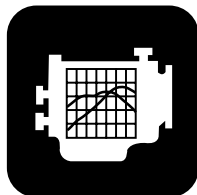
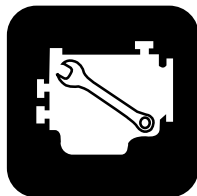


# engine repair



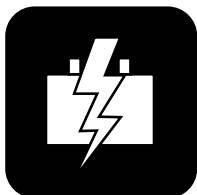
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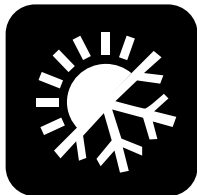
Engine Repair



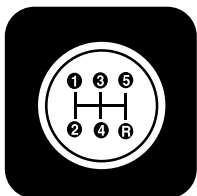
Steering & Suspension



Electrical Systems



Climate Control



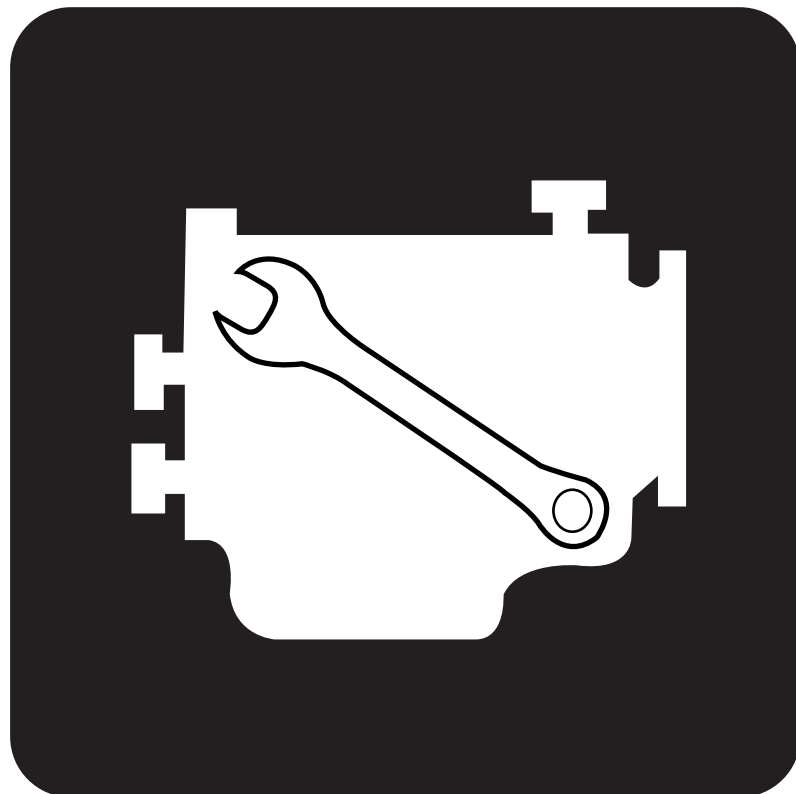
Manual Transmission



Automatic Transmission



Brakes



# engine repair fundamentals

self-study

COURSE CODE: 32S01S0  
ORDER NUMBER: FCS-13031-REF



Service Technician Specialty Training



Ford Customer Service Division  
Technical Training



# IMPORTANT SAFETY NOTICE

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from instructions provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. NOTES give you added information that will help you to complete a particular procedure. CAUTIONS are given to prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in those areas where carelessness can cause personal injury. The following list contains some general WARNINGS that you should follow when you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Be sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK unless instructed otherwise for a specific service operation. If you have a manual transmission it should be in REVERSE (engine OFF) or NEUTRAL (engine ON) unless instructed otherwise for a specific service operation.
- Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide.
- Keep yourself and your clothing away from moving parts when the engine is running, especially the fan and belts.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on the vehicle.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle. Tie long hair securely behind your head.
- Keep hands and other objects clear of the radiator fan blades. Electric cooling fans can start to operate at any time by an increase in underhood temperatures, even though the ignition is in the OFF position. Therefore, care should be taken to ensure that the electric cooling fan is completely disconnected when working under the hood.

