



San Diego Unified

SCHOOL DISTRICT

Transportation Department Safety & Training

Unit 4: Vehicle Components

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Objectives

1. Familiarize students with basic fundamentals of power train and braking systems.
2. Prepare students to better understand vehicle inspection.
3. Test the student to evaluate instructional quality.

Introduction

Unit 4 is devoted to the study of the vehicle, which is made up of many components. As a professional school bus driver, you should be familiar with each component, what each one is and how it works. The purpose of this unit is not to qualify you to become a mechanic; however, you **SHOULD** understand the basic principles of the operation of various components of the bus. The knowledge you gain from this unit will help you to make proper decisions when one of the components of the drive train malfunctions.

Many serious accidents have occurred as the result of:

1. A component malfunctions; and
2. A driver who was unable to recognize that a component was malfunctioning or who made the wrong decision when a component did malfunction.

To help ensure that you and the bus are not involved in this type of accident, learn as much as you can about the vehicle that you will be driving. You have this obligation both to yourself and your passengers.

Let's begin Unit 4 with the legal definition of a school bus.

454 VC SCHOOL BUS

(a) A "School Bus" is a motor vehicle designed, used, or maintained for the transportation of any school pupil at or below the 12th grade level to or from a public or private school or to or from public or private school activities, except the following:

- (1) A motor vehicle of any type carrying only members of the household of the owner of the vehicle.
- (2) A motor truck transporting pupils who are seated only in the passenger compartment, or a passenger vehicle designed for and carrying not more than 10 persons, including the driver, unless the vehicle or truck is transporting two or more disabled pupils confined to wheelchairs.
- (3) A motor vehicle operated by a common carrier, or by and under the exclusive jurisdiction of a publicly owned or operated transit system, only during the time it is on a scheduled run and is available to the general public, or on a run scheduled in response to a request from a disabled pupil confined to a wheelchair, or from a parent of the disabled pupil, for transportation to or from non-school activities, and the motor vehicle is designed for and actually carries not more than 16 persons including the driver, is available to eligible persons of the general public, and the school does not provide the requested transportation service.
- (4) A school pupil activity bus.

(5) A motor vehicle operated by a carrier licensed by the federal Surface Transportation Board that is transporting pupils on a school activity entering or returning to the state from another state or country.

(6) A youth bus.

(7) Notwithstanding any other provisions of this section, the governing board of a district maintaining a community college may, by resolution, designate any motor vehicle operated by or for the district, a school bus within the meaning of this section, if it is primarily used for the transportation of community college students to or from a public community college or to or from public community college activities. The designation shall not be effective until written notification thereof has been filed with the Department of the California Highway Patrol.

(8) A state-owned motor vehicle being operated by a state employee upon the driveways, paths, parking facilities or grounds specified in Section 21113 that are under the control of a state hospital under the jurisdiction of the State Department of Developmental Services if the posted speed limit is not more than 20 miles per hour. The motor vehicle may also be operated for a distance of not more than one-quarter mile upon a public street or highway that runs through the grounds of a state hospital under the jurisdiction of the State Department of Developmental Services, if the posted speed limit on the public street or highway is not more than 25 miles per hour and if all traffic is regulated by posted stop signs or official traffic control signals at the points of entry and exit by the motor vehicle.

(9) A general public paratransit vehicle, if the general public paratransit vehicle does not duplicate existing school bus service, does not transport a public school pupil at or below the 12th grade level to a destination outside of that pupil's school district, and is not used to transport public school pupils in areas where school bus services were available during the 1986–87 school year. In areas where expanded school services require expanded transportation of public school pupils, as determined by the governing board of a school district, general public paratransit vehicles shall not be used to transport those pupils for a period of three years from the date that a need for expansion is identified. For purposes of this section, a pupil is defined as a student at or below the 12th grade level who is being transported to a mandated school activity.

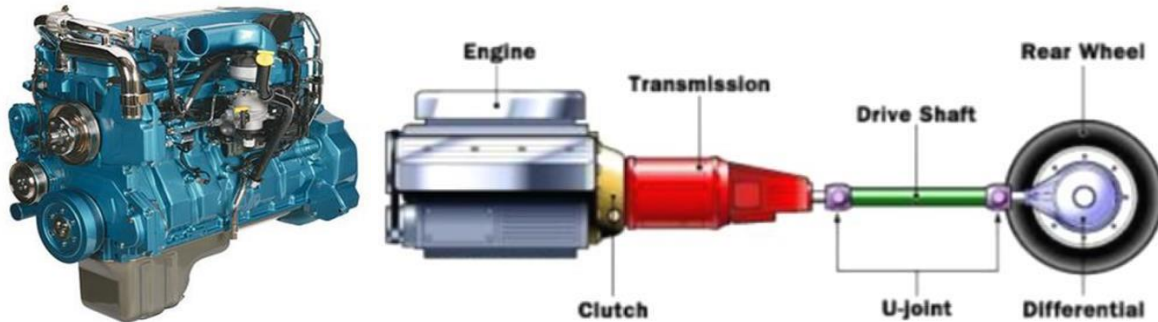
(10) A school bus with the flashing red light signal system, the amber warning system, and the school bus signs covered, while being used for transportation of persons other than pupils, to or from school or school-related activities.

(11) A motor vehicle, other than a motor vehicle described in paragraph (2), that is designed to carry not more than 25 persons including the driver, while being used for the transportation of pupils to or from school-related activities if the vehicle is operated by a passenger charter-party carrier certified and licensed by the Public Utilities Commission pursuant to Chapter 8 (commencing with Section 5351) of Division 2 of the Public Utilities Code that is not under a contractual agreement with a school or school district, and the transportation does not duplicate school bus service or any other transportation services for pupils contracted, arranged, or otherwise provided by the school or school district.

(b) This section shall not be construed to prohibit the use of a school bus for any activity authorized by any other law, including Section 39837.5 of the Education Code.

Engine

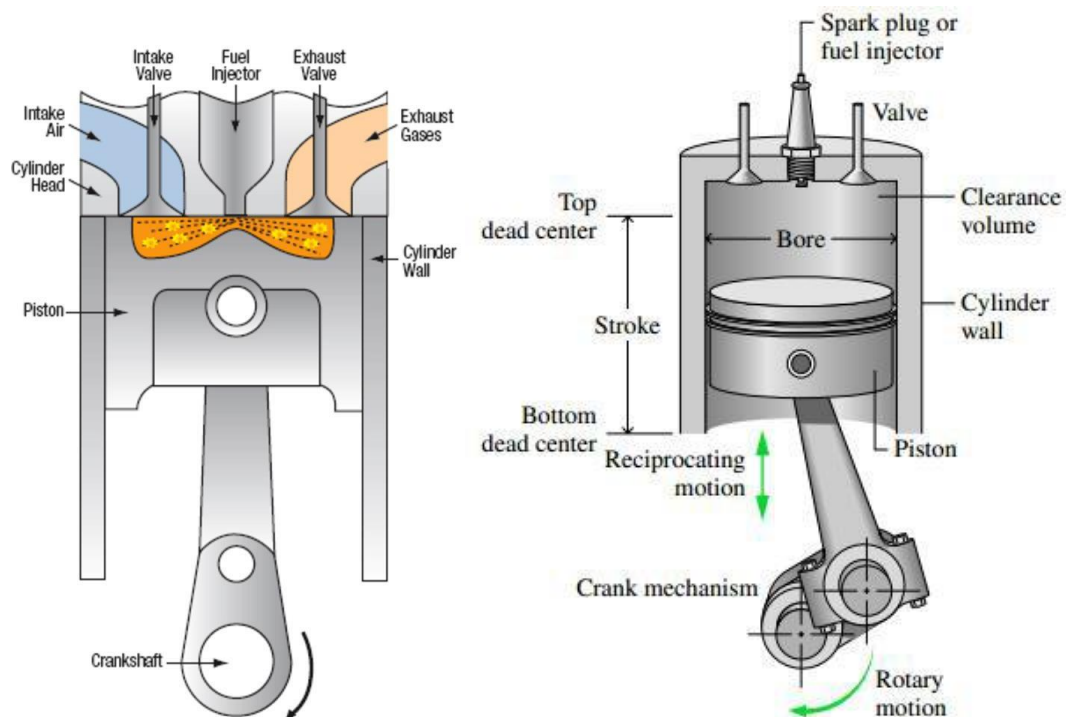
The power plant of the bus is the engine. The engine is the unit that creates the power supply for the rest of the power train. The power train consists of the engine, clutch (manual Transmission only), transmission, drive shaft, differential, rear axle, and drive wheels.



