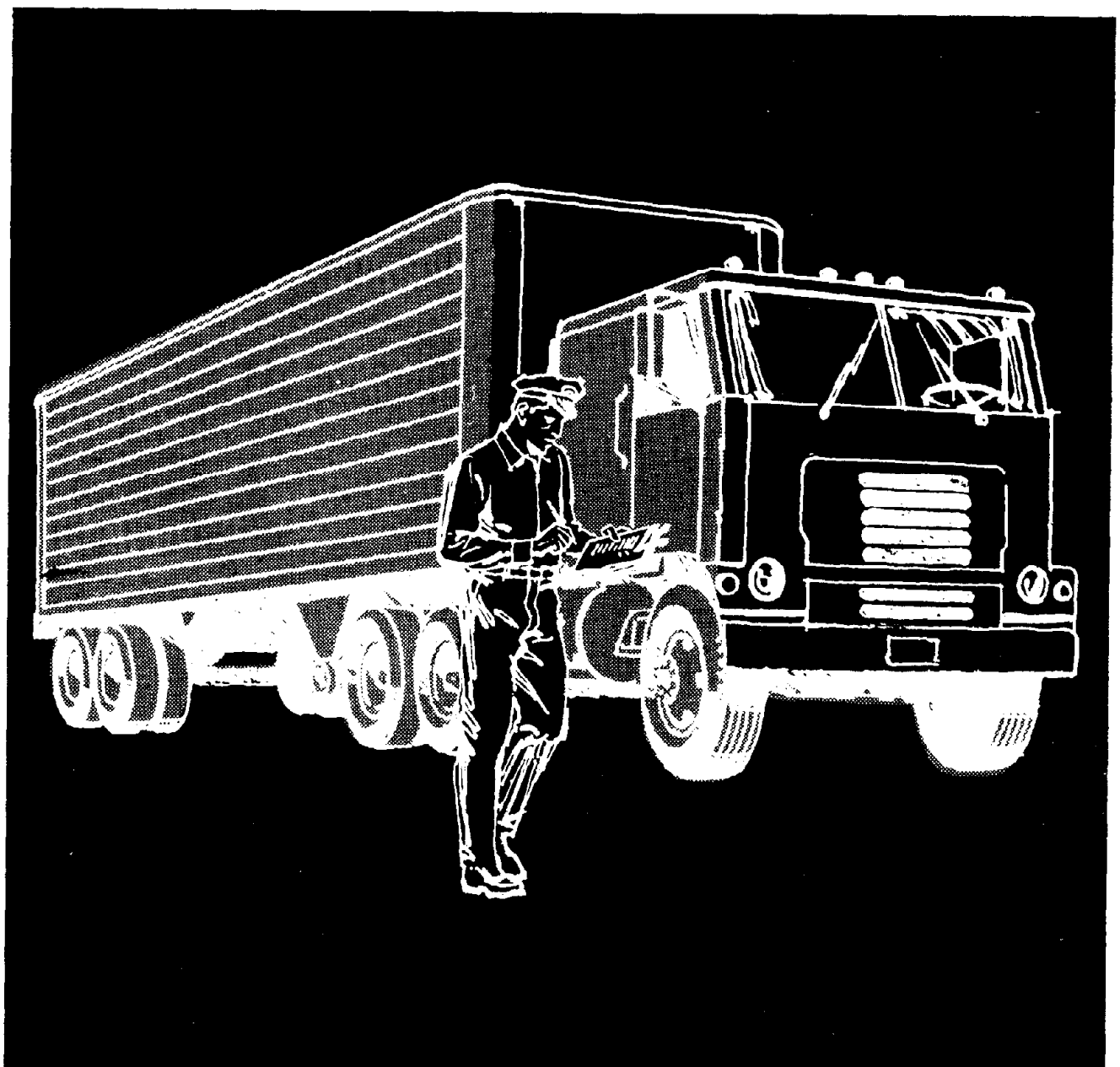
# Model Curriculum for Training Tractor-Trailer Drivers



# Student's Manual





U.S. Department of Transportation
**Federal Highway Administration**

# DISCLAIMER

# Model Curriculum for Training Tractor-Trailer Drivers

Bureau of Motor Carrier Safety

1985

# Student's Manual

US Department
of Transportation
**Federal Highway Administration**

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STUDENT'S MANUAL

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NOTE: All pages of this manual (except the introductory material) are numbered using a four-digit (number) code. Here is the meaning of this code:

FIRST DIGIT: shows the section number

SECOND DIGIT: shows the unit number (for that particular section)

THIRD AND FOURTH DIGITS: show the page number (for that unit of that section)

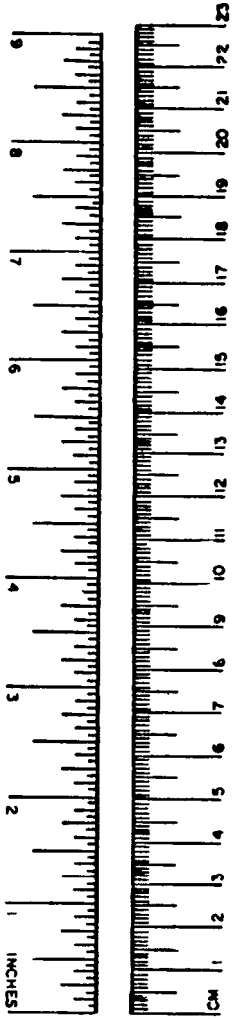
For example, the code 4.2 - 18 means:

Section number 4
Unit number 2
Page number 18

# METRIC CONVERSION FACTORS

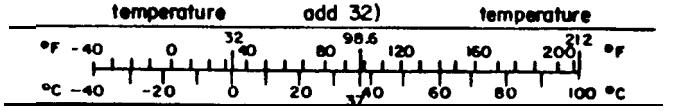
## APPROXIMATE CONVERSIONS FROM METRIC MEASURES

| SYMBOL | WHEN YOU KNOW | MULTIPLY BY | TO FIND | SYMBOL |
|---|---|---|---|---|
| | **LENGTH** | | | |
| in | inches | 2.5 | centimeters | cm |
| ft | feet | 30 | centimeters | cm |
| yd | yards | 0.9 | meters | m |
| mi | miles | 1.6 | kilometers | km |
| | **AREA** | | | |
| $in^2$ | square inches | 6.5 | square centimeters | $cm^2$ |
| $ft^2$ | square feet | 0.09 | square meters | $m^2$ |
| $yd^2$ | square yards | 0.6 | square meters | $m^2$ |
| $mi^2$ | square miles | 2.6 | square kilometers | $km^2$ |
| | acres | 0.4 | hectares | ha |
| | **MASS (weight)** | | | |
| oz | ounces | 28 | grams | g |
| lb | pounds | 0.45 | kilograms | kg |
| | short tons(2000 lb) | 0.9 | tonnes | t |
| | **VOLUME** | | | |
| tsp | teaspoons | 5 | milliliters | ml |
| tbsp | tablespoons | 15 | milliliters | ml |
| fl oz | fluid ounces | 30 | milliliters | ml |
| c | cups | 0.24 | liters | l |
| pt | pints | 0.47 | liters | l |
| qt | quarts | 0.95 | liters | l |
| gal | gallons | 3.8 | liters | l |
| $ft^3$ | cubic feet | 0.03 | cubic meters | $m^3$ |
| $yd^3$ | cubic yards | 0.76 | cubic meters | $m^3$ |
| | **TEMPERATURE (exact)** | | | |
| °F | Fahrenheit temperature | 5/9 (after subtracting 32) | Celsius temperature | °C |




## APPROXIMATE CONVERSIONS FROM METRIC MEASURES

| SYMBOL | WHEN YOU KNOW | MULTIPLY BY | TO FIND | SYMBOL |
|---|---|---|---|---|
| | **LENGTH** | | | |
| mm | millimeters | 0.04 | inches | in |
| cm | centimeters | 0.4 | inches | in |
| m | meters | 3.3 | feet | ft |
| m | meters | 1.1 | yards | yd |
| km | kilometers | 0.6 | miles | mi |
| | **AREA** | | | |
| $cm^2$ | square centimeters | 0.16 | square inches | $in^2$ |
| $m^2$ | square meters | 1.2 | square yards | $yd^2$ |
| $km^2$ | square kilometers | 0.4 | square miles | $mi^2$ |
| ha | hectares($10,000 m^2$) | 2.5 | acres | |
| | **MASS (weight)** | | | |
| g | grams | 0.035 | ounces | oz |
| kg | kilograms | 2.2 | pounds | lb |
| t | tonnes (1000 kg) | 1.1 | short tons | |
| | **VOLUME** | | | |
| ml | milliliters | 8.03 | fluid ounces | fl oz |
| l | liters | 2.1 | pints | pt |
| l | liters | 1.06 | quarts | qt |
| l | liters | 0.26 | gallons | gal |
| $m^3$ | cubic meters | 36 | cubic feet | $ft^3$ |
| $m^3$ | cubic meters | 1.3 | cubic yards | $yd^3$ |
| | **TEMPERATURE (exact)** | | | |
| °C | Celsius temperature | 9/5 (then add 32) | Fahrenheit temperature | °F |



INTRODUCTION

# INTRODUCTION

This Student Manual is part of the U.S. Department of Transportation's, Federal Highway Administration's, Bureau of Motor Carrier Safety's (BMCS) "Model Curriculum for Training Tractor-Trailer Drivers." The model curriculum also includes an Instructor's Manual and a School Administrator's Manual. The contents of these three manuals are based upon the BMCS Proposed Minimum Standards for Training Tractor-Trailer Drivers.

## WHAT MIS COURSE IS ABOUT

The four basic goals of this course are identical to those found in the BMCS Minimum Standards for Training Tractor-Trailer Drivers, which are designed to insure the student's:

- Personal safety (during training activities);
- Learning how to drive safely (avoiding accidents);
- Learning how to drive legally (how to comply with laws and regulations for truckers); and
- Learning how to drive efficiently (how to get maximum fuel mileage and avoid excess wear and tear on vehicle parts).

This course is divided into five major "sections," which are divided into "units" and these units each contain several lessons. A brief description of the five sections follows:

## SECTION 1 - BASIC CONTROL

This section gets you started on the path to becoming a tractor-trailer driver. You will learn how to inspect a tractor and a trailer, what all the various parts and controls are named and what they are used for, how to hook-up a tractor to a semi-trailer and then start practice driving on an offstreet driving range.

## SECTION 2 - SAFE OPERATING PRACTICES

In this section you will begin applying the basic driving skills (learned in the previous section) to onstreet driving in traffic. You will learn how much space a big rig needs, speed control and many other things that are necessary for you to know in order to operate one of these vehicles safely and efficiently.

## SECTION 3 - ADVANCED OPERATING PRACTICES

This section is where you will be learning the high level driving skills that professional drivers need, to safely operate under all types of complex traffic conditions, including foul weather and driving emergencies. You will learn how to quickly recognize hazards and how to deal with them.

## SECTION 4 - VEHICLE MAINTENANCE

This section deals with the various parts of the vehicle and how to determine when they are working properly. While it is not the purpose of this course to teach you to be a mechanic, a professional driver must be able to recognize an improperly working part of the vehicle, before it causes serious damage or even an accident, Your own safety as well as that of other highway users depends on you- having this knowledge. You will also learn how to safely and correctly perform basic, everyday types of vehicle servicing and simple maintenance tasks, as well as how to determine when the vehicle needs the attention of a skilled mechanic.

## SECTION 5 - NONVEHICLE ACTIVITIES

This section covers such things as cargo handling, hours of service regulations and other duties that must be handled properly by drivers to ensure the safety of themselves, the vehicle, its cargo and other highway users.

