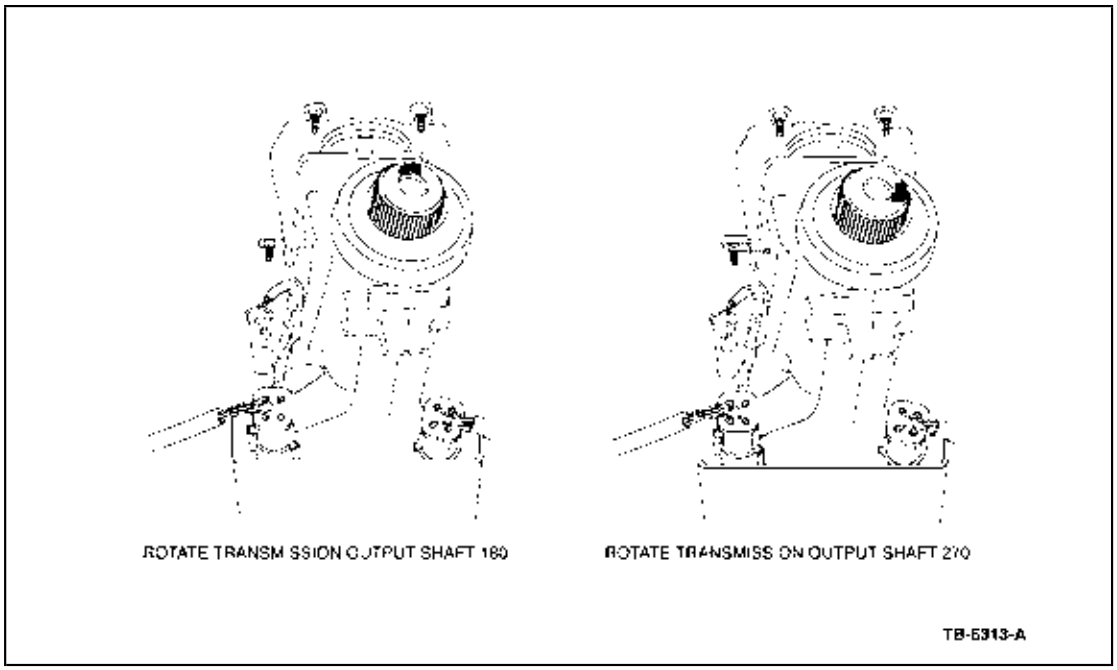


Figure 7 - Article 01-8-3

PAGE 4

TRIM—PASSENGER SEAT RUBS AGAINST DOOR PANEL	Article No. 03-1-5

FORD: 1999-2003 MUSTANG

ISSUE

Some vehicles may exhibit the passenger seat rubbing against the door panel or trim. This may result in a squeak type noise, especially in vehicles equipped with leather seating. This may be caused by the seat position in the vehicle.

ACTION

To service, install shims (washers) to move the seat-back away from the door trim. Refer to the following Service Procedure for details.

SERVICE PROCEDURE

CAUTION
SEAT TRACK MAY BE SPRING LOADED. THIS MAY CAUSE THE SEAT TRACK TO MOVE DURING REMOVAL.

1. Remove the front passenger seat per Workshop Manual procedure listed in Section 501-10.
2. Remove the front passenger seat backrest and latch per Workshop Manual procedure listed in Section 501-10. Only remove the top two bolts of latch (Figure 1). Discard lower bolt.
3. Obtain Seat Shim Kit 1R3Z-63000A25-AB.
4. Install four (4) of the 1.5mm-thick washers (8 included in kit with a 12.1- 12.4mm I.D.) between the seat backrest bracket and the seat bottom cushion frame (Figure 2).
5. Install other four (4) of the 1.5mm-thick washers between the seat backrest latch and the seat backrest frame at the upper bolt location (Figure 1).
6. Install the three (3) 2mm thick washers (smaller I.D.) between the seat backrest latch and the seat backrest frame at the lower bolt location (Figure 1).
7. Using the bolt that is provided in the kit for the lower hole, Re-install the seat backrest latch using the reverse of the procedure listed in Section 501-10.
8. Re-install the seat backrest using the reverse of the procedure listed in Section 501-10.
9. Re-install seat into vehicle using the reverse of the procedure listed in Section 501-10. Slide seat towards center console before tightening seat to floor.
10. Verify that seat does not touch door panel.