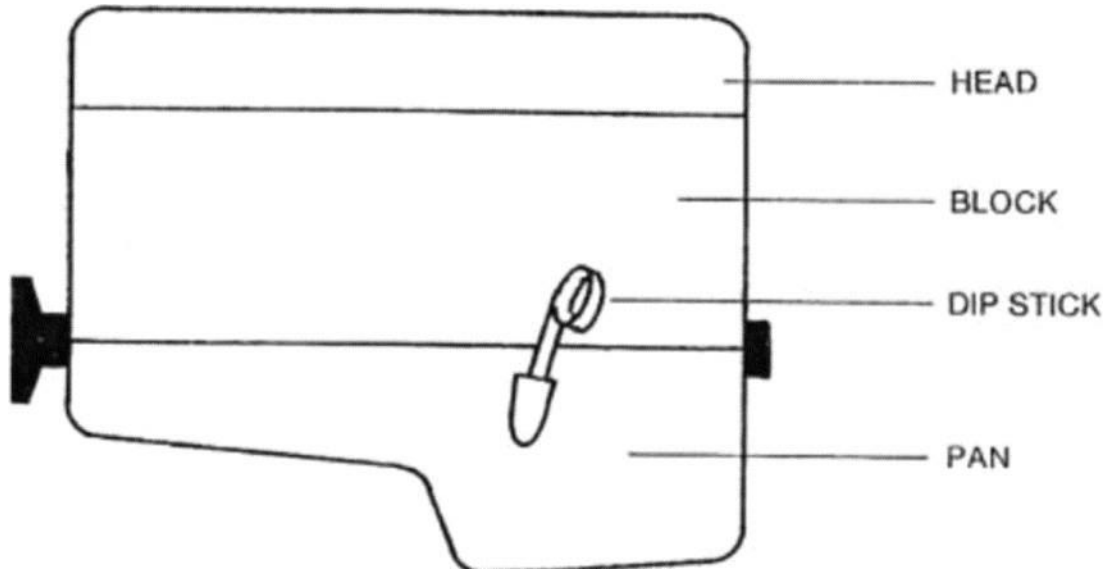
Two basic engine types

The two basic types of engines are used in school buses. Both are referred to as internal combustion engines. They differ, however, in the type of fuel they burn. Some engines operate on gasoline, while others run on diesel fuel. The basic difference between a gasoline engine and a diesel engine is the method of fuel ignition.

1. In a gasoline engine the fuel is ignited by means of a spark plug
2. In the diesel engine it is ignited by heat of compression

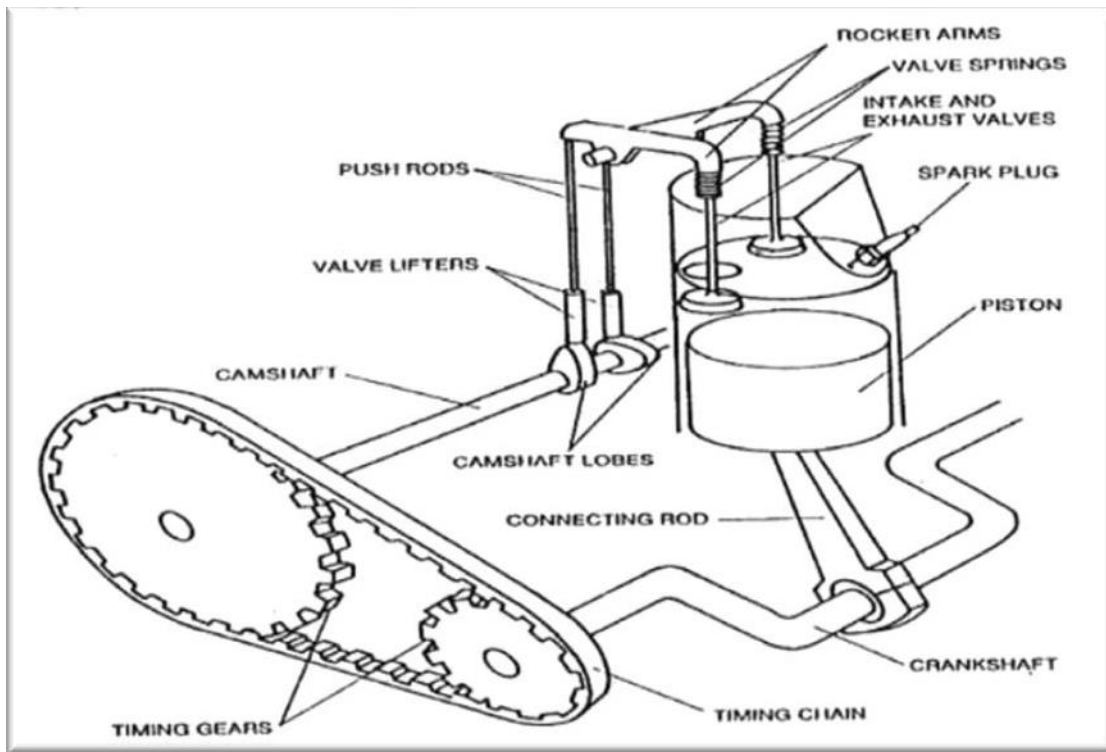


Basic Engine Components



The engine consists of sections and have components attached to them.

Basic Engine Operation

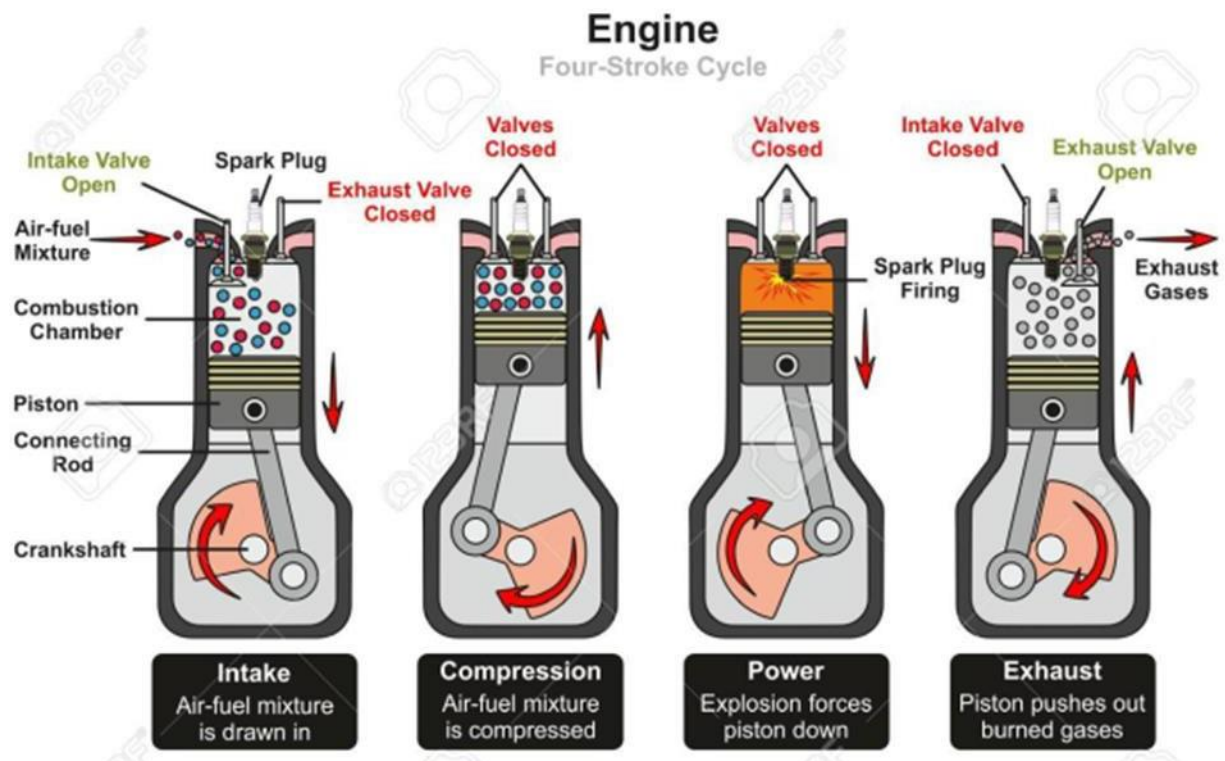


Several things are required to make an engine run:

- Fuel - (Gasoline and diesel)
- Air
- Oil
- Water - (Coolant)

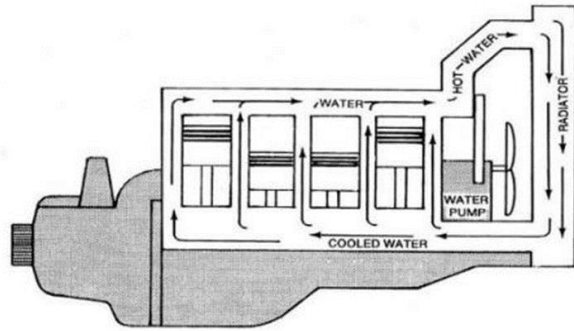
The engine supplies power to the entire power train. It also powers many accessories that are necessary to the operation of many other components and systems, including the alternator, power steering mechanism, and air compressor.

Basic Engine 4 Stroke Process



The pistons move in an up and down motion. The burning of fuel within the engine cylinders builds up heat. The temperature of the engine is controlled by means of coolant, which comes from the radiator and is pumped through the engine block and cylinder head. A fan mounted behind the radiator pulls outside air through the radiator and cools the coolant when it returns to the radiator from the engine.

Basic Engine Cooling System



Coolant Flow

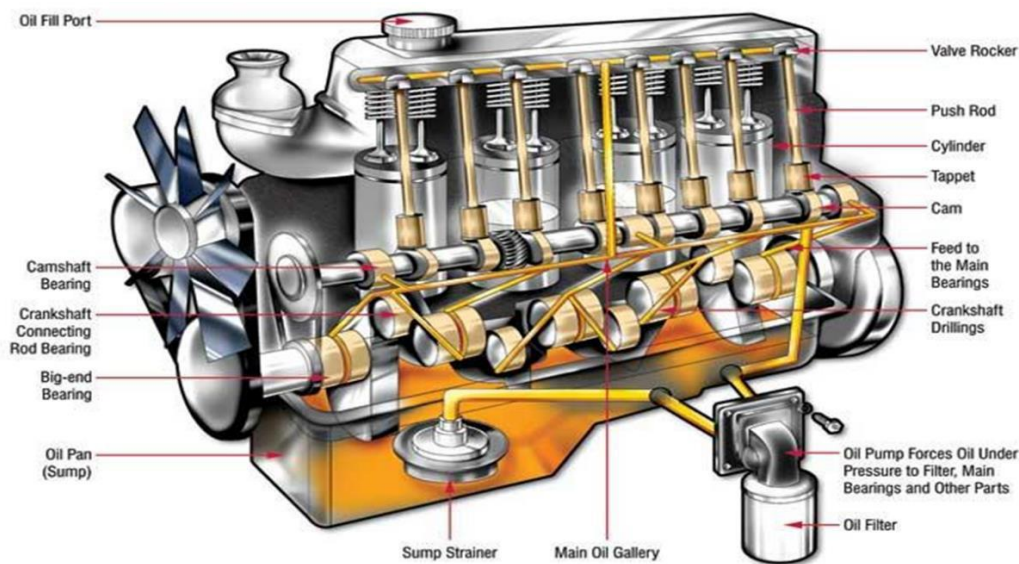
Colors of coolant

Lubricating oil, which is stored in the bottom of the engine in a pan, is pumped through channels or pipes to all moving parts in the engine. This keeps all moving parts lubricated.



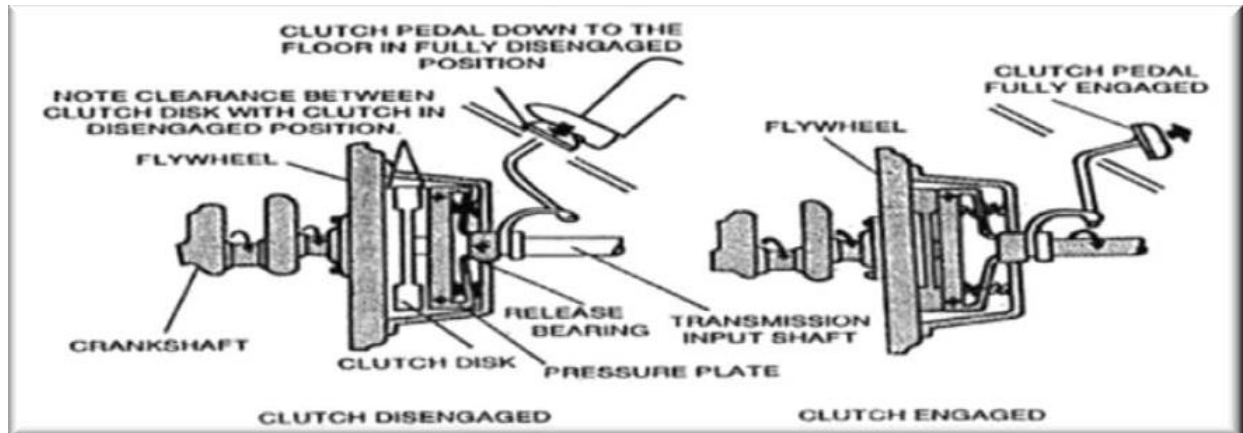
The color of engine oil is light tan to dark black.

Basic Engine Lubrication



Flywheel

The flywheel is a heavy, round, thick metal plate that performs more than one duty and must be heavy enough to carry the rotary motion of the crankshaft between power strokes. The flywheel also serves as the power outlet to the rest of the power train. It is one “side” of the clutch with a manual transmission. Or it connects to the torque converter in an automatic transmission.



The clutch applies pressure to the friction plate to engage. Excessive heat (riding the clutch) will shorten the life of the clutch. The release bearing has to have enough “free play” so it is not constantly turning with the engine. The clutch release bearing does not turn unless the clutch is engaged. When the clutch is used to shift gears, the release bearing makes contact with the pressure plate and begins turning. If the driver “rides” the clutch, the release bearing continues to turn and wears out faster.

Transmission

21710 VC TRANSMISSION USE

The driver of a motor vehicle when traveling on down grade upon any highway shall not coast with the gears of such vehicle in neutral.

The transmission multiplies the power from the engine to the drive wheels. In first gear, for example, the engine runs very fast but the bus speed is very slow. While in 5th gear, the engine runs relatively slow while the bus speed is relatively fast.



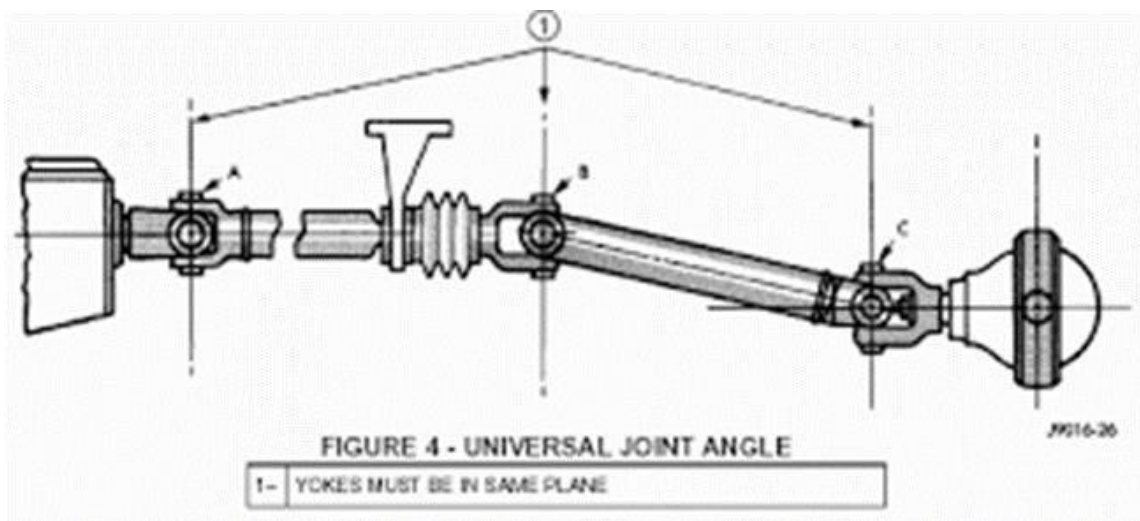
A bus driver can use the transmission to assist with braking for descending hills by downshifting to lower gears. Downshifting to lower gears while climbing hills is also very beneficial as downshifting allows for higher engine RPM's and more power applied to the drive wheels.