The recommendations and suggestions contained in this manual are made to assist the dealer in improving his dealership parts and/or service department operations. These recommendations and suggestions do not supersede or override the provisions of the Warranty and Policy Manual, and in any cases where there may be a conflict, the provisions of the Warranty and Policy Manual shall govern.

The descriptions, testing procedures, and specifications in this handbook were in effect at the time the handbook was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications, design, or testing procedures without notice and without incurring obligation. Any reference to brand names in this manual is intended merely as an example of the types of tools, lubricants, materials, etc. recommended for use. Equivalents, if available, may be used. The right is reserved to make changes at any time without notice.

**WARNING: MANY BRAKE LININGS CONTAIN ASBESTOS FIBERS. WHEN WORKING ON BRAKE COMPONENTS, AVOID BREATHING THE DUST. BREATHING THE ASBESTOS DUST CAN CAUSE ASBESTOSIS AND CANCER.**

Breathing asbestos dust is harmful to your health.

Dust and dirt present on car wheel brake and clutch assemblies may contain asbestos fibers that are hazardous to your health when made airborne by cleaning with compressed air or by dry brushing.

Wheel brake assemblies and clutch facings should be cleaned using a vacuum cleaner recommended for use with asbestos fibers. Dust and dirt should be disposed of in a manner that prevents dust exposure, such as sealed bags. The bag must be labeled per OSHA instructions and the trash hauler notified as to the contents of the bag.

If a vacuum bag suitable for asbestos is not available, cleaning should be done wet. If dust generation is still possible, technicians should wear government approved toxic dust purifying respirators.

OSHA requires areas where asbestos dust generation is possible to be isolated and posted with warning signs. Only technicians concerned with performing brake or clutch service should be present in the area.



# CUSTOMER EXPECTATIONS

## Customer Expectations: Service

1. Make it convenient to have my vehicle serviced at your dealership.
2. The Service Advisor should demonstrate a genuine concern for my service needs.
3. Fix it right the first time.
4. Complete servicing my vehicle in a timely and professional manner.
5. Provide me with a clear and thorough explanation of the service performed.
6. Call me within a reasonable amount of time after my service visit to ensure that I'm completely satisfied.
7. Be responsive to questions or concerns I bring to your attention.

### Expectation 3

#### “Fix It Right The First Time, on Time.”

Both service advisors and technicians are important players when it comes to Expectation #3.

#### Why

Customers tell us “Fixing It Right The First Time, on Time” is one of the reasons they would decide to return to a dealer to buy a vehicle and get their vehicles serviced.

#### Technician Training

It is our goal to help the technician acquire all of the skills and knowledge necessary to “Fix It Right The First Time, on Time.” We refer to this as “competency.”

#### Technician’s Role

Acquire the skills and knowledge for competency in your specialty via:

##### STST

- Self Study
- FordStar Broadcasts
- Ford Multimedia Training (FMT)
- Instructor Led

##### New Model

- Self Study
- FordStar Broadcasts
- Instructor Led

#### The Benefits

The successful implementation of expectations means:

- Satisfied customers
- Repeat vehicle sales
- Repeat service sales
- Recognition that Ford and Lincoln/Mercury technicians are “the Best in the Business”

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## INTRODUCTION

The Engine Fundamentals self-study is the first course of the Engine Repair Curriculum. Since this course sets the building blocks for the other courses, it is important that it be completed first. It is also important that all prerequisite courses be completed prior to taking this self-study, as this will lead to a better understanding of the material presented.

This course has two main goals. The first goal is to introduce you to the basic engine theory of operation. The second goal is to provide an understanding of the symptom-to-system-to-component-to-cause diagnostic process. As you learn new information, try to relate the new knowledge to the basic engine systems as a whole. Think about the cause-and-effect relationships between the subsystems and components. Understanding the cause-and-effect relationships will help you in diagnosis. This course will include information related to basic engine systems. Some of the topics that will be covered in this course include the following:

- Four-stroke operation
- Intake air system
- Fuel system
- Ignition system
- Exhaust system
- Exhaust gas recirculation (EGR) system
- Cooling system

Although you may be familiar with some of these topics, it is essential that you, as a professional engine technician, have a thorough understanding and mastery of this information. You will find that mastery learning is necessary to diagnose and service the latest engine systems.