PART NUMBER	PART NAME
1R3Z-63000A25-AB	Kit - Seat Shim

OTHER APPLICABLE ARTICLES: NONE
WARRANTY STATUS: Eligible Under The Provisions Of Bumper To Bumper Warranty Coverage

OPERATION	DESCRIPTION	TIME
030105A	Install Shims To Move Seat Away From Door Trim Panel (Includes Time To Remove And Install Seat)	0.8 Hr.

DEALER CODING

BASIC PART NO.	CONDITION CODE
7661018	07

OASIS CODES: 101000, 107000, 702000, 702300

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

 PAGE 1

Article No. 03-1-5 Cont'd.

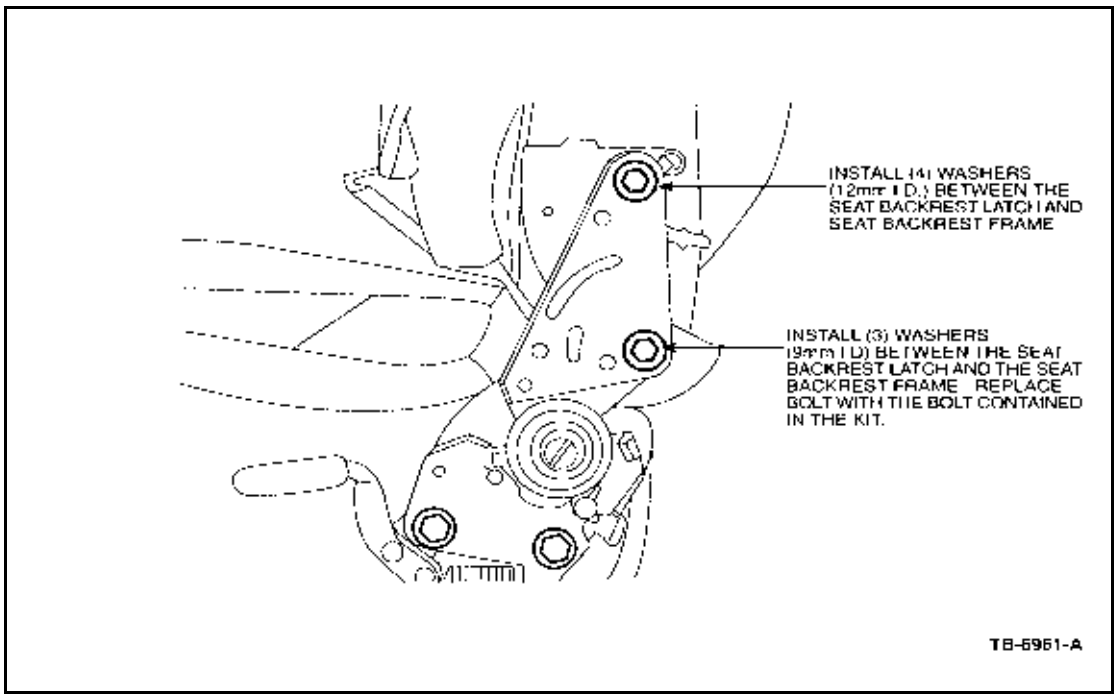


Figure 1 - Article 03-1-5

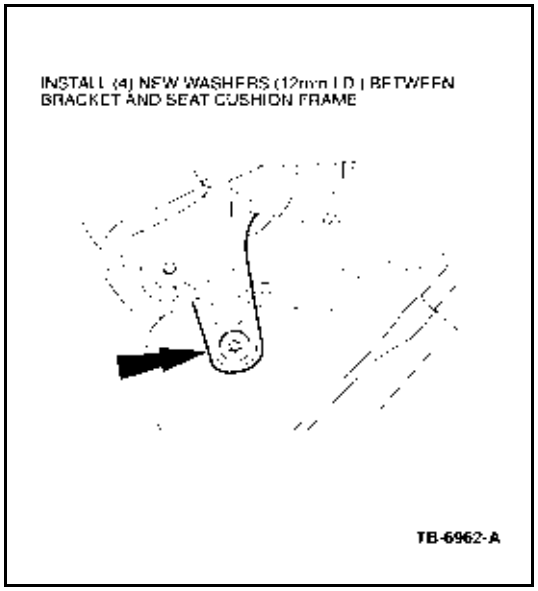


Figure 2 - Article 03-1-5

PAGE 2

SUSPENSION—DRIFT OR PULL TO RIGHT OR LEFT—MUSTANG COBRA MODELS ONLY	Article No. 03-3-6

FORD: 2003 MUSTANG

ISSUE

Some 2003 Mustang Cobra vehicles may exhibit a steering drift/pull condition. This may be a result of the tire size on this vehicle (P275/40R17). This size of tire makes the vehicle particularly sensitive to road crown and truck ruts compared to other vehicles. This tire size also makes the vehicle more sensitive to front end alignment than other Mustangs. Crown sensitivity is how a vehicle responds to crowned roads and how quickly it runs off a straight line course.