All automatic transmissions have a range selector with different range selections. This is the driver's hand control over the transmission. Proper selection of the correct range provides better control and avoids undue "hunting" by the transmission for the required gear. The transmission gear selector is the driver's control over the transmission. A driver can "pre-select" the drive gear he/she wants based on the road or weather conditions.



Drive Shaft

The drive shaft or drive line is used to transmit power or torque from the output of the transmission to the differential or rear axle. The drive shaft is constructed of metal tubing, with connectors at each end called universal joints, which allow for flexibility of the driveline. The drive shaft is constructed in halves in some cases, which are joined by means of a splined joint to allow an in-in out movement.



13 CCR § 1266 DRIVE SHAFT PROTECTION (GUARD)

A drive shaft guard to prevent broken shafts from whipping through the floor or dropping to the ground shall be required on:

- (a) School Buses--On all Type 1 school buses constructed after January 1, 1950, and all Type 2 school buses constructed on or after July 1, 1970, each segment of the drive shaft shall be equipped with a guard.
- (b) Other Vehicles--All Type 1 buses and all farm labor vehicles designed for more than 16 passengers and the driver shall be equipped with at least one guard or bracket if the drive shaft extends under the passenger compartment.



Transit Style Bus



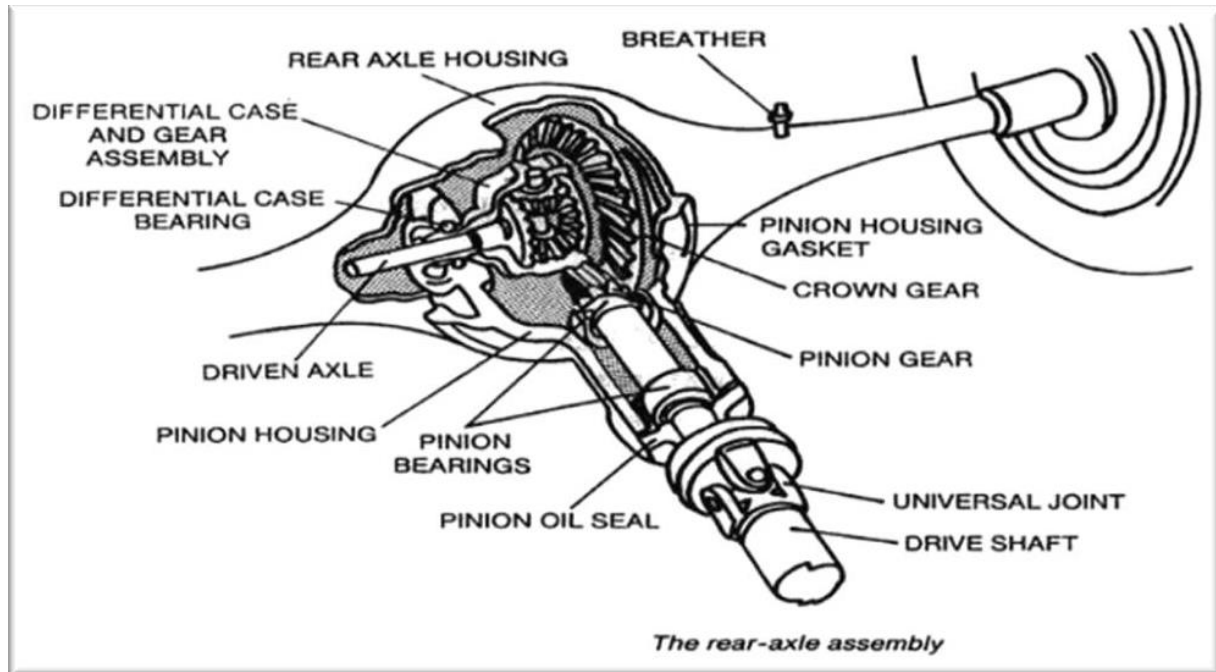
Conventional Style Bus



The drive shaft is located between the transmission and the differential and drive axle. The drive shaft can be very dangerous to passengers if it breaks and enters into the passenger compartment. The drive shaft is protected on all buses by drive shaft guards. The main purpose of a guard is to prevent the drive shaft from hitting the ground if it should break. A broken drive shaft hitting the ground could cause a pole-vaulting effect that could cause the vehicle to overturn.

Differential and Rear Axle

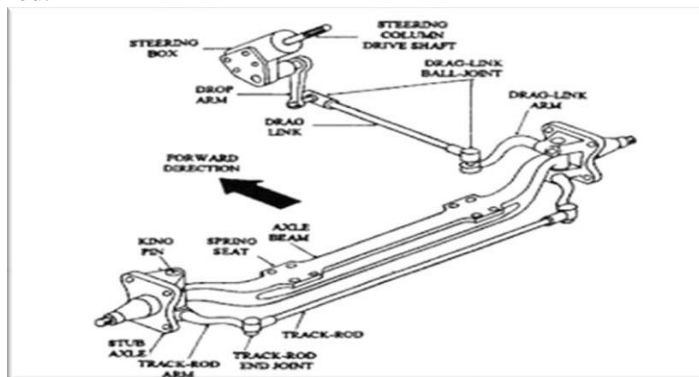
The differential and rear axle make up the rear axle assembly. This is the last component of the power train, and it performs three basic functions. The first is to change the direction of rotation of the power train. The second is to allow the driver wheels to rotate at different speeds, which is necessary when the bus is turning or rounding a curve. The third function is gear reduction.



The rear axle, or differential, is the last unit of the power train

Front Axle

The front axle is usually a one beam unit or a rigid steel member. In some cases, an independent front suspension system is used. In either case, a steering spindle is mounted on each side of the axle. Mounted on the spindle are the wheel hubs and wheel bearings and attached to the hubs are the wheels. The action of the spindle is like that of your wrist; it can be moved in two directions. The spindle allows the wheels to turn. The left steering spindle is attached to a drag link, which is connected to the steering gear that is controlled by the steering wheel. The right and left steering spindles are connected by a tube called a tie-rod.



Steering Mechanism

Several types of steering mechanisms are used in the bus industry. They include:

1. Manual Steering
2. Manual Steering with Power Assistance
3. Full-time Power Steering

The source of power for power steering may be:

1. Hydraulic
2. Air
3. Electric (newly emerging electric buses)

A driver may have to drive different sizes and types of school buses during their day. It is extremely important that the driver makes adjustments, both physically and mentally, when changing between different types of buses with different requirements to steer safely. Some buses are very easy to steer while others can be very difficult and require a lot of upper body strength.

Brake Systems

Brakes are a very important subject. You will be trained on how to perform a complete brake system check for every type of bus you will operate. Keep in mind that many things on a school bus can fail, but when the brakes fail on any vehicle, it is serious. It takes force and friction to make brakes work. Force is applied by air pressure, hydraulic fluid, and hand or foot leverage and transmitted by rods or cables and spring force. None of these will stop a vehicle unless the brake shoes are kept in proper adjustment.