As stated earlier, these sections are divided into units and each unit consists of several lessons. Lessons are of four types, which are: classroom, lab, driving range and onstreet. The majority of the lessons involve practicing on the driving range or onstreet training. However, you must understand that your classroom training is very important as no company will want to hire you unless you know how to handle the "paperwork" that all professional drivers must be able to do. Also to be employable, you must know all the many laws and regulations which a truck driver must obey.

## ABOUT THIS MANUAL

This manual has been supplied to you for several important reasons. Treat it with care, always bring it to school every day, make notes of important things to remember and keep it after graduation as a helpful source of information on your new job.

The manual contains several types of material to help you in this training program, some of which are:

- What you will be expected to learn in each unit;
- What will happen in each unit, including outlines of classroom, lab, range and street lessons.
- Student aids, including checklists and any printed information that may be provided for a specific unit
- Preview information to help you prepare for some of the more complex classroom lessons
- Information to serve you as reference material both during school and after graduation

You will note that the page numbers in this manual (except for the Introduction section) are different from most books, in that they use several numbers. This is necessary because the manuals are constantly updated and therefore can't use regular page numbers.

The numbering system is a "code," so that materials can be quickly identified should it accidentally fall out of the binder. The way to read this four-number code is as follows:

FIRST NUMBER: shows the section number involved

SECOND NUMBER: shows the unit number involved

THIRD AND FOURTH NUMBERS: show the actual page number involved

For example, the code 4.2 - 18 means:
Section number 4
Unit number 2
Page number 18

# GLOSSARY AND LIST OF ABBREVIATIONS

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**abandon** To give up. For example, when consignee or shipper relinquishes or gives up damaged freight to carrier.

**A.C. generator** An electrical generator that generates voltage and current by rotating a magnetic field across stationary conductors. Also called alternator, it produces alternating current and uses diodes to change the alternating current to direct current. See **D.C. generator.**

**accelerate** To increase speed.

**accelerator pedal** Depresses accelerator to increase engine speed.

**acceptance** Receipt by the consignee of a shipment. This **termi -** nates the common carrier contract for transportation.

**accessorial service** A service rendered by a carrier in addition to a transportation service, such as stopping in transit to complete loading or to partially unload. Also heating, storage, etc.

**adapter, electrical** A device that allows a connection to be made between two items of equipment having different types of connectors Most often used to connect electrical lines, particularly a connection between the tractor and trailer, when one electrical line has four prongs and the other six prongs.

**adjustable axles** See **sliding tandem.**

**agency** Used interchangeably with call station but generally an agent picks up and delivers freight for an intercity carrier while a call station handles orders from shippers but performs no freight handling functions. See **call station.**

**agent** A person authorized to transact business for and in the name of another. A driver becomes an agent of the trucking company when signing for freight.

**aggregated shipments** Several shipments from different shipper to one consignee that are consolidated and treated as a single consignment.

**agitator body** Truck body designed and equipped to mix concrete in transit.

**agreed valuation** Freight value mutually agreed upon by shipper and carrier as a basis for transportation charges. It also may represent an agreed maximum amount that can be recovered in case loss or damage.

**agreed weight** A weight set and agreed upon by carrier and shipper as a basis for charges.

**air brakes** Brakes that utilize compressed air instead of fluid.

**air cleaner** Device for cleaning and purifying air entering engine. Also called **air filter.** There may be two, a primary a secondary.

**air compressor** Device to build up and maintain required air pressure in the brake system reservoir.

**air filter** Same as **air cleaner.**

**air filter restriction gauge** Registers the flow of air through the air filter element. Provides indication of filter's obstruction by dirt and other materials which would restrict the flow of air to the engine*

**air hose** See **air lines.**

**air intake distributing manifold** Distr butes air to the various cylinders of the engine and attaches to the cylinder heads at the intake ports.

**air-lift axle** An axle with an elevating device operated by air that enables the driver to regulate the amount of weight carried on that axle by raising or lowering it.

**air lines** Used to carry compressed air from one part of the air brake system to another and from tractor to the trailer, One line is called the **emergency** or **supply** line and is always charged with compressed air. The other line is called the **service** or **control** line. When the air brake treadle valve is depressed, air flows from the supply resevoir through the service 'line and causes the brakes to apply,

**air-over-hydraulic brakes** Brakes on a vehicle that have a regular hydraulic system assisted by air pressure.

**air pressure gauge** Measures pressure of air in air tanks in psi. If the pressure drops below 60 psi, a low pressure warning device (buzzer or light) will operate, indicating unsafe vehicle, Sometimes there are two. The second gauge indicates pressure used during braking.

**air reservoir** Storage tank for compressed air,

**air reservoir (trailer)** Storage tank for compressed air for the trailer brakes.

**air slider** A cab-controlled sliding fifth wheel that can be unlocked by air to be moved backward or forward. See **sliding fifth wheel.**

**air tag** A tag axle that has two bellows-like air bags that, when filled, force the tractor's rear axle harder against the ground for a smoother ride and for weight distribution between the two axles of the tractor.

**allowance** (1) A sum granted as a reimbursement or repayment. (2) A deduction from the gross weight or value of goods.

**alternating current** Electrical current that changes its direction of flow many times a second and is used in a building, as opposed to **direct current** as used on a vehicle.

**American Trucking Associations, Inc. (ATA)** A national federation of independent and automomous state trucking associations, each representing all classes and types of truck operation, and thirteen independent and automomous conferences, each of which represents a special class or type of truck operation. Headquarters location 1616 P Street, N.W., Washington, DC 20036.

**ammeter** An instrument that measures the amount of current flowing in an electrical current.

**ampere** Unit of measurement of flow of electrical current.

**application pressure air gauge** Gauge that indicates pressure being applied by brakes during brake operation. See **air pressure gauge.**

**A.P.U.** Authorized pickup.

**arrival notice** A notice, furnished to consignee, of the arrival of freight.

**articulated** Having parts connected by joints. A tractor-trailer is an articulated vehicle.

**assign** The transfer of property to another, frequently for the benefit of creditors.

**assignee** One to whom a right or property is transferred.

**assignor** One by whom a right or property is transferred to another.

**astray freight** Freight bearing marks indicating origin and destination, but separated from the waybill. See **overfreight.**

**automobile transporter body** Truck or trailer body designed for the transportation of vehicles.

**auxiliary transmission** A second transmission connected with the main transmission to provide a wider range of speeds and gear ratios.

**axle** The bar that connects opposite wheels. There are two types of axles: live axles, which transmit power from the drive shaft to the wheels, and dead axles, which do not transmit power and are used only to help carry the load or to steer.

**axle ratio** Ratio of axle to drive 'line; the number of turns of the drive line in relation to one full turn of the drive wheels. The higher the numerical ratio, the slower the road speed. See **gear ratio.**

**axle temperature gauges** Indicate temperature of lubricant in drive axles.

**axle weight** The amount of a rig's gross weight that rest on any one axle.

**back haul** (1) The return part of the trip; (2) the freight that is carried on the return portion of a trip; (3) a shipment that is carried back over part of a route that has been previously traveled.

**balloon freight** Light, bulky cargo.

**band ply** The first ply on the inside of a tire.

**base state** The state in which a vehicle is primarily registered.

**battery** An electrochemical device for storing and supplying electrical energy.

**BBC** The length of the tractor from the bumper to the back of the cab. Always stated in inches.

**bead** The inner edge of the outer wall of a rubber tire, fitting on the rim. The "foundation" of a tire. It is made of high tensile steel wires and wrapped and reinforced by the plies.

**bead-to-bead measurement** The distance from the heel of one bead straight up at 90" to the bead over the crown and down the other side to a position on the heel of the other bead directly opposite the starting point.

**belt drive axle** An axle driven by V-belts, which transmit power from the drive axle. See **V-belt drive.**

**berm** The shoulder of the road.

**bill of lading (B/L)** The written transportation contract between shipper and carrier (or their agents). It identifies the freight, who is to receive it and the place of delivery and gives the terms of the agreement. All goods going to a receiver at one destination in a single shipment or on one truck must be on a single bill of lading.

The straight bill of lading provides that freight be delivered to the receiver shown on the bill. It is non-neqotiable. Surrender of this type of bill of lading is not required except when it is necessary for the receiver to identify himself. This might be necessary, for example, for certain bonded goods such as liquor. Always printed on white paper.

The order bill of ladinq is negotiable. Its purpose is to enable a shipper to collect for the shipment before it reaches its destination. The shipper sends an original bill of lading and a draft for the charges through a bank. The receiver pays the carrier's agent the amount of the draft and then can receive the goods. With this method, the shipper customarily consigns the shipment to himself. The person or company to be notified at destination is specified. The shipment may be released to the receiver only upon the order of the shipper. The order bill of lading must be surrendered with delivery of the freight. Always printed on yellow paper.

Either straight or order bills of lading may be designated as "through." A through bill of lading covers shipment by more than one transportation company at a fixed rate for the entire service. More than one type of transportation company (such as truck and rail) may be utilized. Also see **clean bill of lading.**

**bill of sale** A contract for the sale of goods.

**billed weight** The weight shown in a freight bill.

**bingo card** (Slang) See **cab card.**

**birdyback** Transportation of highway freight containers -on aircraft.

**bl anketwaybill** A waybill covering two or more consignments of freight.

**blasting agents** See **HAZARDOUS MATERIALS.**

**bleed the air tanks** To drain the accumulated water out of the air tanks of a tractor to prevent the condensed water from reducing air tank capacity and thus cutting braking efficiency.

**bleed the fuel lines** To remove trapped air from the fuel lines.

**blind side** Right side of the truck and trailer, opposite of the **sight side.**

**blocking** Supports used to prevent cargo from shifting during transportation.

**blower** (1) A device that forces additional air into the engine to increase its efficiency and horsepower. Two types of blowers are the supercharger and the turbocharger; (2) fan that blows air over ice to maintain a low temperature in a trailer transporting perishable goods,

**blow-off valve** A regulatory valve on the air system that allows the escape of excess air pressure if the governor on the air compressor fails to operate.

**blue label** See **HAZARDOUS MATERIALS.**

**B.M.C.S.** See **BUREAU OF MOTOR CARRIER SAFETY.**

**bobtail** A tractor without a trailer; or a straight truck.

**bogey** Usually an axle added to tractor to carry more weight as for weight distribution. See **bogies.**

**bogies** An assembly of two or more axles, such as a tandem axle. See **tandem axle.**

**bonded warehouse** A warehouse approved by the U.S. Treasury Department and under bond or guarantee for the strict observance of the revenue laws. Also utilized for storing goods until duties are paid or otherwise released.

**bonnet** The protective covering over the air intake that keeps water or other substances from entering the air system; or the hood on any conventional type tractor.

**boomers** (Slang) See chain binders.

**boom it down** (Slang) Tighten chains around freight,

**bore** The diameter of a cylinder.

**bottlers body** Truck body designed for hauling cased, bottled beverages.

**bottom dump** Trailer body designed to dump its cargo through gates in bottom or floor of the trailer.

**brake drum** The rotating unit of the brake that is attached to the wheel.

**brake horsepower** The actual horsepower of an engine, measured by a brake attached to the drive shaft and recorded on a dynamometer.

**brake lining** A material designed to create friction that is attached to the brake shoe.

**brake shoe** The nonrotating unit of the brake (to which the brake shoe is attached) that contacts the rotating unit to supply braking force.

**braking distance** See **total stopping distance.**

**break bulk** To separate a composite load into individual shipments and route them to different destinations.

**break bulk point or terminal** A place where a composite load is separated into individual shipments and routed to different destinations.