ACTION

Inspect steering and suspension components for wear. Inspect brake components for drag and realign the vehicle with the provided revised specifications if necessary.

SERVICE PROCEDURE

Wider tires cause the tire centerline to move outboard on the vehicle (Figure 1). This increase in distance between the narrow tire and the wide tire may cause Cobra models to be more crown sensitive than base Mustangs. Wider tires are used on the Cobra to meet the expectations for driving dynamics and more aggressive appearance.

1. Inspect front tires for condition and pressure. Adjust pressure to 32 psi and rotate tires if necessary.
2. Inspect front suspension components (bushings, ball joints, wheel bearings, shocks, etc.) for wear or play and replace as necessary.
3. Inspect steering components (tie rod ends, intermediate shaft, steering gear) for wear or play and replace if necessary.
4. Inspect brakes for brake drag and replace if necessary.
5. Realign vehicle to revised specifications below.

2003 MUSTANG COBRA ALIGNMENT SPECIFICATIONS

Item	Unit	Left	Right	Total/Split
Front Camber	Degrees	-0.8 ± 0.2	-1.0 ± 0.2	+0.2 ± 0.2
Front Caster	Degrees	3.1 ± 0.2	3.3 ± 0.2	-0.2 ± 0.2
Front Toe-In	Degrees	0.125 ± 0.04	0.125 ± 0.04	0.25 ± 0.08
Rear Camber	Degrees	-0.8 ± 0.2	-0.8 ± 0.2	0.0 ± 0.2
Rear Toe-In	Degrees	0.10 ± 0.04	0.10 ± 0.04	0.20 ± 0.08

OTHER APPLICABLE ARTICLES: NONE
WARRANTY STATUS: INFORMATION ONLY
OASIS CODES: 303000

Article No. 03-3-6 Cont'd.