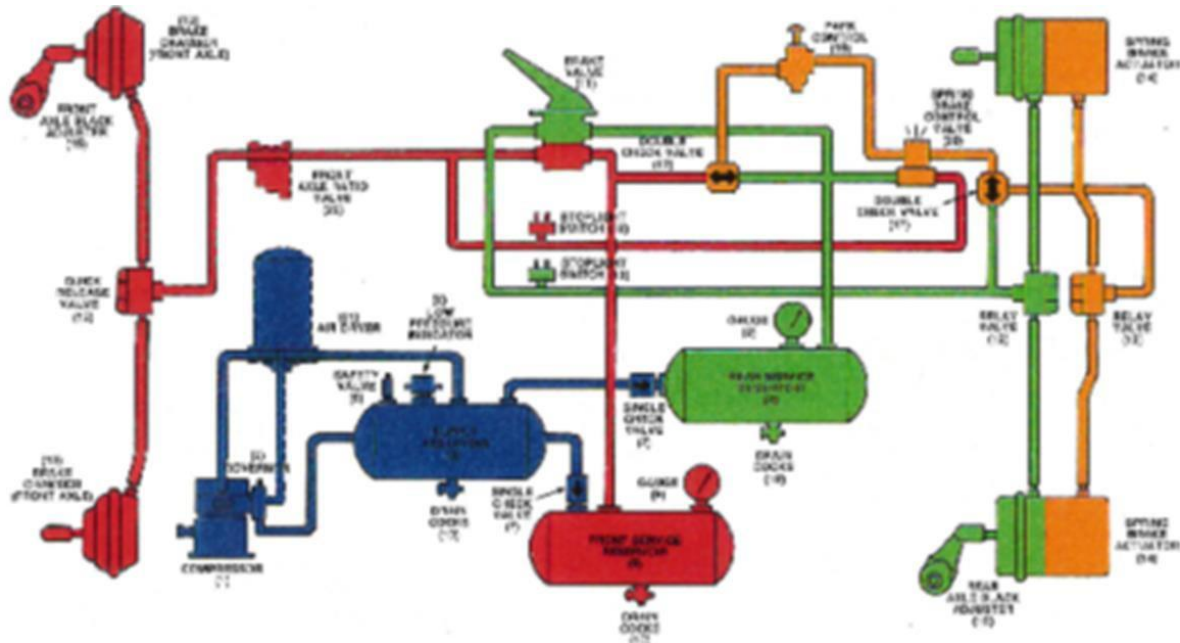
The best braking effort is using the brakes up to what is referred to as the “impending skid.” When the wheels lock up on any vehicle, for all intent and purposes, there are no brakes. The stopping power is the friction between the tires and the surface the tire is sliding on.

We use the term service brake or foot brake for that portion of the braking system that we use in normal operation. Another term being used in conjunction with service brakes is power brakes. The term “power brakes” means any braking gear or mechanism that uses air, electricity, or vacuum to aid in the application of the brakes on a vehicle.

The air supply comes from the outside atmosphere into the air compressor and is compressed into the air storage tanks. The compressor is driven by the engine and can be belt-driven or gear-driven. Let’s discuss the air storage tanks, or reservoirs.

It should be clear at this point that we are talking about three different storage systems:

1. The wet tank supplies air to the rest of the system.
2. The dry tank supplies air to the service brakes and the emergency stopping system.
3. The auxiliary tank supplies air to the air-operated accessories—doors, horns, wipers, and so forth.



The air governor has some requirements specified in the law. The minimum cut-in pressure has been established at 85 psi. and the maximum cut-out pressure has been established at 130 psi. A gauge is mounted on the instrument panel to allow the driver to see clearly is the proper amount of pressure is being maintained.

26504 VC AIR GOVERNOR

The air governor cut-in and cut-out pressures of every motor vehicle equipped with airbrakes or equipped to operate airbrakes on towed vehicles shall be adjusted so that the maximum pressure in the air system and the minimum cut-in pressure shall be within limits prescribed by the department. In adopting regulations specifying such pressures the department shall consider the safe operating capacities of the various airbrake systems which are now or may be used on motor vehicles and shall be guided by the designed capabilities of those systems.

26505 VC AIR PRESSURE GAUGES

A motor vehicle equipped with airbrakes or equipped to operate airbrakes on towed vehicles shall be equipped with a pressure gauge of reliable and satisfactory construction and maintained in an efficient working condition, accurate within 10 percent of the actual air reservoir pressure, and visible and legible to a person when seated in the driving position.

26506 VC LOW AIR WARNING DEVICES

(a) Every motor vehicle airbrake system used to operate the brakes on a motor vehicle or on a towed vehicle shall be equipped with a low air pressure warning device that complies with either the requirements set forth in the Federal Motor Vehicle Safety Standards in effect at the time of manufacture or the requirements of subdivision (b).

(b) The device shall be readily visible or audible to the driver and shall give a satisfactory continuous warning when the air supply pressure drops below a fixed pressure, which shall be not more than 75 pounds per square inch nor less than 55 pounds per square inch with the engine running. A gauge indicating pressure shall not satisfy this requirement.

13 CCR § 1246 (b) (1) (3) (4) LOW AIR WARNING DEVICES

(b) Warning Devices -Type 1 school bus brake systems shall have warning devices as follows:

(1) Air brakes shall have a buzzer or other audible warning signal and a visual, air-operated, flag-type warning device, both used exclusively for the brake system. Both devices shall give a continuous warning when the air supply pressure in the first reservoir to receive air from the compressor, or any service reservoir, drops below a fixed pressure as specified by Vehicle Code Section 26506. The flag-type device is not required on vehicles manufactured on or after March 1, 1975, in compliance with FMVSS 121 (49 CFR 571.121).

(3) The visual warning devices required in (1) and (2) shall be readily visible to the driver when seated in the normal driving position.

(4) Override switches are prohibited for audible warning devices required in (1) and (2).

Emergency Stopping System

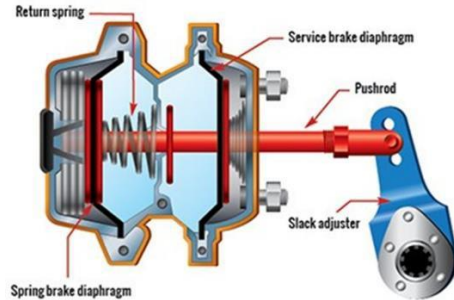
The emergency stopping system is of great importance, and all drivers must understand the system thoroughly. If you do not understand how the system works on the bus you will be driving, be sure to find out before you leave on a trip. The term “emergency stopping system” refers to the backup system that is available when a malfunction occurs in the service brake system.

26301.5 VC EMERGENCY STOPPING SYSTEM

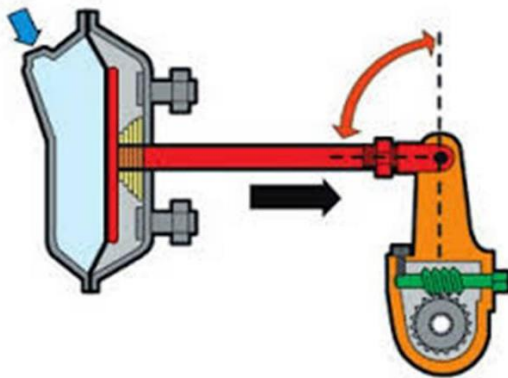
Every passenger vehicle manufactured and first registered after January 1, 1973, except motorcycles, shall be equipped with an emergency brake system so constructed that rupture or leakage-type failure of any single pressure component of the service brake system, except structural failures of the brake master cylinder body or effectiveness indicator body, shall not result in complete loss of function of the vehicle’s brakes when force on the brake pedal is continued.

Spring Brake System

One system that is widely used is called a spring brake system. In unit 4 we will discuss the operation of the spring brake chamber in various situations.

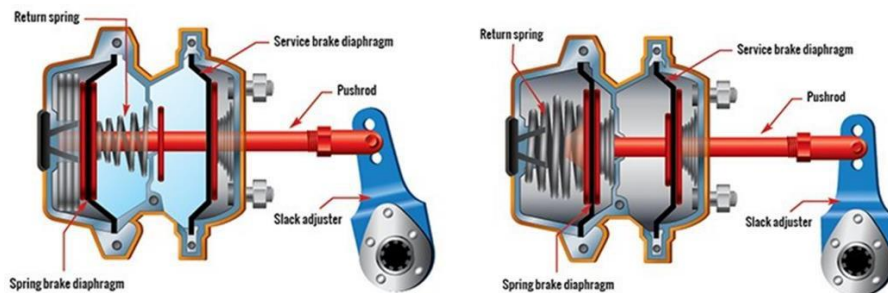


In normal brake application through the service brake (foot pedal), applied air pressure is the force used to stop the vehicle. Air pressure through the system applies force against a rubber diaphragm. This force, working with other components of the system, will apply the brakes.



Emergency Application: Rear Wheels Only

In normal brake application the spring is held in the COMPRESSED position by air pressure in the spring brake chamber. If an air leak develops in the system and air pressure drops to a certain point, the force of the compressed spring will be greater than the air pressure. The spring will expand, forcing the brake shoe against the brake drum to stop the vehicle.