**break the unit** (Slang) Uncouple the tractor from the trailer.

**bridge** The distance between one axle and another, or between two sets of axles. Used in some states to ascertain the permissible gross weight for the vehicle. Also called **spread.** See **spread tandem.**

**B-trains** A combination consisting of a tractor and two semi-trailers, the second trailer coupled to the first trailer by use of a fifth wheel, which is mounted directly behind the cargo body on the lead semi-trailer.

**bulk freight** Freight not in packages or containers.

**bulkhead** A metal or wooden device located on the back of the tractor or on the front of the trailer to keep loads from sliding forward and going through cab of tractor. Sometimes called a **header board.**

**burdened vehicle** In any situation, the vehicle which is required by law to yield right-of-way to another, "privileged" vehicle. See **privileged vehicle.**

**Bureau of Motor Carrier Safety (BMCS)** A part of the Federal Highway Administration, which is one of several administrations within the U.S. Department of Transportation that issues the Motor Carrier Safety Regulations (FMCSRs).

**bushing** A cylindrical metal sleeve inserted into a machine part for reducing the effect of friction on moving parts or for decreasing the diameter of a hole.

**buttress** The area on a tire between the edge of the tread and the sidewall.

**cab-alongside-engine** A tractor in which the cab is located alongside the engine (abbreviated CAE). Same as **cab-beside-engine.**

**cab-behind-engine** A tractor on which the cab is located behind the engine; a **conventional cab.**

**cab-beside-engine** Same as **cab-alongside-engine** (abbreviated CBE).

**cab card** Uniform Identification Cab Card in which the various State operating authorities and **permit** stamps are affixed. Called **bingo card** by drivers.

**cab, conventional** A tractor on which the cab is behind the engine. Also see **snub-nose.**

**cab-over-engine** A tractor on which the cab is **located** over the engine (abbreviated COE).

**call station** A person or company that agrees to transact business for a trucking **company** in a given **location, generally** a **location** where **terminal** facilities are not **justified. Call station handles** calls from shippers but **usually** performs no freight **handling function.** See **agency** .

**camber** Outward (or **inward**) tilt of wheels from true vertical.

**camel back body** Truck body with floor curving downward at the rear.

**carbon monoxide** (CO) A colorless, odorless, **highly** poisonous gas, produced by the **incomplete combustion** of fuel. It is **usually** expelled by the exhaust system.

**carburetor** That part of the gas **engine** fuel system where gasoline and air are mixed in **controlled** proportions.

**cargo** The **freight** carried by a vehicle.

**cargo manifest** See **manifest.**

**carrier** See **motor carrier.**

**carrier's lien** Right of a motor carrier to retain property which it has transported as security for the **collection** of freight charges.

**cartage** The charge made for **hauling** freight.

**cartage allowance** See **allowance.**

**casing** The tire structure, excepting tread and **sidewall** rubber.

**cast wheel** A casting that **includes** the hub and spokes at the end of which are studs, clamps and nuts that are used to support the rim.

**caster** Forward (or rearward) **inclination** of **kingpin** or support arm of wheel; amount of tilt in axle beam.

**center of gravity** The point within the length and width of a vehicle around which its weight is evenly distributed or balanced,

**centrifugal force** The force tending to pull a thing outward it is rotating rapidly around a center or rapidly rounding a curve.

**certificate of weight** An authoritative statement of the weight of a shipment prepared by a weighmaster.

**Certificate of Public Convenience and Necessity** Authority or certificate granted by the Interstate Commerce Commission to common carriers by railroad, motor vehicle, and water to operate in interstate commerce.

**cetane number** Rating applied to ignition properties of diesel fuel; the higher the number, the better the ignition quality. See **octane number.**

**chain binders** A device used to remove slack from chains used to tie down loads.

**charge it** (Slang) Allow compressed air to flow into semi-trailer lines.

**charges (payment of transportation charges)** Ordinarily, unless specific arrangements have been made, no carrier is permitted to deliver or relinquish possession at destination of any freight transported by it until all tariff rates and charges thereon have been paid. Carriers upon taking precaution deemed to be sufficient to assure payment of tariff charges may relinquish possession of freight in advance of payment of tariff charges and may extend credit in the amount of such charges for a period of seven days.

**chasing** Steering a tractor while backing so as to cause the tractor to follow (i.e., "chase") along the path of the trailer. Combines with "jacking" to allow the trailer to be maneuvered along the prescribed path. See **jacking.**

**chassis** The part of a motor vehicle that includes the frame, suspension system, wheels, steering mechanism, etc., but not the body and engine.

**check valve** Device to automatically isolate one part of air brake system from another. A one-way check valve provides free air flow in one direction only. A two-way check valve permits actuation of the brake system by either of two brake application valves

**circuit breaker** A device that automatically interrupts the flow of an electric current when the current becomes excessive.

**circuit (electrical)** A path through which electrical current can flow. A closed circuit provides a continuous, unbroken path from a current source through various current consuming devices back to the source (or a common ground). An open circuit occurs when the current path is interrupted or broken either by an open switch or

relay or by a broken wire or loose connection. A short circuit occurs when a damaged or loose wire accidently touches another damaged wire or some other conductive material. Current then takes a "short cut" to ground, bypassing part of its normal path. See **grounded circuit.**

**circuitous route** An indirect route.

**claim** (1) A demand for payment to compensate for freight damage that is supposed to have occurred while the cargo was in the bands of the carrier; (2) A demand for refund of an overcharge. See **overcharge.**

**claim agent** An employee who adjusts or settles claims made against his company.

**claim tracer** A request for information concerning the status of a claim,

**claimant** Person or company filing a claim.

**classification** (freight) A publication containing a list of articles and the classes to which they are assigned for the purpose of applying class rates together with governing rules and regulations.

**classification rating** The class to which an article of freight is assigned for the purpose of applying class rates.

**Class I Motor Carriers** Carriers having average gross operating revenues (including interstate and intrastate) of $5 million or more per year.

**Class II Motor Carriers** Carriers having average gross operating revenues (including interstate and intrastate) between $1 to $5 million per year,

**Class III Motor Carriers** Carriers having average annual gross operating revenues (including interstate and intrastate) of less than $1 million per year.

**clean bill of lading** A bill of lading signed by the carrier for receipt of merchandise in good condition (no damage, loss, etc., apparent), and which does not bear such notation as "shipper's load and count."

**clean bore tank** A single tank without compartments inside,

**clear record** A record which shows that a shipment was handled without loss or damage.

**clearance lights** The small lights that outline a vehicle's length and breadth. The lamps at the front and sides are amber; those visible from the rear are red. Also called marker or running lights. Also see **identification lights.** Required by the F.M.C.S.R. on vehicles 80 inches or more in width.

**clearing house** An organization set up to process and collect bills for participating trucking companies.

**cleat** A strip of wood or metal used for additional strength; to prevent warping; or to hold something in position.

**clutch** The part of the power train that allows the driver to connect the engine to the wheels.

**C.O.D.** See **collect shipment.**

**collect shipment** A shipment where collection of freight charges and advances are made by the delivering carrier upon delivery. Abbreviated as COD and commonly called COD by truckers.

**combination rate** A freight rate made through rates by combining two or more rates published in different tariffs.

**combination through rate** A through rate made by combining two or more rates published in different tariffs.

**combination vehicle** A truck or truck-tractor coupled to one or more trailers, also referred to as a "rig." See **rig.**

**combustible** Able to catch fire and burn easily.

**combustible liquids** See **HAZARDOUS MATERIALS.**

**combustion** Burning.

**commodity** Any article of commerce. Goods shipped.

**commodity, exempt** One that may be transported in interstate commerce without operating authority or published rates.

**common carrier** A transportation business that offers service to the general public. Interstate common carriers must hold a franchise issued by the Interstate Commerce Commission. This franchise limits service to a specific geographical area. Rates also are regulated. Routes and schedules of regular common carriers are regulated by government agencies, but irregular route common carriers may set their own without regulatory approval. Most states also regulate common carriers.

**compression ratio** Volume of air above the piston at bottom dead center compared with volume of air at top dead center.

**compression stroke** A phase of the four-stroke cycle when the air-fuel mix is compressed.

**compressor** See **air compressor.**

**concealed damage** A damage to the contents of a package which is apparently in good condition externally.

**concealed loss** Loss or damage that cannot be determined until the package is opened.

**condenser** An element usually found in the distributor (in gasoline engine ignition systems) that stores electricity for a short period of time.

**connecting carrier** Motor carriers which interchange trailers with another for completion of shipments.

**connecting rod** Rod that connects the piston to the crankshaft.

**consign** To send or address goods to another*

**consignee** One to whom something is shipped.

**consignee marks** A symbol placed on packages for export, consisting of such things as a square, triangle, diamond circle, cross, etc. with designed letters and/or numbers for the purpose of identification.

**consignment** A shipment.

**consignor** The person by whom articles are shipped (also known as the shipper).

**container** Anything in which articles are packed.

**container (van body type)** A truck or trailer body provided with means for ready removal from and attachment to a vehicle.

**containerization** Shipping system based upon large cargo-carrying containers that easily can be interchanged between trucks, trains and ships without rehandling the contents,

**continuous seal** A term denoting that the seals on a truck remained intact during the movement of the truck from origin to destination; or, if broken in transit, that it was done by proper authority and without opportunity for loss to occur before new seals were applied.

**contraband** Illegal or prohibited traffic or freight.

**contract carrier** A company that engages in for-hire transportation of property under individual contract or agreement with one or a limited number of shippers.

**control (air line)** See **air lines.**

**converter gear or dolly** The coupling device composed of one or two axles and a fifth wheel by which a semi-trailer can be coupled to the rear of a tractor-trailer combination, forming a double-bottom rig.

**convertible** A truck or trailer that can be used either as a flat-bed or open top by means of removable side panels.

**convex mirror** A type of mirror having a convex shape in order to show a larger field of view than can be obtained from a flat mirror of the same size.

**cords, tire** Strands forming the plies in a tire.

**core** On a radiator, a tubular fin structure acting as a heat exchanger for engine cooling fluids.

**corrosive material** See **HAZARDOUS MATERIALS.**

**cowl** Metal structure supporting dash and windshield.

**crankshaft** A shaft within the engine having one or more cranks for transmitting motion; the connecting rods transmit motion between the pistons and the crankshaft.

**creeper gear** (Slang) Lowest gear or combination of gears used for extra power.

**cubic capacity** The carrying capacity of a truck measured in cubic feet.

**cubic foot** A common measure of the capacity of a truck, 1,728 cubic inches.

**curb weight** The weight of. an empty tractor-trailer minus driver and cargo but including fuel, oil, and all standard equipment.

**current regulator** A device that controls the amperage output of a generator.

**custom house** The government office where duties, tolls, import, or export taxes are paid.

**cutout relay** A magnetic switch used to open and close the electric circuit between the battery and the generator.

**cylinder** A chamber in the engine block that contains a piston.

**Dangerous Articles** See definitions under **HAZARDOUS MATERIALS.**

**Dangerous Goods** See definitions under **HAZARDOUS MATERIALS.**

**D.C. Generator** An electrical generator that generates voltage by rotating a conductor across a stationary magnetic field. Producing alternating current like an A.C. Generator, the D.C. Generator uses a mechanical device called a commutator, to convert the alternating current to direct current. See **A.C. generator.**

**dead axle** An unpowered axle used to increase the legal weight capacity of a vehicle.

**dead-heading** Running empty, without cargo,

**defensive driving** Driving in a way that avoids conflicts that may be caused by the mistakes of others while making no mistakes yourself.