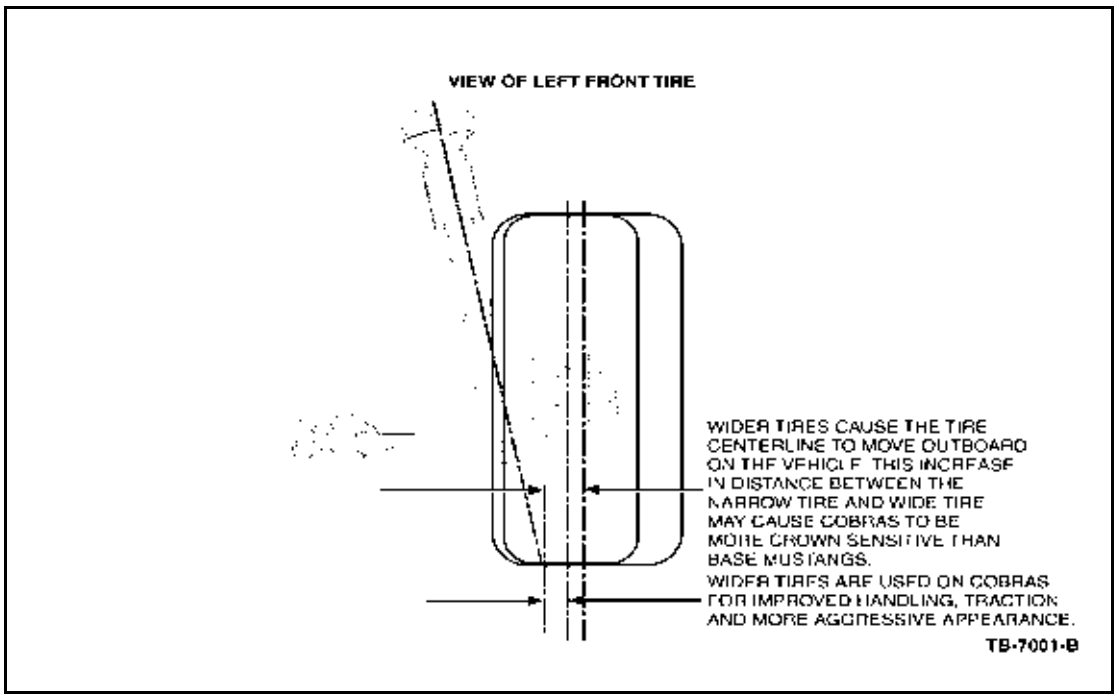


Figure 1 - Article 03-3-6

PAGE 2

• **SUSPENSION—CLUNK OR POP NOISE FROM REAR SUSPENSION—MUSTANG COBRA ONLY—SERVICE TIPS** • **NOISE—CLUNK OR POP NOISE FROM REAR SUSPENSION—MUSTANG COBRA ONLY—SERVICE TIPS**	**Article No. 03-9-5**

FORD: 1999-2003 MUSTANG

ISSUE

Some 1999-2003 Mustang Cobra vehicles may exhibit a “popping” type noise while turning into or out of an incline, such as turning into a driveway, at low speeds (below 15 mph (25 km/h). The steeper the incline the more noticeable the noise will be. This may be caused by the lateral movement of the stabilizer bar or one or more of the fasteners shown in Figures 1-3, that may not be tightened within the required torque specifications.

ACTION

Inspect and torque all of the fasteners listed for the proper torque. Refer to the following Service Information for details.

SERVICE INFORMATION

Raise vehicle on hoist and verify torque at the following components and locations:

- Stabilizer bar bracket bolts (both sides) (Figure 1) - 42.8 ± 3.7 Lb-ft. (58 ± 5 N•m)
- Stabilizer bar collar bolts (both sides) (Figure 1) - 6.6 ± 1.0 Lb-ft. (9 ± 1.4 N•m)
- Lower shock bolts (both sides) (Figure 2) - 98.1 ± 14.8 Lb-ft. (133 ± 20 N•m)
- Upper control arm bushing bolts (both sides) (Figure 3) - 66.4 ± 10.0 Lb-ft. (90 ± 13.5 N•m)
- Stabilizer bar link bolts (both sides) (Figure 3) - 35.0 ± 5.3 Lb-ft. (47.5 ± 7.2 N•m)

OTHER APPLICABLE ARTICLES: NONE
WARRANTY STATUS: INFORMATION ONLY
OASIS CODES: 304000, 305000, 390000, 702000, 702200

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by “do-it-yourselfers”. Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

 PAGE 1

Article No. 03-9-5 Cont'd.

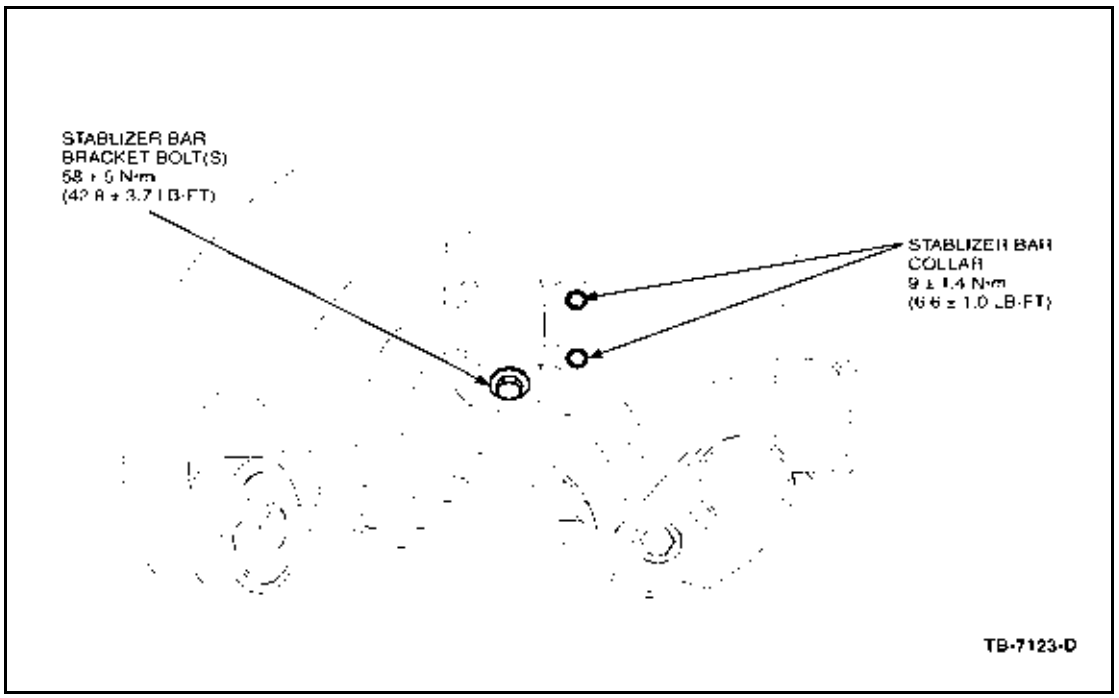


Figure 1 - Article 03-9-5

PAGE 2

Article No. 03-9-5 Cont'd.