# INTRODUCTION

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## ENGINE REPAIR CURRICULUM

Each course found in the Engine Repair Curriculum is one of the following types:

- Self-study – This type of course is a self-paced program. The technician is responsible for learning the material on his or her own. The training material consists of a reference book and an accompanying videotape. The videotape is designed to support the material in the reference book and should not be used on its own.
- Ford Multimedia Training (FMT) – This type of course is also self-paced. The multimedia course allows the technician to interact with the training materials. The multimedia course allows the technician to utilize the knowledge attained in the self-study course. The FMT concentrates on relationships, such as the cause-and-effect relationships between symptoms and components.
- Classroom – The classroom course allows for practical, real-world application of skills and knowledge learned in the other courses.

There are five courses in the Basic Engine Curriculum. Please refer to the Engine Repair Curriculum Path that follows.

### Course Codes

These courses may be found in the STARS planner using the following course codes:

#### Engine Performance

- Engine Repair Fundamentals – Self-Study ..... Course code: 32S01S0
- Automotive Measuring Tools – FMT ..... Course code: 32S02M0
- Base Engine Operation and Diagnosis ..... Course code: 32S03M0
- Engine Repair – Classroom ..... Course code: 32S05T0
- Servicing New Engine Designs – Fordstar ..... Course code: 32S06F0

### Why Training?

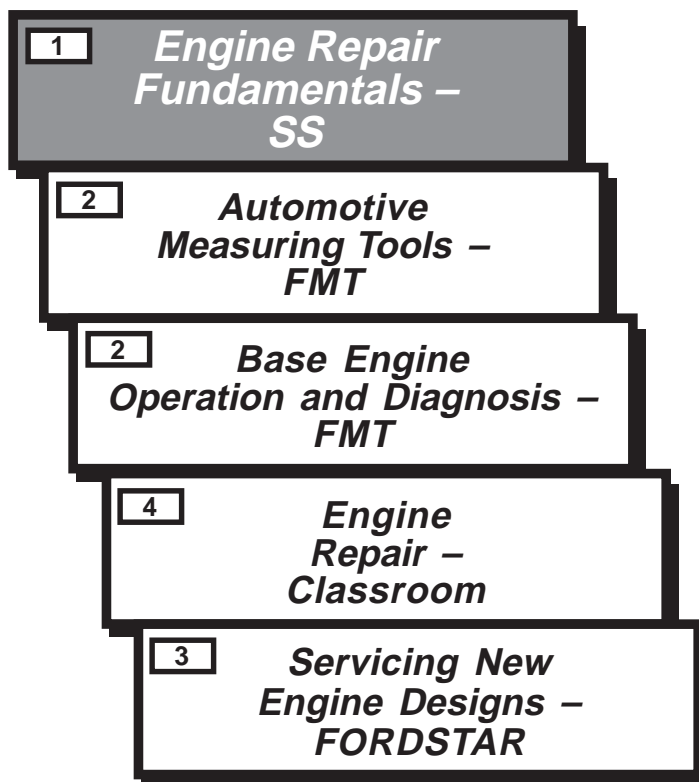
1. Customers bring vehicles to the dealership because they want the best service possible. They believe that no other technician besides you, a Ford trained technician, could know their vehicle better.
2. Customers expect a dealership to “Fix It Right The First Time, On Time.”

So, how do you live up to the customer’s expectations? The answer is continuous training. Training allows you to gain efficiency. Efficiency makes you an asset to the customer, the dealer, and yourself. Training promotes job security and allows you to learn the “latest and greatest” technology and service procedures.



ENGINE REPAIR CURRICULUM PATH

# ENGINE REPAIR CURRICULUM PATH



**Legend**

- 1 = Self Study (SS)
- 2 = Ford Multimedia Training (FMT)
- 3 = FORDSTAR
- 4 = Instructor Led – Classroom

**Prerequisites**

- NVH – (Classroom)
- Basic Electrical Part 1 – (Self Study)
- Basic Electrical Part 2 – (FMT)
- Basic Electrical Part 3 – (Classroom)
- Electronics Part 1 – (Self Study)
- Electronics Part 2 – (FMT)
- Electronics Part 3 – (Classroom)