**delivering carrier** The transportation company that delivers a shipment.

**delivery** The act of transferring possession of a shipment. This could be from consignor to carrier, one carrier to another or carrier to consignee.

**demurrage** Detention of a freight vehicle or container beyond a stipulated time. Also the payment made for such delay.

**density** The weight of an article per cubic foot. The ratio of mass to bulk or volume.

**Department of Transportation (DOT)** The federal agency responsible for the administration of the Federal Motor Carrier Safety Regulations. See **Bureau of Motor Carrier Safety.**

**depth perception** The ability to judge distances.

**destination** The place to which a shipment is to be delivered.

**detention** See **demurrage.**

**diesel engine** An internal combustion engine that uses compression to raise air temperature to the igniting point, whereas fuel is ignited by a spark in a gasoline engine.

**differential** The part of the power train that permits one wheel to turn at a different rate of speed from the other, as occurs when going around a turn.

**differential lock, interaxle type** Used on twin-screw tractors, this valve can be set to 'lock both rear axles together so that they pull as one for off-the-road operation. Never used for over-the-road operation*

**direct current** Electrical current that always flows in one direction only and is the type used in automotive equipment.

**direct drive** Refers to a condition in which the transmission is in a gear having a 1:1 ratio, that is, when the engine crankshaft is turning at the same rate as the vehicle drive shaft. See **overdrive** and **underdrive.**

**disc brakes** Brakes that function by causing friction pads to press on either side of a disc rotating along with the wheel.

**disc wheel** A single unit that combines a rim and a wheel.

**dispatcher** Person in charge of dispatching.

**dispatching** The scheduling and control of intercity traffic and intracity pickup and delivery.

**distributor** A device for distributing electric current to the spark plugs of a gasoline enginer so that they fire in the proper order,

**diversion** A change made in the route of a shipment in transit. See **reconsignment.**

**divert** To change the route of a shipment in transit. See **reconsignment.**

**dock** A platform where trucks load and unload.

**dock receipt** A receipt given for a shipment received or delivered at a pier or dock. Whe delivery of a foreiqn shipment is completed, the dock receipt is surrendered to the transportation line and a bill of lading is issued.

**document** Anything printed, written, etc., relied upon to record or prove something.

**documentation** (1) the supplying of documents; (2) the documents that are supplied.

**dolly** A small platform mounted on wheels that is used in a warehouse to move objects. Also used in reference to (1) The coupling device composed of one or two axles and a fifth wheel used to convert a semi-trailer to a full trailer so it can be coupled to the rear of a tractor-trailer unit, making the combination into a double-bottom rig; (2) landing gear on a trailer.

**D.O.T. HAZARDOUS MATERIALS SHIPPING LABELS** See **labels, D.O.T. HAZARDOUS MATERIALS WARNING.**

**D.O.T. HAZARDOUS MATERIALS WARNING LABELS** See **labels, D.O.T. HAZARDOUS MATERIALS WARNING.**

**D.O.T. PLACARDS** See **placards, D.O.T. HAZARDOUS MATERIALS WARNING**

**double-axle** See **tandem axle.**

**double-clutching** Shifting the gears of a nonsynchronized truck transmission without clashing them, by depressing and releasing the clutch pedal twice.

**double drop frame** A drop frame trailer with one drop behind the kingpin and one in front of the rear axles. See **drop frame.**

**double-reduction rear axle** A rear end that reduces the drive line rpm in relation to the rear wheel rpm by means of a double

reduction of gears. Used where very slow speed is needed. Two reductions are made in the differential. See **gear ratio.**

**double bottoms** See **doubles.**

**doubles** A combination vehicle consisting of a tractor, a semi-trailer and a full trailer, coupled together. Also called **twins, twin trailers** and most often **double bottoms.**

**drag line** A method of moving freight carts around a carrier's terminal. Refers to a moving cable (the line) that operates either from a suspended position overhead or in a slot in the floor. The line supplies the motive power (drag) to the carts when they are attached to the line.

**drain lines** In some fuel systems, unburned fuel is returned to the supply tank through the drain lines, Not found on all tractors.

**drayage** The charge made for carting, draying, or trucking freight.

**drive axle** An axle that transmits power to the wheels. A drive axle is a powered axle that actively pulls the load.

**drive shaft** A heavy-duty tube that connects the transmission to the rear end assembly of the tractor.

**drive train** A series of connected mechanical parts for transmitting motion.

**drivers** (Slang) The drive wheels of a tractor.

**driver's duty status record book** See **log book, driver's daily.**

**driver's log** See **log book, driver's daily.**

**dromedary tractor** A tractor with a cargo body placed between the fifth wheel and the cab.

**drop frame** A trailer frame that drops downward to increase cargo capability without increasing the vertical clearance of the vehicle. Consists of two types: single drop and double drop.

**drop it on the nose** Uncoupling a tractor from a semi-trailer without lowering the landing gear to support the trailer's front engine.

**drop the body** (Slang) Unhook and drive a tractor away from a parked semi-trailer.

**dry freight** Freight that does not need to be shipped at a specific temperature to prevent spoilage.

**dry tank** Part of brake system. Air passes from wet tank to dry tank. Dry tank is the air reservoir from which the air is drawn for operating the brake system.

**duals** A pair of wheels and tires mounted together on the same side of one axle.

**dummy coupler** A fitting used to seal the opening in an air brake hose connection (glad hands) when the connection is not in use. Sometimes called a dust cap.

**dump body** Truck or trailer body of any type which can be tilted to discharge its load.

**dunnage** The material used to protect or support freight in trucks. The weight of **dunnage** is shown separately on the bill of lading since it is material used around a cargo to prevent damage. Often it is transported without charge.

**dusk** The beginning of darkness in the evening.

**dust cap** See **dummy coupler.**

**dust shield** Sheet metal shield on brake assembly used to keep debris from brakes.

**duty** A tax levied by a government on imports and exports.

**dynamometer** A device for measuring the work output of an engine. See **brake horsepower.**

**electrical line adapter** See **adapter.**

**electrolyte** A chemical solution (usually sulfuric and water) that covers the positive and negative plates in the cells of an automotive storage battery, it reacts with the chemicals of the plates to produce voltage and current flow.

**elevator** (Slang) A hydraulic or electrically powered end gate on a truck or trailer.

**embargo** To resist or prohibit the acceptance and handling of freight. A formal notice that certain freight will not be accepted.

**emergency (air line)** See **air lines.**

**emergency brake release** Will override the spring brake control in the event air pressure is lost. You must hold it while pulling out on the spring brake control. For emergency use only.

**emergency stop** See **stop and emergency stop.**

**emission** Refers to gases and other materials vented to the atmosphere by the exhaust system.

**encroachment** The act of intruding or going beyond the proper limits, such as encroachment on another lane of traffic.

**engine water jackets** Hollow chambers that surround the cylinders and other parts exposed to high temperatures in the engine. They circulate coolant around engine parts to cool them.

**enroute** On the way to a destination.

**enroute inspection** See **inspection.**

**entry (customs)** A statement of the kinds, quantities, and values of goods imported together with duties due, if any, and declared before a customs officer or other designated officer

**environmental** Relating to the environment (air, water, land). Air and water pollution are environmental problems.

**escape ramp** A ramp on a steep downgrade that can be used by a truck driver to stop a runaway truck when brakes have failed. The ramp often has a soft gravel surface and forms a steep upgrade to stop the truck. Sometimes called a runaway truck ramp.

**ether** Substance used as a starting aid for diesel engines in freezing or subfreezing weather.

**etiologic agents** See **HAZARDOUS MATERIALS.**

**evasive** Tending or seeking to evade. Evasive action is action taken to evade or escape from a problem, danger, or hazard.

**excess freight** Freight in excess of the quantity shown on freight bill.

**exchange bill of lading** A bill of lading issued in exchange for another bill of lading.

**exclusive use of truck** A request made by a shipper on the bill of lading for the sole use of a vehicle, i.e., no other freight to be carried.

**exempt carrier** Trucks hauling certain commodities are exempt from Interstate Commerce Commission economic regulation. By far the largest portion of the exempt carriers transport agricultural commodities or seafood.

**exhaust manifold** That part of the exhaust system that carries the exhaust gases from the cylinders to the exhaust pipe.

**exhaust pipe** Pipe connected to muffler through which exhaust gases are released. See **tailpipe** and **stack.**

**exhaust ports** Connecting passages from the inside to the outside of the cylinder heads.

**exhaust stroke** Phase of the four-stroke cycle when waste gases are pushed out the exhaust valve.

**exhaust valves** Open to discharge the burned gases from the combustion chambers.

**expandable (trailer)** Flat bed trailer which can be expanded beyond its regular length to carry larger shipments.

**expediting** To accelerate a process. Expedited freight service is usually superior to normal service. Dispatching less than truckload quantities on a single truck for quick delivery is an example of expedited service. Such service frequently necessitates payment of "exclusive use of vehicle" freight charges.

**explosives** See **HAZARDOUS MATERIALS.**

**export** To send goods to a foreign country.

**external contracting brake** A type of brake in which the brake shoes contract against the outside of the brake drum.

**eye lead time** Term used to describe the distance that a driver is looking ahead on the road. A 12-second eye lead time means that the driver is looking ahead the distance he will travel in I2 seconds' time.

**Federal Highway Administration (FHWA)** Part of the U.S. Department of Transportation. See **Bureau of Motor Carrier Safety.**

**Federal Motor Carrier Safety Regulations (FMCSR)** Governs the operation of trucks and buses being operated in interstate or foreign commerce by common, contract and private motor carriers. Among other things, the FMCSR specifies insurance requirements, driver qualifications, driving of motor vehicles, hours of service for drivers, reporting of accidents, inspection and repair of vehicles as well as parts and accessories needed for safe operation.

**false billing** Describing freight on shipping documents so as to misrepresent the actual contents or weight of shipment.

**fifth wheel** The coupling device located on the tractor's rear frame that is used to join the front end of the trailer to the tractor. It is a flat, rounded plate with a V-shaped notch in the rear.

**first aid** The immediate and temporary care given the victim of an accident or sudden illness until the services of medical personnel can be obtained.

**fishy-back** Transportation of truck trailers or highway freight containers on ships or barges.

**fixed charges** Carrier costs that do not vary with an increase or decrease in traffic. An accounting classifications.

**flammable gas** See **HAZARDOUS MATERIALS.**

**flammable liquids** See **HAZARDOUS MATERIALS.**

**flap, tire** Used in tube type tires, it is a piece of rubber that separates the tube from the bead seat.

**flat bed** See **low bed.**

**flexi-van** Trailers with detachable container bodies that are loaded on specially constructed flat cars equipped with two turntables.

**float** Flat bed semi-trailer.

**F.M.C.S.R.** See **Federal Motor Carrier Safety Regulations.**

**fog lamps** Auxiliary headlights for use during fog and mist.

**foot brake valve** Valve which the driver depresses with his foot, which controls the amount of air pressure delivered to or released from the brake chambers. Also called a **treadle valve.**

**forklift** A machine used to move goods loaded on pallets or skids.

**forklift truck** A self-propelled vehicle for lifting, stacking, etc., heavy objects that may be loaded on pallets or skids; it consists typically of projecting prongs that are slid under the load then raised or lowered.

**four-by-four** (Slang) J-speed transmission and 4-speed auxiliary transmission.

**frame** A metal support for the body, power unit, and running gear; the backbone structure around which the vehicle is assembled. Contains the engine mounts, fuel tank supports, etc.

**free on board** Delivered (by the seller) aboard the train, ship, truck, etc., at the point of shipment, without charge to the buyer. Usually indicates place where responsibility for expenses and risk for goods is passed from seller to buyer. For example, F.O.B. motor carrier would usually mean that a price quoted for goods would include loading on a truck at the seller's building. This term is not always used precisely, and it is best to qualify it to show exactly what is covered. Abbreviated F.O.B.