Parking Application

The emergency application occurs when the vehicle loses air. Buses are equipped with a hand-controlled valve that can be used for emergency stops or parking; and when this valve is operated, it releases air out of the spring brake chamber and allows the spring to expand and forces the brake shoe against the brake drum and holds the vehicle in a stopped position utilizing spring pressure.



Air-Applied Emergency Parking Brake DD3

There must be a separate air supply in the system for the air applied emergency brake to work. Air applies the parking brake and a mechanical system holds the parking brake applied if air leaks out of system.

Air-Applied Emergency Parking Brake DD2

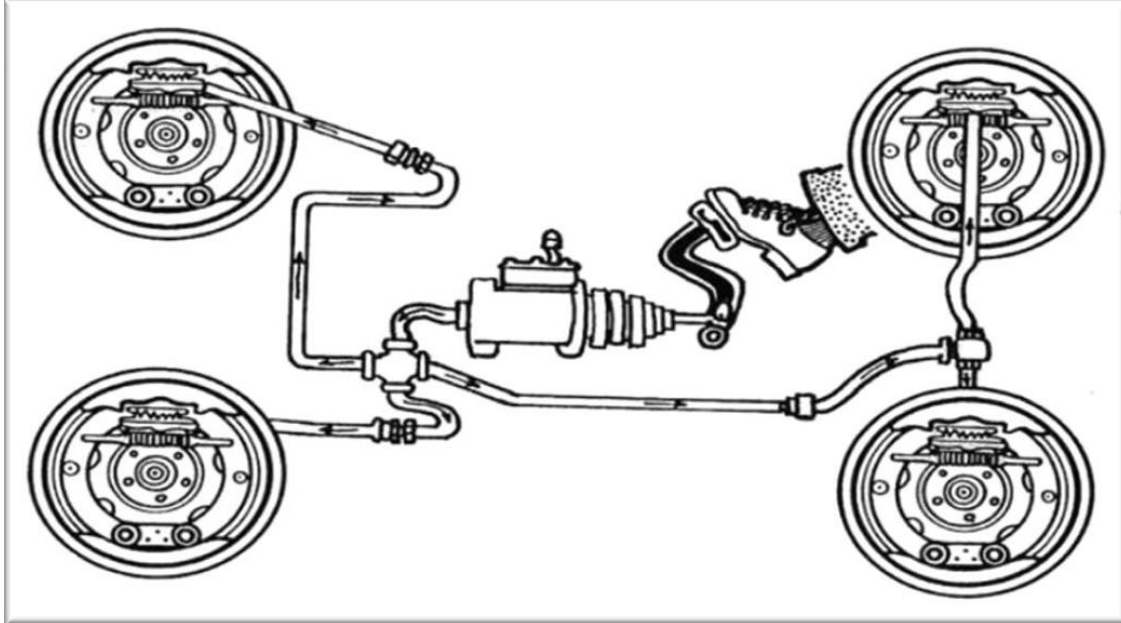
There must be a separate air supply in the system for the air applied emergency brake to work. This system should not be used as a parking brake because there is nothing to keep the brakes applied should the air supply be depleted.

Hydraulic Brake System

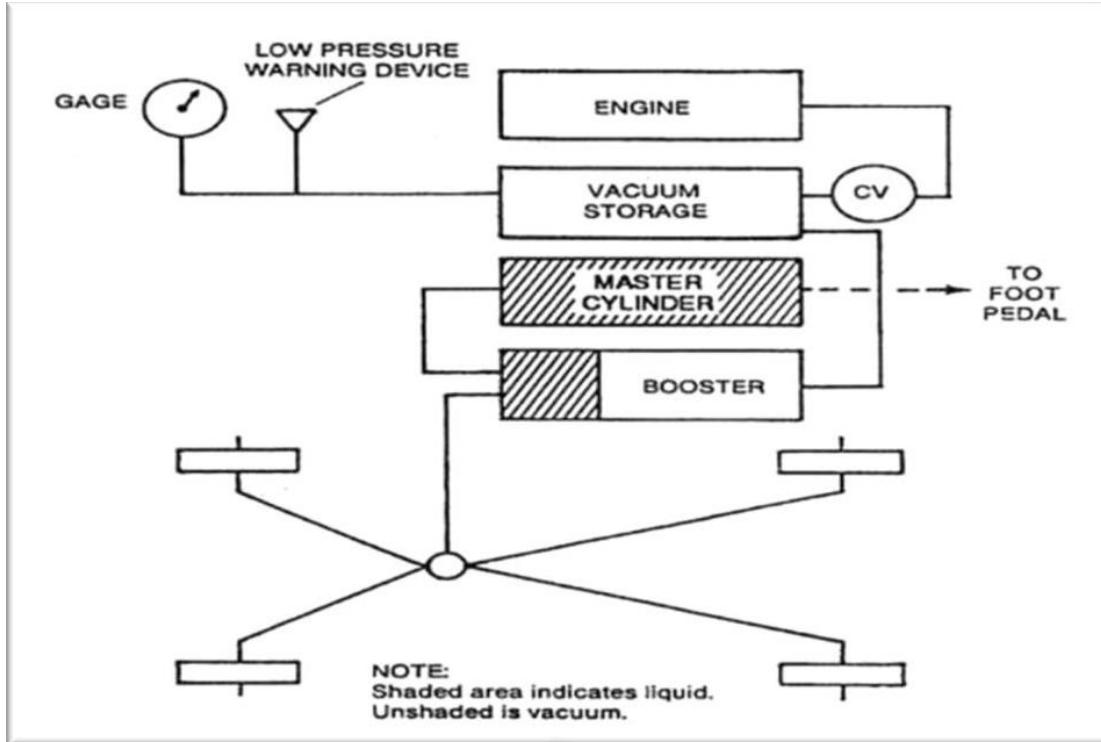
The hydraulic brake system works on the same principle as the air brake system except that the power is applied by fluid instead of air. The pressure applied by the driver to the brake pedal regulates the pressure to the brake shoes.



At times, hydraulic brakes are referred to as power or vacuum brakes. This means that additional power or pressure, other than that which is applied by the driver when stepping on the brake pedal, is utilized. The additional power makes it easier for the driver to apply the brakes. It also provides more pressure on the brake shoes and requires little or no additional effort from the driver.



Vacuum Brake System



26520 VC Vacuum Brakes

Motor vehicles required to be equipped with power brakes and which are equipped with vacuum or vacuum-assisted brakes shall be equipped with a properly maintained vacuum gauge of reliable and satisfactory construction, accurate within 10 percent of the actual vacuum in the supply reservoir, and visible and legible to the driver at all times.

This section shall not apply to a two-axle motor truck operated singly.

26521 VC Buzzers

Motor vehicles required to be equipped with power brakes and equipped with vacuum or vacuum-assisted brakes and motor vehicles used to tow vehicles equipped with vacuum brakes or vacuum-assisted brakes shall be equipped with either an audible or visible warning signal to indicate readily to the driver when the vacuum drops to eight inches of mercury and less. A vacuum gauge shall not be deemed to meet this requirement.

This section shall not apply to a two-axle motor truck operated singly nor to any motor vehicle manufactured prior to 1964.

Parking Brakes

This component, commonly referred to as the hand brake, is controlled by means of a hand lever. Several types are used on buses. We have air actuated hand parking brakes. The purpose of the hand brake is to retain or hold the bus in a stopped (parked) position. Under emergency conditions—when all other means of stopping the vehicle have failed—the parking brake could, and should, be used to slow or stop the vehicle. Under normal conditions, the parking brake should NOT be applied until the bus has stopped.

26451(A) VC Parking Brake

The parking brake system of every motor vehicle shall comply with the following requirements:

- (a) The parking brake shall be adequate to hold the vehicle or combination of vehicles stationary on any grade on which it is operated under all conditions of loading on a surface free from snow, ice or loose material. In any event the parking brake shall be capable of locking the braked wheels to the limit of traction.

Tires

We all know the purpose of tires, but as professional drivers you should know a few things about specific laws and proper care of tires. Every bus must be equipped with tires that are adequate to support the gross vehicle weight of the vehicle. The tires shall be marked to indicate their ply rating and/or load range, and they must meet Federal Motor Vehicle Standards 119.