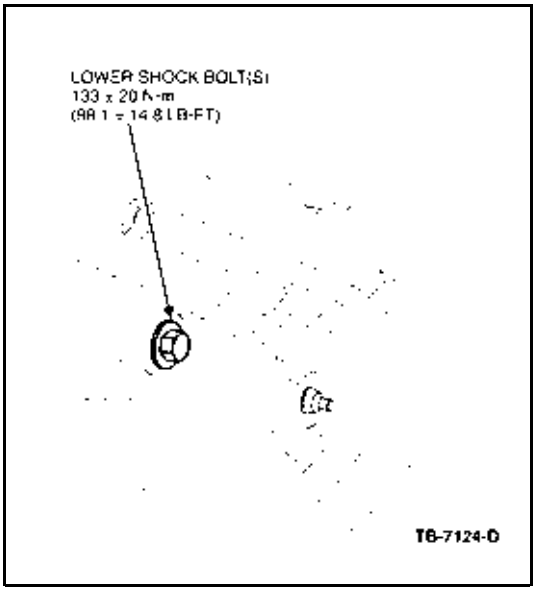


Figure 2 - Article 03-9-5

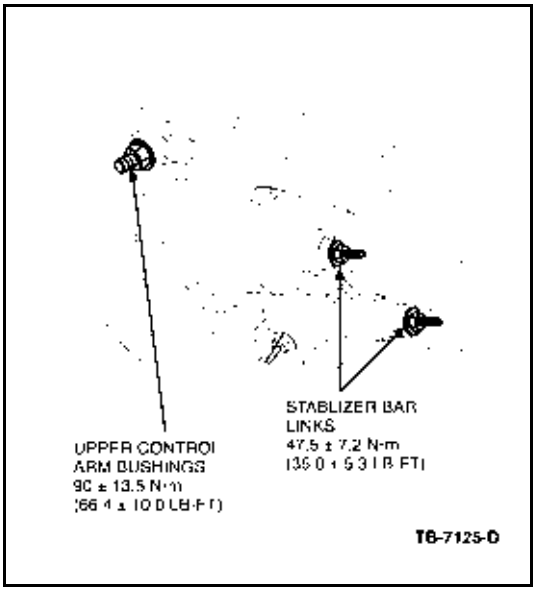


Figure 3 - Article 03-9-5

PAGE 3

NOISE—"POPPING/CLUNKING" HEARD WHILE PERFORMING A QUICK LANE CHANGE AT HIGHWAY SPEEDS AND/OR GOING UP AN INCLINE AT LOW SPEEDS—COBRA VEHICLES ONLY (DOES NOT INCLUDE COBRA R VEHICLES)	Article No. 00-9-4

FORD: 1999 MUSTANG

ISSUE

A "popping/clunking" noise may be heard while driving. The noise will be most noticeable during a quick lane change at about 90 km/h (55 mph) or going up an incline (driveway) at low speeds below 25 km/h (15 mph). The steeper the driveway the more noticeable it will be. This may be caused by excessive lateral movement of the stabilizer bar resulting in an audible noise which is heard by the driver.

ACTION

Install a new collar and stabilizer bar plate (shim) on each side of the rear stabilizer bar. This should reduce the possibility of noise. Refer to the Instruction Sheet included in the kit for installation details.

PART NUMBER	PART NAME
XR3Z-5L497-AA	Collar Kit

OTHER APPLICABLE ARTICLES: NONE
WARRANTY STATUS: Eligible Under The Provisions Of Bumper To Bumper Warranty Coverage

OPERATION	DESCRIPTION	TIME
000904A	Install Collar And Stabilizer Bar Plate	0.8 Hr.

DEALER CODING

BASIC PART NO.	CONDITION CODE
5A772	07

OASIS CODES: 303000, 304000, 702200

NOTES