**free time** The time period freight is held before storage charges are applied.

**free-astray** A shipment miscarried or unloaded at the wrong terminal is billed and forwarded to the correct terminal free of charge because it is astray. Hence the term "free-astray." See **astray freight.**

**freight** Anything being transported.

**freight bill** Document for a common carrier shipment, Gives a description of the freight, its weight, amount of charges, the rate for charges, taxes and whether collect or prepaid. If the charges are paid in advance or are to be collected at the origin, it is called a prepaid freight bill. If charges are to be collected at destination, it is called a destination or collect freight bill.

**freight charge** Payment due for freight transportation.

**freight claim** A demand upon a carrier for the payment of overcharge or loss or damage sustained.

**freight forwarder** A company that assembles small shipments from various shippers into larger shipments, usually full truck or car load. Forwarders send these consolidated shipments to a station where they are disassembled and routed to the proper destinations. The stations are called break bulk stations. Forwarders try to make up a full truck or car load shipment to take advantage of the better rate for a full load.

**friction** The resistance to motion of two moving objects or surfaces that touch.

**front brake limiting valve** Found only on tractors having brakes on the front axle. Limits amount of braking force applied to the front axle brakes under conditions where locking up the front brake might adversely affect the driver's ability to safely steer the vehicle. Usually controlled by a two-way switch mounted on the dashboard. When in "Dry Road" position, limiting valve is not operating. In "Slippery Road" position, the valve is in full operation (only found on the pre 1975 model tractors).

**front haul** (1) The front portion of a trip, from start to destination; (2) Freight carried on the front portion of the trip. See **back haul.**

**fuel filter** Device for cleaning engine fuel.

**fuel gauge** Registers amount of fuel in fuel tank. One for each tank.

**fuel pump** Pump that moves a fuel from the fuel tank to the engine.

**full capping** Application of new rubber to the tread area and some distance down the buttress of a used tire.

**full trailer** A trailer with both front and rear axles; used as the second trailer in a double-bottom rig or hooked behind a straight, truck to form a truck-trailer combination. A semi-trailer can be converted into a full trailer by the use of converter dollies. See **semi-trailer.**

**furniture van body** Truck body designed for the transportation of household goods; usually a van of drop-frame construction.

**fuse** A wire or strip of easily melted metal, usually set in a plug, placed in a circuit as a safeguard; if the current becomes too strong, the metal melts, thus breaking the circuit.

**fusee** A colored burning flare used as a signal to warn other road users.

**G.B.L.** Government bill of lading.

**gasket** A thin piece of material installed in a joint to prevent leakage.

**gateway** A point at which freight moving from one territory to another is interchanged between transportation lines.

**gear box temperature gauge** Indicates temperature of lubricant in transmission.

**gear pump** Located at the rear of the fuel pump. Driven by the fuel pump main shaft. Consists of a single set of gears to pick up and deliver fuel throughout the fuel system. From gear pump, fuel flows through the filter screen and to the pressure regulator.

**gear ratio** The relationship of the number of teeth on or revolutions of one gear to the number of teeth on or revolutions of the gear with which it is engaged.

**generator** Device that converts mechanical energy to electrical energy by means of electromagnetic induction. Automotive generators use the mechanical force of engine rotation to produce voltage and electrical current. See **A.C. GENERATOR** and **D.C. GENERATOR.**

**glad hands** Connectors mounted on the front of a trailer for connecting air lines from the tractor.

**goods** Merchandise.

**gooseneck** The curved section of a trailer frame that includes the kingpin and the fifth wheel apron.

**governor (air)** Device to automatically control the air pressure being maintained in the air reservoirs. Keeps air pressure between 90 and 120 psi, Prevents excessive air pressure from building up.

**governor (fuel)** A system of springs and weights with two functions: maintains sufficient fuel for idling with the throttle control in "Idle" position, and cuts off fuel above maximum rated rpm,

**grain body** Low side, open-top truck body designed to transport dry flowable commodities.

**groove** On a tire, the space between adjacent tread ribs.

**grounded circuit** A circuit in which a damaged wire or other current carrying device accidentally touches the vehicle frame or some metal object connected to the vehicle ground. See **circuit.**

**gross combination weight** The weight of the tractor, trailer, and cargo (abbreviated GCW).

**gross ton** 2,240 pounds. More commonly called a long ton.

**gross vehicle weight** The weight of an empty tractor or trailer (abbreviated GVW).

**gross weight** (1) The weight of an article together with the weight of its container and the material used in packing; (2) as applied to a truck, the weight of a truck together with weight of its entire contents. See **gross vehicle weight** and **gross combination weight.**

**half-cab** A tractor having only a half of a cab along the left side of the engine.

**half capping** Application of new rubber only to the tread area of a used tire. See **full capping.**

**hand throttle** A manually set throttle in a tractor that is used to maintain a certain engine speed. See **throttle.**

**hand valve** The valve that controls only the trailer brakes. See **trailer brake.**

**hazard** A source of danger.

**hazardous** Involving risk or danger to persons or property.

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**HAZARDOUS MATERIALS** The various substances (materials, chemicals, gases, etc.) which the U.S. Government agencies have determined could cause harm or danger to public health and safety when being transported improperly. There are approximately 24 different DOT transport related, broad types or classifications of hazardous materials all of which have strictly enforceable laws or regulations covering such things as types of containers or packages to be used for shipping, the labeling of the packages and/or the placarding of the vehicles, among other requirements. The hazardous material classifications and an example of each are as follows:

**blasting agents** Any material designed for blasting that is not easily detonated, such as ammonium nitrate fuel oil mixture.

**combustible liquid** A liquid that can be burned such as furnace oil, also see **Flammable Liquids.**

**corrosive material** A substance which will eat away or "burn" your skin such as battery acid.

## Hazardous Materials (Cont 'd)

**etiologic agent** Items which are likely to cause diseases in human beings shipped for laboratory analysis.

**explosives, Class A** An example is dynamite.

**explosives, Class B** An example is special fireworks.

**explosives, Class C** An example is small arms ammunition.

**flammable gas** Any gas (or vapor) usually kept under pressure and which easily catches fire such as propane gas used for cooking.

**flammable liquid** A liquid that catches fire very easily such as gasoline. Also see **COMBUSTIBLE LIQUID.**

**flammable solid** A solid material that catches fire easily such as charcoal.

**irritating material** A liquid or solid material which when exposed to air or fire gives off dangerous or very irritating fumes such as tear gas used for riot control.

**non-flammable gas** A gas (or vapor) usually kept under pressure and does not burn such as nitrogen used in trailer refrigerator systems.

**organic peroxide** A substance which is a strong oxidizing agent and fire hazard commonly used in the bleaching of leather.

**oxidizer** A substance which gives off oxygen which makes it a fire hazard such as ammonium nitrate which is used as a fertilizer by farms.

**poison A** Any liquids or gases that are extremely dangerous to human life, an example of which is hydrorganic acid (prussic acid) used in the making of pesticides.

**poison B** Less dangerous poisons than POISON A but are still dangerous to human health such as arsenic used for pesticides.

**radioactive material** Any material which gives off atomic radiation such as fuel in nuclear powered electrical generating plants.

**ORM (other regulated material)** Any substance which poses a human health and safety risk and which does not fit any of the other hazardous materials classes. There are 5 classes of ORM which are:

**Hazardous Materials** (Cont'd)

ORM-A Any material which can cause an uncomfortable reaction in human beings exposed to it such as chloroform.

ORM-B Any substance which can cause damage to the transport vehicle if leaked during transport such as mercury.

ORM-C Any substance which does not fit the ORM-A or ORM-B classification but which makes it unfit for transportation unless properly prepared such as bleaching powder.

ORM-D Any material packaged in small quantity for consumer use that would otherwise be subject to the hazardous material classifications, but due to the fact it is packaged in small quantities poses a minimum risk, such as small cans of cigarette lighter fluid.

ORM-E Any substance which is not included in any of these other hazardous materials classes but which is subject to the Hazardous Materials Regulations such as some forms of Hazardous Waste. Example - sludqe from manufacturing procedures and Hazardous Substances such as materials used to el iminate fungus.

**spontaneously combustible material (solid)** Any solid substances which, when exposed to air may increase in temperature and/or catch fire, such as wet hay.

**water reactive material (solid)** Any solid material (including sludges or pastes) which when accidently gotten wet may catch fire and/or give off unhealthy gases such as magnesium metal used in making car engines.

**waste, hazardous** Materials that are hazardous which are being shipped to a disposal site or dump, and which requires special shipping manifest papers as required by the U.S. Environmental Protection Agency.

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**haz mat** Nickname for **HAZARDOUS MATERIALS.**

**hazardous shipping labels** See **labels, D.O.T. HAZARDOUS MATERIALS WARNING.**

**hazardous warning labels** See **labels, D.O.T. HAZARDOUS MATERIALS WARNING.**

**hazardous warning placards** See **PLACARDS, D.O.T. HAZARDOUS MATERIALS WARNING.**

**haz mat placards** See **PLACARDS, D.O.T. HAZARDOUS MATERIALS WARNING.**

**headache rack** (Slang) Heavy bulkhead mounted behind the cab to protect it from a shifting load.

**header bar** A hinged, rear cross piece on open-top trailer, that can be swung out of the way to load high objects.

**header board** See **bulkhead.** Also known as headache rack (slang).

**heater service** Heat protection of freight that would be damaged by freezing.

**high-cube** A truck body or semi-trailer with above average cubic content. Usually constructed with low floors and thin walls.

**hi-low** Nickname for a forklift truck.

hole (Slang) A shift position in a gear box, e.g., low hole means the lowest gear.

**hopper body** Truck or trailer body capable of discharging its load through a bottom opening without tilting.

**horse van body** Truck designed for the transportation of valuable saddle horses.

**hose tenders** Devices that keep air and electrical lines between the tractor and trailer suspended and out of the way. Also known as "pogo sticks."

**hot load** (Slang) Rush shipment of cargo.

**hydraulic brakes** Brakes that depend on the transmission of hydraulic pressure from a master cylinder to the wheel cylinders.

**hydrometer** An instrument used to determine the state of charge of a battery.

**hydroplaning** Action produced by water on the roadway, in which tires lose traction (contact with the road) and skim along the water's surface, thus causing dangerous loss of directional control.

**ICC** See **Interstate Commerce Commission.**

**identification lights** Three lights mounted in a row on vertical centerline of the vehicle front and rear. Front lights are amber. Rear lights are red. Required by FMCSR on vehicles 80 inches or more in width. Also see **clearance lights.**

**ignition coil** A part of the electrical system that converts low voltage electricity to high voltage electricity.

**import** To receive goods from a foreign country.

**in bond** Merchandise on which a duty or import tax is still due (unpaid) is referred to as "in bond." Bonding guarantees that the duty will be paid to the government.

**initial carrier** The tranportation line that picks up a shipment from the shipper; in other words, the "first" carrier.

**initial point** The point at which a shipment originates.

**injector** A device found in a diesel engine that changes liquid fuel oil into a mist or spray and meters it to each cylinder.

**injector pump** A pump used to deliver fuel to the injectors under very high pressure.

**inspection (vehicle)** Checking over the vehicle parts and systems for problems and malfunctions and to see that everything is in order and in place. Pre-trip inspection is a thorough inspection done before the trip. Enroute inspections are made periodically during the trip. Post-trip inspections are done after the trip, so that problems and malfunctions can be reported to maintenance personnel.