All tires must be of the same size. A serviceable spare tire must be carried in the spare tire compartment except where tire service and service trucks are immediately available.

Spare tires are not to be placed inside the passenger compartment, nor placed to block windows or doors. They must be securely fastened in a proper rack or compartment expressly for that purpose.

Important regulations pertaining to tires include the following:

1. Front tires shall not have less than $\frac{4}{32}$ of an inch tread depth measured at any point on the major tread groove, except where bars, humps, or fillets are located in the tread groove.
2. Tires shall be free of damaging cuts, bruises, and any other defects in the tire casing.
3. No tire shall be retreaded, recapped, or repaired if worn through the breaker strip or if there has been any separation in the outer wall of the casing or if the casing is otherwise damaged.
4. Retreaded or recapped tires shall not be used on the front wheels of a school bus, nor shall regrooved tires be used.

All type 1 school buses must have dual tires on the rear axle.

27465 VC Tires

(a) No dealer or person holding a retail seller's permit shall sell, offer for sale, expose for sale, or install on a vehicle axle for use on a highway, a pneumatic tire when the tire has less than the tread depth specified in subdivision (b). This subdivision does not apply to any person who installs on a vehicle, as part of an emergency service rendered to a disabled vehicle upon a highway, a spare tire with which the disabled vehicle was equipped.

(b) No person shall use on a highway a pneumatic tire on a vehicle axle when the tire has less than the following tread depth, except when temporarily installed on a disabled vehicle as specified in subdivision (a):

(1) One thirty-second ($\frac{1}{32}$) of an inch tread depth in any two adjacent grooves at any location of the tire, except as provided in paragraphs (2) and (3).

(2) Four thirty-second ($\frac{4}{32}$) of an inch tread depth at all points in all major grooves on a tire on the steering axle of any motor vehicle specified in Section 34500, and two thirty-second ($\frac{2}{32}$) of an inch tread depth at all points in all major grooves on all other tires on the axles of these vehicles.

(3) Six thirty-second ($\frac{6}{32}$) of an inch tread depth at all points in all major grooves on snow tires used in lieu of tire traction devices in posted tire traction device control areas.

(c) The measurement of tread depth shall not be made where tie bars, humps, or fillets are located.

(d) The requirements of this section shall not apply to implements of husbandry.

(e) The department, if it determines that such action is appropriate and in keeping with reasonable safety requirements, may adopt regulations establishing more stringent tread depth requirements than those specified in this section for those vehicles defined in Sections 322 and 545, and may adopt regulations establishing tread depth requirements different from those specified in this section for those vehicles listed in Section 34500.

13 CCR § 1244 Tires

All tires, rims, and wheels used on vehicles subject to these regulations shall comply with the requirements of Article 14, Chapter 4, of this title, beginning with Section 1080, and the following provisions:

- (a) Aluminum Wheels. No aluminum alloy disc wheel demountable at the hub and manufactured on or before September 30, 1955, shall be used on the front or steering axle(s) of a motor vehicle or the leading vehicle of a vehicle combination.
- (b) Spare Tires. Externally mounted spare tires shall be contained and supported by tire carriers or other means specifically designed for the purpose and secured to prevent accidental release of the tires.
- (c) School Bus Tires and Rims. All tires and rims used on school buses shall comply with the following requirements:
 - (1) All tires on a school bus shall be of the same size, except as otherwise specified on the Federal data plate or label.
 - (2) All Type 1 school buses shall have dual tires on the rear axle.
 - (3) No tire shall be permitted inside a Type 1 school bus, nor shall any tire compartment project into the passenger compartment. Spare tires shall be secured to the vehicle and shall not be placed across a window, entrance, or any exit, or in any position that may endanger the occupants.

13 CCR § 1229 Proficiency with Equipment

Motor carriers shall require each driver to demonstrate that the driver is capable of safely operating each different type of vehicle or vehicle combination (i.e., vehicles with different controls, gauges, of different size, or requiring different driving skills) before driving such vehicle(s) on a highway unsupervised. The driver's capability to operate the vehicle shall include special equipment such as wheelchair lifts, ramps, or wheelchair tie downs. This Section shall not apply to a motor carrier who is the owner and sole driver of a vehicle or combination of vehicles.

Wheelchairs

Equipment and Securement of Wheelchairs. All readily accessible exposed edges or other hazardous protrusions on parts of lifts assemblies located in the passenger compartment or parts of the bus associated with the operation of the lift shall be padded with energy absorbing material to minimize injury in normal use and in case of an accident. A device or devices shall be provided to secure wheelchairs during transportation to keep them restrained during normal movement of the bus as in starting, stopping, and turning.

Unit 4 Part 2

In past years, accidents involving buses were caused by the driver in about 50% of cases nationwide. One or two things were involved:

1. Driver error in judgment
2. A mechanical failure, Or a combination of both

The mechanical failure, in most cases, could be held to a minimum if all drivers would conduct the proper daily bus inspection and report any defects found. Professional drivers take their job seriously and learn all they can about the vehicle being driven. By learning, any driver should be able to detect a problem before it becomes serious.

All drivers must keep in mind that they will be entrusted with the lives of every passenger riding the bus. The purpose of this unit is to learn more about components, how they operate, plus the regulations and laws related to safe operation of the vehicle.

Dual Air Systems

This system provides for separate operation of the brakes on the front and rear axles. The purpose of the dual air brake system is to help ensure that braking capability is maintained on one axle in the event of a brake system failure on the other axle.

Most dual air systems are constructed in such a manner that separate air storage tanks are provided for the brakes on wheels of the front and rear axles. The air supply to the brake chambers, both front and rear, is regulated by means of the same foot pedal. (A single control).

In the event of brake failure, including the loss of a significant amount of air pressure to the brakes on the wheels on one axle, a shuttle (check) valve shuts off air supply to those brakes. The air supply to the brakes on the wheels of the other axle will still be maintained, providing for, at least, partial stopping capability for the vehicle.

Vehicles equipped with a dual air brake system have either:

1. Two service brake gauges (one for each tank); or
2. A single service brake air gauge with two indicator needles.

In the latter case the needles are generally of different colors. During the building up of air pressure, the two air gauges of vehicles so equipped should show the same pressure. (once the air pressure is equalized) If the vehicle has a single gauge, both needles should move together to show the same pressure. In either case any deviation from the patterns just described would indicate some abnormality.



Hypothetical problem.

You are on a run and driving a vehicle equipped with a single air pressure gauge, which has two indicator needles. While driving down a steep grade, you apply the brakes and notice that one of the needles is falling at a much more rapid rate than the other needle.

Immediately, you should recognize that an air loss has developed in the brake system of the wheels of one of the axles. The problem could be a broken airline or a ruptured diaphragm.

When the air pressure drops to between 55 and 75 psi, the low air pressure warning buzzer sounds. At this point only one brake system is working properly, and you should bring the vehicle to a stop as quickly as is practical. If you should have to stop in the roadway, your next step would be to place the transmission in the lowest gear and drive the vehicle to a safe place off the roadway. You would then secure the vehicle. The vehicle should not be driven again until necessary repairs have been made. Under no circumstances should you attempt to complete the trip with only half of the overall braking system operable.

The dual air brake system also includes an additional safety component, which is an emergency stopping system. The emergency stopping system, which may be either an air-applied system or a spring-applied system, is applied under certain conditions on the wheels of the REAR axle.

If, for example, the air pressure supply for the brakes on the rear axle should drop below 55 psi, the emergency stopping system would be applied on the wheels of the rear axle when the driver depresses the service brake pedal. (Spring brake control valve or “modulator.”)

If the brakes on the wheels of the front axle were not operable in the situation just described, the vehicle would still have braking capability at the wheels of the rear axle. In other words, the emergency stopping system is designed to maintain no less than braking capability at the wheels of the rear axle

Antiskid brake Systems

Some vehicles are equipped with an antiskid brake system, which is an air brake system designed to prevent the wheels of the vehicle from locking (skidding) when the brakes are applied with great force, such as during a “panic” stop or while the vehicle is traveling over a slippery surface.

The system responds to rapidly changing conditions of friction between the tires of the vehicle and the road, thereby providing the best available combination of braking ability, lateral stability, and steering control during a panic stop.