**instruments** Devices for indicating or measuring conditions, performance, position, direction, etc.

**insulated body** Truck or trailer body designed for transportation of commodities at controlled temperatures. It may be equipped for refrigeration, heating or both.

**insurance** A contract binding a company to indemnify an insured party against a specified loss or damage. Motor carriers purchase many types of insurance, including cargo insurance, property damage insurance, public liability insurance, and workmen's compensation insurance.

**intake manifold** That part of the fuel system that carries the air or air/fuel mixture to the cylinders.

**intake ports** Provide the connecting passages from the outside of the cylinder heads to the inside head openings (the valves).

**intake stroke** Phase of the four-stroke cycle when fuel and air enter the cylinder.

**intake valves** Valves used in an engine to admit air into the combustion chambers of the cylinders.

**interaxle differential lock** See **differential lock.**

**interchange point** A station at which freight in the course of transportation is delivered by one transportation line to another.

**interline freight** Freight moving from point of origin to destination over the lines of two or more transportation companies.

**interline waybill** A waybill covering the movement of freight over two or more transportation lines.

**internal combustion engine** Any engine that burns fuel within itself, as a source of power.

**internal expanding brake** A type of brake designed with the brake shoes on the inside of the braking drum to expand against the inner surface of the drum.

**interstate** Between states. See **intrastate.**

**Interstate Commerce** The Interstate Commerce Act defines interstate as transportation from one state or territory of the United States or the District of Columbia to any other, or from any place in the United States through a foreign country to any other place in the United States, or from or to any place in the United States.

**Interstate Commerce Act** An Act of Congress regulating the practices, rates and rules of transportation lines engaged in handling interstate traffic.

**Interstate Commerce Commission** The Federal agency charged with enforcing the Acts of Congress affecting interstate commerce.

**intrastate** Within the borders of a State. See **interstate.**

**Intrastate Commerce** Transportation having origin, destination and entire transportation within the same State.

**invoice** (I) An itemized list of goods shipped to a buyer stating quantities, prices, fees, shipping charges, etc., often with a request for payment; (2) a shipment of invoiced goods,

**irritating material or irritant** See **HAZARDOUS MATERIALS.**

**jacking** Turning a tractor while backing so as to cause the trailer to assume a "jackknife" position. Combines with "chasing" to allow the trailer to be steered along the prescribed path. See **chasing.**

**jacking it around** Backing a semi-trailer around a very sharp curve.

**jackknife** (1) To place the trailer at a sharp angle to the tractor; (2) a type of skid in which either the tractor or the trailer loses traction and slides sideways.

**Jake Brake** (Slang) The Jacobs engine brake. Used as an auxiliary braking device on a tractor. Builds up back pressure in the engine by preventing the exhaust from escaping so that the engine slows.

**Jeep wheel** See **joe dog.**

**joe dog** Device with a dead axle that converts a single-axle tractor to a tandem-axle tractor. It hooks over the tractor's fifth wheel, replacing it with another for the semi to be hooked onto.

**Johnson bar** Type of **prybar** used to maneuver heavy cargo.

**jumped the pin** Missing the fifth wheel pin on the trailer when coupling tractor to trailer.

**kingpin** The bolt-like device on the underside of the front of a semi-trailer that fits into the tractor's fifth wheel to couple the tractor and the trailer together.

**kingpin weight** Weight of the trailer at the kingpin or the trailer weight applied to the fifth wheel.

**knocked down** A freight classification term denoting that an article is partially or entirely taken apart (not **set up**). Abbreviated KD.

**known damage** Damage discovered before or at the time of delivery of a shipment.

**known loss** Loss discovered before or at the time of delivery of a shipment.

**labels, D.O.T. HAZARDOUS MATERIALS WARNING** A regulation type label (or sticker) that is required to be placed on any package/container of hazardous materials which identifies the type of hazard.

**laden weight** The weight of a vehicle and its cargo. See **gross weight.**

**lading** That which constitutes a load. The freight in a vehicle.

**landing gear** A slang term for the support legs that hold up the front end of a semitrailer when it is disconnected from a tractor. See **dolly.**

**layover** To take a rest period of eight or more hours before continuing trip, or any extended off-duty period away from the home terminal.

**layover time** The non-working time that a road driver spends away from his home terminal before being dispatched to some other destination.

**lead-acid battery** A commonly used automotive battery in which the active materials are lead, lead peroxide, and a solution of sulfuric acid. See **storage battery.**

**less-than-truckload rate** Refers to cargo shipments of less than truckload size and weight; usually handled at proportionately higher rates and freight charges. Abbreviated LTL.

**liable** Legally bound or obligated to make good any loss or damage that occurs.

**liability** Anything for which a person is liable.

**lien** A 'legal claim upon goods for the satisfaction of some debt or duty.

**line haul** The movement of freight between major cities or terminals. Line haul operations do not include pick-ups or deliveries. Line haul service is also commonly referred to as over-the-road (abbreviated OTR) operations or "runs".

**live axle** Same as **drive axle** or **powered axle.**

**livestock body** Truck or trailer designed for the transportation of farm animals.

**lock ring** In three-piece wheel rims, the lock ring holds1 the side ring firmly on the rim base.

**log** See **log book.**

**log body** Truck or trailer body designed for the transporation of long items. See **pole trailer.**

**log book, driver's daily** A legal record kept by interstate truck and bus drivers in which they make entries showing their daily number of hours worked, vehicles driven, etc. The maintenance of such records is required by the Federal Motor Carrier Safety Regulations. Recently the name was officially changed to **Driver's Duty Status Record Book.**

**long ton** 2,240 pounds. Al socall ed a **gross ton.**

**louver** Opening in cab, hood radiator sheel, or compartment for the purpose of ventilating.

**low bed** An open trailer with drop frame construction used primarily to haul heavy equipment. Also known as flat bed or low boy.

**low boy** See **low bed.**

**low-air-warning device** Any mechanical means of warning a truck driver that his vehicle is not maintaining the proper amount of air pressure needed to operate the brakes, etc. Can be a buzzer, a flashing red light on the instrument panel, or a small red metal flag that drops into the driver's line of vision.

**low cab forward** A tractor with the cab mounted forward of the engine to allow cab entry height to be reduced for ease of entry and exit.

**lumber body** Platform truck or trailer body with rollers designed for the transportation of lumber.

**manifest** A document describing a shipment or the contents of a vehicle or ship.

**marker lights** Also called clearance or running lights. See **clearance lights.**

**marks** Letters, numbers, and/or characters placed on a package for purposes of identification.

**memorandum bill of lading** A duplicate copy of a bill of lading.

**mile** 5,280 feet.

**mileage** Distance in miles.

**minimum rate** The lowest lawful rate that may be charged for transporting a shipment.

**minnie** (Slang) Less than 100-pound shipment.

**mixed truckload** A truckload of different freight articles combined into a single shipment.

**mode** Frequently used to refer to the basic divisions of the transportation industry. The principal modes of transportation are truck, rail, air and water.

**moisture-release valve** A valve in the air line that emits some air each time the brakes of the tractor are applied. Prevents water and moisture from collecting in the air system.

**motor carrier** An individual, partnership or corporation engaged in the transportation of property or persons.

**motor vehicle** Any vehicle, self-propelled or drawn by mechanical power, designed for operation on the highways or natural terrain in the transportion of property or passengers.

**muffler** Noise-absorbing chamber used to quiet the engine's noise.

**mule** (Slang) See **yard mule.**

**multi-stop body** Fully enclosed truck body with driver's compartment designed for quick, easy entrance and exit.

**negligence** Failure to exercise the degree of care the law demands.

**nested** Packed one within another.

**net ton** 2,000 pounds. Also called a **short ton.**

**net weight** (a) The weight of an article clear of packing and container; (b) as applied to a truckload, the weight of the entire contents of the truck.

**nonflammable gas** See **HAZARDOUS MATERIALS.**

**nozzle** Same as injector. See **injector**

**octane number** Rating applied to gasoline. Indicates the anti-knock properties of the gasoline. The higher the number, the greater the antiknock properties. See **cetane number.**

**odometer** An instrument that measures the total number of miles traveled by a vehicle.

**off-tracking** A term used to refer to the path taken by the rear end of a vehicle when turning. The path of the rear wheels is shorter than the path of the front. The off-track is much shorter on a tractor-trailer. Drivers must compensate for off-tracking in turns and on curves.

**ohm** A unit of measurement of electrical resistance that allows an electromotive force of one volt to produce a current flow of one amphere.

**ohmeter** An instrument that measures the amount of resistance (in OHMs) in a circuit or in an electrical component outside the circuit.

**oilfield body** Heavily constructed platform-type truck body equipped with instruments for oil drilling.

**oil filter** Device for cleaning and purifying the engine lubricating oil.

**oil pressure gauge** Measures pressure of engine lubricating oil. Pressure varies with engine speed and oil viscosity. Sudden drop of pressure indicates a problem.

**oil seal** A device used to retain lubricant in the bearing area of the wheel. The sealing part of the seal is usually made of a resilient material such as synthetic rubber or leather, which is assembled into a wheel or the hub bore.

**open top (trailer)** A truck or trailer body with sides but without any permanent top, often used for heavy equipment that must be lowered into place by crane. Nicknamed **ragtop.**

**order bill of lading** See **bill of lading.**

**organic peroxide** See **HAZARDOUS MATERIALS.**

**ORM-A** See **HAZARDOUS MATERIALS.**

**ORM-B** See **HAZARDOUS MATERIALS.**

**ORM-C** See **HAZARDOUS MATERIALS.**

**ORM-D** See **HAZARDOUS MATERIALS.**

**ORM-E** See **HAZARDOUS MATERIALS.**

**out-of-service driver** Driver declared out-of-service by a government representative because of hours of service violations. The out-of-service form indicates when such a driver may commence driving again.

**out-of-service vehicle** A vehicle that cannot pass the government safety inspection and is declared out-of-service. Cannot be driven until the problem or problems are corrected or repaired.

**outriggers** Devices used for increasing width of low boy trailer.

**over freight** Freight separated from its waybill and bearing no identifying marks. See **astray freight.**

**over on bill** Freight in excess of that specified by the freight bill or the bill of lading.

**over, short and damaged (OS&D)** Discrepancies between freight on hand and freight shown on the bill. Freight not covered by billing is "over." If some is missing, it is "short." Freight received in bad condition, is "damaged." Freight agents file an OS&D report showing these discrepancies.

**over without bill** When a terminal has freight without its bill of lading or freight bill.

**overage** Freight in excess of the quantity or amount shown on the bill of lading or other shipping document.

**overcharge** To charge more than the amount provided in the proper tariff.

**overdrive** Refers to a condition in which the vehicle's transmission is in a gear having a ratio greater than 1:1, that is, the engine crankshaft turns at a slower rate than the vehicle drive shaft. Opposite of **underdrive.** (Also see **direct drive).**

**overdriving the headlights** Driving at a speed that will not permit you to stop your vehicle within the distance you can see ahead.

**overhang (front)** Distance from centerline of front axle to front of vehicle.

**overhang (rear)** Distance from centerline of rear axle to rear of vehicle.

**overriding the governor (overspeeding)** When the weight of the vehicle drives the engine beyond governed speed. Happens on hills when vehicle is not in a low enough gear and is not supplemented as necessary by light, steady brake application. The governor does not control the engine speed when the vehicle is driving the engine.

**oversized vehicle** Any vehicle whose weight and/or dimensions exceeds State regulations.

**over-the-road (OTR)** See **line haul operation.**

**owner-operator** A trucker who both owns and drives his tractor.

**oxidizers** See **HAZARDOUS MATERIALS.**

**packing, improper** Any packing that does not comply with the classification rules and regulations for proper packing.

**packing list** A detailed specification of packed goods.

**pajama wagon** (Slang) Sleeper tractor.

**pallet** A portable platform for holding material for storage or transportation.

**palletized** Stacked on pallets.

**panel body** Small, fully enclosed truck body often used for small package delivery.

**parallel circuit** A circuit in which all control and current consuming devices are arranged in several independent branches. Each branch provides a separate current path through the circuit components on this branch only. See **series circuit.**

**payload** The cargo or freight that a vehicle hauls.

**peddle run** Truck route with frequent delivery stops.

**peg leg** (Slang) Liftable axle with only one wheel at each end.

**perishable freight** Freight subject to decay or deterioration.

**permit** A document granting permission.

**pig** Trailer transported on flat rail car.

**piggyback** Transportation of a highway trailer on a railway flat car.

**pigtail** (Slang) Electrical cable used to transmit power from the tractor to trailer.

**pilferage** Stealing.

**pintle hook** Coupling device at rear of truck for the purpose of towing trailers.

**piston** A device that moves up and down in the engine cylinder and provides power to the crankshaft.

**PLACARDS, D.O.T. HAZARDOUS MATERIALS WARNING** A regulation type of sign that is required to be displayed on all four sides of a motor vehicle when it is hauling hazardous materials.

**platform body** Truck or trailer body with a floor, but no sides or roof.

**ply** A layer of rubber-coated parallel cords on a tire.

**point of origin** The terminal at which a shipment is received by a transportation line from the shipper.

**point system** States assign points for traffic violations toward driver license suspension.

**poison A** See **HAZARDOUS MATERIALS.**

**poison B** See **HAZARDOUS MATERIALS.**

**polarity** The condition of having opposite poles. In electricity, the poles are the positive and negative terminals posts of a battery. In magnetism, the poles (north and south) are the ends of a magnet or electromagnet.

**pole trailer** Trailer composed of a single telescopic pole, a tandem rear-wheel unit, and a coupling device used to join the trailer to a tractor. Pole trailers are used to transport logs or similar items, when chained together becomes a rigid unit thereby serves as its-own trailer body: Pole trailers are adjustable in length.

**ports** Apertures in engine block for the passage of gas or liquid.

**possum belly** (Slang) Livestock trailer with a drop frame to haul animals on 2 levels.

**post-trip inspection** See **inspection (vehicle).**

**pot torches** Safety equipment used on a highway to warn traffic of an obstruction or hazard.

**power-lift tail gate** A power-operated tail gate capable of lifting load from street level to the level of the truck or trailer floor.

**power stroke** Phase of the four-stroke cycle when fuel is ignited and combustion take place.

**power train** The series of parts that transfer the power of the engine to the wheels. Same as drive train.

**powered axle** See **drive axle.** Commonly called a **live axle.**

**prepaid** A term denoting that transportation charges have been or are to be paid at shipping point.

**prepay** To pay before or in advance.

**pressure regulator (fuel)** A bypass valve to regulate the pressure of the fuel supplied to the injectors. Bypassed fuel flows back to the suction side of the gear pump.

**pre-trip inspection** See **inspection.**

**preventive maintenance** A systematic checking and care of equipment to keep repairs to a minimum.

**private carrier** A company that is not primarily engaged in transportation business and that hauls its own property in its own vehicles. Private carriers do not have to obtain operating authority from the Interstate Commerce Commission, but they must comply with the Federal Motor Carrier Safety Regulations of the Department of Transportation.

**privileged vehicle** In any situation, the vehicle which has the right-of-way over other vehicles under the law. Also see **burdened vehicle.**

**progressive shifting** A process of shifting high torque rise engines that involves shifting at lower rpms at slower speeds, and at progressively higher rpms as the speed of the vehicle increases.

**prohibited articles** Articles of freight which will not be handled.

**pro number** The abbreviation of the word progressive and is usually prefixed to an agent's record numbers on freight bills, etc.

**proof of delivery** A motor carrier establishes proof of delivery from delivery receipt copy of freight bill signed by consignee, at time of delivery. This is legal proof of delivery.

**public service commission** Same as **public utilities commission.**

**public utilities commission** State agency that regulates public utilities and transportation companies. Sometimes called **public service commission.**

**pull the pin** Release the fifth wheel lock.

**pup** (Slang) A short four-wheel trailer which is pulled behind a semi-trailer or a straight truck,

**put on the air** (Slang) Apply the brakes.

**put on the iron** (Slang) Put on the tire chains.

**pyrometer** An instrument that registers the temperature of the exhaust gases.

**radiator** A device of tubes and fins through which circulating water passes to give off excess heat and thus cool the engine.

**radius rods** Rods attached to frame and axles to prevent misalignment.

**rag top** (Slang) Open-top trailer with a tarpaulin. See **open top.**

**rain cap** Protection device used on exhaust stacks to prevent rain entry when the engine is stopped. Opens and closes automatically. Opens by the pressure of exhaust gases passing out of the stack. When exhaust stops (with engine shut off), the rain cap closes.

**reaction time** The time that elapses between the point that a driver recognizes the need for action and the time that he takes the action.

**recap (driver's daily log)** A summary of the hours that a driver has worked. Used to figure out how many hours a driver can work under hours of service regulations. Short for "recapitulation."

**recap (tires)** (1) To recap a tire by bonding new tread rubber to the used tire; (2) a tire that has been recapped. See **full capping** and **half capping.**

**recharge (battery)** Feeding a direct current into the cells of a storage battery.

**reciprocity** (1) Mutual action; (2) exchange of privileges, such as between two states.

**reconsignment** A change (made in transit) in the route, destination, or consignee as indicated in the original bill of lading.

**reefer** (Slang) See **refrigerated trailer.**

**refrigerated trailer** An insulated van-type truck or trailer body equipped with a refrigeration unit. Used for carrying perishable goods. Also called a **reefer.**

**regroove** To cut new grooves into a tire. This can be done only on tires that are made specifically to be regrooved. They are marked "regroovable."

**regulator** See **voltage regulator.**

**relay emergency valve** A combination valve in an air brake system, which controls brake application and which also provides for automatic trailer brake application should the trailer become disconnected from the towing vehicle.

**relay valve** Valve used to speed up the application and release of the rear wheel brakes.

**reparation** Compensation for damage.

**reservoir pressure air gauge** See **air pressure gauge.**

**reshipment** Goods sent to another destination under conditions which do not make the act subject to reconsignment rules and charges of the carrier. See **reconsignment.**

**resistence** Opposition to the free flow of electrical current in a circuit.

**resistor** Any device that "uses up" voltage by opposing, or resisting, the flow of electrical current. Resistors may be current consuming devices such as lamps or motors, or devices which are designed for the purpose of using a specific amount of voltage.

**restricted articles** Types of freight that cannot be handled at all or may only be handled under certain specific conditions.

**revenue waybill** A waybill showing the amount of charges due on shipment.

**revolutions per minute** The number of turns or rotations the engine makes in a minute (abbreviated RPM). Engine RPM is expressed in hundreds on the tachometer.

**ride shotgun** (Slang) To ride in the passenger seat of the tractor. Said of a co-dirver.

**rig** (Slang) Truck; tractor-semi-trailer; truck and full trailer, or other combination vehicle.

**road, primary** A main road or highway.

**road, secondary** Not a main road or highway. Usually narrower, less direct, and often more winding than a primary road.

**rock it** To free vehicle from mud or snow by alternately driving forward and reverse.

**rolling radius** Distance from center of the tire to ground.

**rolltop** A truck or trailer body with a sliding roof to permit overhead crane loading of freight.

**route** (I) The course or direction that a shipment moves; (2) to designate the course or direction a shipment shall move; (3) the carrier or carriers over which a shipment moves.

**runaway truck ramp** See **escape ramp.**

**running lights** Same as clearance or marker lights. See **clearance lights.**

**rural** Of or characteristic of the country (as opposed to the city).

**saddle tanks** Barrel type fuel tanks that hang from the sides of the tractor's frame.

**seal** A security device to assure that truck doors have not been opened in transit.

**secure** (1) To guard or protect, such as to secure the scene of an accident; (2) to make firm or tight, such as the cargo tie-downs or to secure the truck after parking; (3) to obtain, such as to obtain help; (4) safe and free from danger, such as secure place to stop.

**semi** (Slang) For either a tractor-trailer combination; or for a semi-trailer.

**semi-trailer** A trailer that has only rear axles. The front of a semi-trailer either rests on the tractor or is supported by its landing gear when coupled. See **full trailer.**

**series circuit** A circuit in which all controls and current consuming devices are connected in a single line, so that current must pass through each device in sequence. See **parallel circuit.**

**series-parallel circuit** A circuit that is made up of combination of series and parallel circuits.

**service (air line)** See **air lines.**

**set up** A freight classification term denoting that an article is put together in its complete state. Not **knocked down.**

**shipper** A person or agent that ships freight.

**shipping labels, hazardous** See **Labels D.O.T. HAZARDOUS MATERIALS WARNING.**

**shipper's load and count** Indicates that the contents of a truck were loaded and counted by the shipper and not checked or verified by the transportation line.

**shipper's order** The document authorizing release of a shipment traveling on an order bill of lading. See **bill of lading.**

**shipping order** Instructions to carrier for transportation of a shipment. Usually it is a copy of the bill of lading. Used also as record by the freight agent at origin.

**shipping papers** Papers used in connection with movement of freight.

**shipping permit** Authority issued by a transportation line permitting the acceptance and forwarding of goods, against the movement of which, an embargo has been placed.

**shock** A frequent condition of accident victim in which there is a lack of sufficient blood circulation.

**short circuit** See **circuit.**

**short ton** 2,000 pounds. Also called a **net ton.**

**shortage** When quantity of freight received is actually less than that shown on the documents.

**shut-down valve (electric solenoid)** Permits the fuel to be shut off or turned on through the use of a switch key similar to that used in automobiles.

**shut-down valve (manual type)** Located on top of the fuel pump used to shut off fuel supply to the engine. When the plunger is pushed in, the fuel passage to the injectors is opened. When it is pulled out, the fuel passage is closed. It is important to keep the valve pulled out in the "Off" position whenever the engine is not running.

**sight gauge** A glass window for determining fluid levels, as in a radiator.

**sight side** The side of the tractor visible by driver, i.e., driver's side. Opposite of **blind side.**

**single axle** (Slang) Slang for either a tractor with one front axle and one rear axle or a semi-trailer with only one axle.

**single drop frame** A drop frame trailer with one drop, immediately behind kingpin. See **drop frame.**

**single-reduction rear axle** A rear end that reduces the drive line rpm in relation to the rear wheel rpm by means of a single combination of gears.

**skid** (1) A wooden platform on which heavy articles or packaged goods are placed to permit handling; (2) failure of tires to grip the roadway because of loss of traction.

**skinnie axle** (Slang) A trailer or tractor equipped with only one rear axle.

**slack adjuster** An adjustable device located on the brake chamber pushrod that is used to compensate for brake shoe wear.

**sleeper** Truck with a sleeping compartment in the cab.

**sleeper berth** Area in a tractor where a driver can sleep. Sleeper berths must meet standards set by the Federal Motor Carrier Safety Regulations.

**sleeper cab** A truck or tractor cab incorporating a bed or bunk.

**sliding fifth wheel** A fifth wheel assembly capable of being moved forward or backward on the truck tractor to obtain desired load distribution between tractor and trailer axles.

**sliding tandem** An adjusted bogie beneath the trailer that can be moved forward or backward to distribute the weight between tractor and trailer axles.

**slip-seat** Relay operation where drivers are changed periodically, but the truck continues from point of origin to final destination of the shipment.