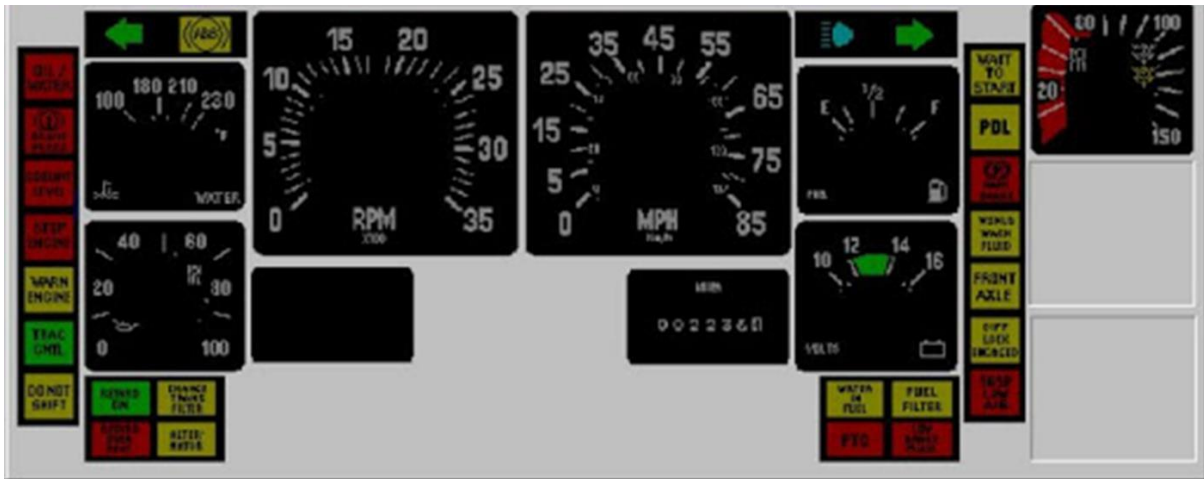
The antiskid system is a computerized system that controls the braking on each axle separately. It consists of the following major components:

1. The computer-valve assembly
2. A slotted brake rotor at each wheel
3. A fixed magnetic sensor at each wheel

The system works this way. As the bus travels, the brake rotors revolve with the wheels to which they are attached. The sensors “read” the wheel speed by reading the speed of the brake rotors. This information is relayed from the sensor to the computers, which, by means of a valve, regulate the air pressure to the brakes.

If the computers determine that a locking of the brakes is imminent, when the brakes are applied the computers will cause the brakes to be released and re-applied many times rapidly to prevent wheel lockup or skid. During the entire sequence, the driver is merely depressing the brake pedal.

The driver of a bus equipped with an antiskid system must, before operating the vehicle, check to make sure that the system's electronic circuitry is in proper working order. During vehicle pre-trip, simply turn the key on and check for the ABS light on the instrument panel.



Automatic Transmissions

If not used properly, an automatic transmission can be damaged, and it is very expensive to repair. Most driver assume that all they must do is to pull the lever into the drive position and step on the throttle. Automatic transmission requires proper training to be used properly.

The range selector lever is the hand control over the transmission. Proper selection of the correct range provides better control and avoids undue “hunting” by the transmission for the required gear. The driver should select the proper gear range for the speed and roads to be traveled.

Automatic transmissions use a “converter” in place of a clutch used in a manual transmission. The converter multiplies engine torque and accomplishes the work of the clutch on a standard transmission. When upshifts or downshifts are made, the converter absorbs the shift “shock.”

When starting from a standstill, regardless of the drive range selected, the converter is operating; and the first shift noticed will be engagement of the lock-up clutch. This lockup is an automatic function that locks the converter out of the operation and causes the gear train to turn at engine speed. The lockup clutch automatically disengages and brings the converter back into play as a fluid coupling to absorb and cushion the shock of the gear change.

Hydraulic Retarder

A hydraulic retarder is a simple device having only one moving part – a vaned rotor that resembles a paddle wheel. When the retarder is activated, a valve is opened, allowing oil to be pumped into a compartment that contains the rotor. This process retards or slows down the rotor. When the retarder is released, the oil is pumped out of the compartment so the rotor can turn freely again.

When fully applied, the retarder has a braking effect much greater than the effect of engine braking alone; however, the retarder is not a brake and will not bring the bus to a complete stop. It can be applied in any gear but is used primarily on downgrades in the proper gear range.

Overuse of the retarder may heat the transmission fluid to a point at which the high-temperature warning light comes on or the temperature gauge reading is in the red band, indicating a temperature of 380 degrees F. or more. If this happens, release the retarder until the light goes out or until the gauge is back in the yellow area below 380 degrees F.

During normal operation in lockup, the temperature gauge indicator should stabilize below 300 degrees F. However, during severe or prolonged retarder operation, the temperature may climb rapidly. If it reaches 380 degrees F., stop in a safe place, shift the transmission to neutral, and run the engine at 1,200 rpm’s until the transmission fluid temperature drops.

Unit 4 Quiz

1. The main difference between a gasoline engine and a diesel engine is the method used to ignite the fuel in the cylinders.

T _____ F _____

2. The pistons move in a rotary motion.

T_ F_____

3. Three up and down movements of the piston are required to complete one cycle.

T_ F_____

4. The four main things needed for an engine to run are fuel, air, oil, and water.

T_ F_____

5. Excessive heat will shorten the life of the clutch.

T_ F_____

6. The clutch release bearing rotates when the clutch pedal is all the way up.

T_ F_____

7. It is unlawful to operate a bus with the transmission lever in the neutral position when the bus is descending a grade.

T _____ F _____

8. The term “free play” is related to the clutch release bearing in the sense that the bearing needs proper clearance.

T _____ F _____

9. Riding the clutch does little damage to the clutch release bearing.

T_ F_____

10. The transmission is a device in a power train to multiply the power from the engine.

T_ F_____

11. A driver should upshift when descending steep grades.

T_ F_____

12. A driver can use the transmission to slow down the bus by shifting down in gears.

T_ F_____

13. In a bus with an automatic transmission, the selector lever is the driver’s control over the transmission.

T _____ F _____

14. The drive shaft is located between the engine and the transmission.

T_ F_____

15. Drive-shaft guards are designed to keep the shaft from whipping through the floorboard or dropping to the ground if broken.

T _____ F _____

16. The rear axle or differential is the last unit of the power train.

T___ F_____

17. A driver who switches from a bus equipped with manual steering to one equipped with power steering must make adjustments both physically and mentally.

T_____F_____

18. The term “service brake” refers to that portion of the braking system that is used in normal operation.

T___ F_____

19. Friction is used to stop or slow down the bus when the brakes are applied.

T___ F_____

20. The law requires that all buses with air brakes be equipped with low air warning devices.

T___ F_____

21. The wet tank should be drained or should be caused to drain daily.

T___ F_____

22. The air governor cuts out at 60 pounds.

T___ F_____

23. Buses must be equipped with warning buzzers that will sound when air brake pressure is between 55 and 75 pounds.

T_____F_____

24. The air wipers, air horn, and air-operated door operate from a separate storage tank protected by a check valve.

T_____F_____

25. Every bus driver must be instructed in the proper use of the emergency stopping system.

T___ F_____

26. The power to assist in pushing the brake shoes against the drums in a hydraulic braking system is created by vacuum from the engine.

T_____F_____

27. A low pressure or vacuum warning system, is not required on a bus unless the bus is equipped with air brakes.

T___ F_____

28. Vacuum helps to operate the service brakes of a bus equipped with hydraulic brakes and a vacuum booster.

T_____F_____

29. A bus with hydraulic brakes and a vacuum booster shall not be operated with less than 8 inches indicated on the vacuum gauge.

T_____F_____

30. A parking brake operated by a hand lever may be used as a service-brake in an emergency.

T_____F_____

31. Under normal operating conditions, a hand parking brake should not be applied until the bus has come to a complete stop.

T _____ F _____

32. Tires on a bus shall not have less than 1/32 of an inch of tread.

T _____ F _____

33. Retreaded tires can be used on the front wheels of a bus.

T _____ F _____

34. The emergency stopping system applies the brakes on all four wheels on all buses.

T _____ F _____

35. Your best braking effort occurs when your wheels are "locked up".

T _____ F _____