**smoker** (Slang) Tractor emitting excessive smoke from exhaust.

**smokestack** See **stack.**

**snorkel** The extension of pipe for the air intake side of the air cleaner. It enables clean air to be taken in from on the top of the cab.

**snub-nose** Conventional style tractor with the engine protruding into the cab in order to shorten overall length of the tractor.

**solenoid** An electromagnetic device that can be used to open and close a circuit (like opening or closing a valve, or engaging the gear of a motor).

**spark plug** A device in the top of the cylinder composed of two electrodes that provide an electrical spark to ignite the gasoline and air mixture in a gas engine.

**speedometer** Indicates road speed in miles per hour.

**spin out** Loose traction on a slippery roadway.

**split pickup or delivery** An accessorial service of picking up or delivering portions of volume shipments at more than one place within origin or destination point boundaries.

**splitter** Mechanism that divides a gear into two or more ratios such as **direct, overdrive,** or **underdrive.**

**spontaneously combustible materials** See **HAZARDOUS MATERIALS.**

**spot the trailer** To park and uncouple a trailer at a designated location.

**spotter** Worker in terminal yard who parks vehicles brought in by regular drivers. Also a supervisor who checks the activities of drivers on the road.

**spread** See **bridge.**

**spread tandem** A two-axle assembly in which the axles are separated by distances substantially greater than that in conventional assemblies.

**spring brake** A device that consists of a conventional brake chamber and an emergency or parking brake mechanism for use on vehicles equipped with air brakes. The service brake chamber portion of the spring brake is identical to, and functions the same as a brake chamber* The rear portion of the spring brake, sometimes called the "piggyback," houses a large and powerful spring and diaphragm, which under normal conditions, is held in the released position (spring compressed) by air pressure, If air is exhausted from the spring cavity, the spring expands, forcing the diaphragm, push plate, and rod forward, applying the vehicle brakes. A mechanical release bolt at the rear of the chamber is provided to mechanically cage the spring and release the brakes, if necessary.

**spring brake control** Controls spring-loaded parking brakes.

**stabilizer** Device used to stabilize vehicle during turns. Also called a sway **bar.**

**stack** Vertically mounted pipe (or pipes] that discharges the engine exhaust to the atmosphere. See **exhaust pipe.**

**stake body** Truck or trailer platform body with readily removable stakes which may be joined by chains, slats, or panels.

**starter motor** An electric or air powered motor used to set the crankshaft in motion in order to start the engine,

**static electricity** An electrical charge produced by the gathering of free electrons in one place. The electrons remain at rest until they find a conductor that provides a path to an opposing charge,

**steering axle** An axle through which directional control of the vehicle is applied. A steering axle may be powered or non-powered. A tractor may have more than one steering axle.

**stop (engine) and emergency stop** Some tractors are equipped with a starter button and an "engine stop" switch. The engine stop is used to shut off the engine. Some tractors are equipped with an "emergency engine stop" switch to be used only when the engine starts to "run away" (exceeding the safe upper RPM limits). Once the emergency stop has been used, the engine will not start again until a mechanic has made repairs.

**stopping distance** See **total stopping distance.**

**stopping in transit to finish loading or unloading** An accessorial service of halting volume shipments to finish loading or do partial unloading at points between origin and final destination.

**storage** Safekeeping of goods in a warehouse.

**storage battery** A device that stores voltage and supplies electrical current by means of a chemical reaction between different chemicals. See **lead-acid battery.**

**storage charges** Payment due for storage.

**storage in transit** Temporary warehousing of a **shipment** at a point between origin and destination.

**store door delivery** Movement of goods to a consignee's place of business.

**straight bill of lading** See **bill of lading.**

**straight job** (Slang) Truck with body built onto its chassis; also called **straight truck.**

**straight truck** A truck with the body and engine mounted on the same **chasis.** (As contrasted to a combination unit such as **tractor-trailer**).

**strip the trailer** (Slang) Unload the trailer.

**stroke** The maximum distance a piston moves in a cylinder.

**suburban** Of or characteristic of the suburbs, as opposed to city or **rural.**

**suburbs** Areas on or near the outskirts of a city.

**supercharger** A type of blower, connected to the engine crankshaft, that forces air into the intake manifold at higher than atmospheric pressure to increase engine power and performance. See **blower.**

**supply (air line)** See **air lines.**

**supply lines (fuel)** The lines that carry a supply of fuel to each injector. Fuel enters the inlet connection and then the injectors.

**surcharge** A charge above the usual or customary freight charge.

**surtax** An additional or extra tax.

**suspension** The system of springs, etc., supporting a vehicle upon its undercarriage or axles.

**swamper** (Slang) A helper who rides with the driver.

**sway bar** See **stabilizer.**

**swinging meat** Sides of slaughtered beef, pork, lamb, etc. that are suspended from special racks in a refrigerated trailer.

**synchronized transmission** A transmission in which the gears are so constructed as to allow smooth shifting without the need to double-clutch.

**tachograph** A recording device in a tractor that automatically records the number of miles driven, the speed, the number of stops, and other pertinent statistics.

**tachometer** A device in the tractor, located on the instrument panel, that indicates the revolutions per minute of the engine's crankshaft=

**tag axle** The rearmost axle of a tandem-axle tractor if that axle serves only to support additional gross weight. A tag axle does not transmit power.

**tailgating** Following the vehicle ahead of you at an unsafe distance, i.e., less than your **total stopping distance.**

**tailpipe** Horizontally mounted pipe that discharges the engine exhaust to the atmosphere. See **stack.**

**tandem axle** An assembly of two axles, either, none or both of which may be powered.

**tandem drive axles** Tandem axles on a tractor, both of which propel the vehicle. Same as **twin screw.**

**tank trailer** A semitrailer consisting of a metal tank for carrying liquid or dry bulk. Also called a tanker.

**tanker** See **tank trailer.**

**tare weight** (I) As applied to a loaded motor vehicle, tare weight is the weight of the vehicle exclusive of its contents. (2) Also refers to the weight on a container and/or the material used in the container for packing the merchandise to be shipped.

**temperature gauge** A device that indicates the temperature of such things as coolant, lubricating oil and gear lube.

**tender** The offer of goods for transportation, or the offer to place trucks for loading or unloading.

**terminal** A building for the handling and temporary storage of freight as it is transferred between trucks, i.e., from a city pickup to a line haul truck,

**terminal carrier** The line haul motor carrier making delivery of a shipment at its destination, Terminal carrier means the last or final carrier.

**terminal charge** A charge made for services performed at terminals.

**terrain** Natural features of the land.

**test lamp** A device used to check an electrical circuit for problems.

**theft** Feloniously taking and removing property with intent to deprive the rightful owner, the taking of the entire container or article. See **pilferage.**

**thermostat** Device used to maintain temperature in the engine's cooling system within a desired range by restricting the coolant flow.

**throttle** Valve that regulates the amount of fuel vapor entering an internal combustion engine; controls the engine speed. Also see **hand throttle** and **accelerator.**

**through bill of lading** See **bill of lading.**

**tie rod** Part of the tractor's steering system, it is the connecting rod between the steering arms.

**tires, belted bias** Body plies are same as those for bias tires. In addition, tires have belt plies that constrict the diameter and give greater rigidity to the tread. Belts are heavier construction and the cords lie in a more circumferential direction than breakers on bias tires.

**tires, bias** Body plycords lie in a diagonal direction from bead to bead. Tires may also have narrow plies under the tread, called breakers, with cords that lie in approximately the same direction as the body ply cords.

**tires, radial** Body plycords are placed perpendicularly across the tread from bead to bead. In addition, radial tries have belt plies that run circumferentially around the tire, under the tread. They construct the radial ply cords and give rigidity to the tread, resulting in less rolling resistance which gives better fuel economy.

**tires, wide base** Same diameter as conventional tires, but have a wider base that provide greater ground contact. Sometimes used to replace dual tires, resulting in cost and weight savings.

**toe-in** The amount of distance which the front of the front wheels are closer together than the rear of the wheels. Front tires are toed-in to improve steering and increase tire life.

**toe-out** Opposite of **toe-in.**

**tolerance** Permissible variation in dimension, weight, etc. For example, some states allow a tolerance in their maximum truck weight limits.

**toll** A charge made for the use of a facility such as a bridge or turnpike.

**ton-mile** A unit of measure. The movement of a ton of freight one mile.

**tonnage** Number of tons.

**torque** Force having a twisting or turning effect.

**torque tube** Tube enclosing the drive shaft. Transmits forward or aft motion from rear axle.

**total engine displacement** Piston displacement times the number of cylinders. Expressed in cubic inches.

**total stopping distance** The distance the vehicle travels between the time the driver recognizes the need to stop and the time the vehicle comes to a complete stop. Total stopping distance includes perception, reaction, brake 'tag and braking distance.

**trace** To check the movement of a shipment.

**tracer** A request that a carrier locate a shipment to speed its movement or to establish delivery. Or a request for an answer to a previously filed claim or other communication.

**traction** Adhesive friction, as of tires on pavement.

**tractor protection valve** Controls flow of compressed air from tractor to trailer; when closed, stops flow of air to trailer. When this happens, the trailer brakes will apply. Used to make sure that air is always available for tractor brakes. Must be in "Normal" position when tractor is hooked up to trailer and in "Emergency" position to unhook trailer.

**traffic** Persons or property carried by transportation lines.

**trailer** See **full trailer; semi-trailer.**

**trailer brake** A hand-operated remote control that applies trailer brakes only. Located on the steering column or dash. Must never be used for parking. Also called hand valve, trolley brake, trolley valve handle, trailer hand brake, and independent trailer brake.-

**trailer hand brake** See **trailer brake.**

**transfer pump** A pump used to move fuel from fuel tank to injectors or carburator.

**transmission** Selective gear box providing various combinations of gear ratios.

**transport** To move traffic from one place to another.

**transportation** The movement of traffic from one place to another.

**treadle valve** See **foot brake valve.**

**tri-axle** An assembly of three rear axles, any or all of which may be powered.

**triples** A combination consisting of a tractor, a semi-trailer and two full trailers, coupled together. Known as triple headers or triple bottoms.

**trolley brake** See **trailer brake.**

**trolley-valve handle** Operates the trailer's brakes. See **trailer brake.**

**trucking industry** The business activity of carrying goods by truck. Used generally to include carrier, drivers, warehouse and terminal employees, and all others who are directly or indirectly involved in trucking.

**truckload** (1) Quantity of freight that will fill a truck, (2) quantity of freight weighing the maximum legal amount for a particular type of truck, (3) when used in connection with freight rates, the quantity of freight necessary to qualify a shipment for a truckload rate, which is cheaper than a **less-than-truckload rate.** Abbreviated TL.

**turbocharger** A type of blower, powered by engine exhaust gases, that forces air into the intake manifold at higher than atmospheric pressure to increase engine power and performance. See **blower.**

**turn around** A type of trip or "run" in which the driver returns to the origin point immediately after his vehicle is unloaded and reloaded.

**twins** See **doubles.**

**twin screw** A truck or tractor with two rear axles, both driven by the engine. Same as **tandem drive axles.**

**twin trailers** See **doubles.**

**two-cycle engine** A piston-type internal combustion engine that produces power on every downstroke of the piston.

**two-speed axle** A drive axle capable of being shifted through two gear ranges in order to double the number of gears available from the transmission.

**unclaimed freight** Freight which has not been called for by the consignee or owner, or freight that cannot be delivered.

**underdrive** Refers to a condition in which the vehicle's transmission is in a gear having a ratio less than 1:1, that is, the engine crankshaft turns at a faster rate than the vehicle's drive shaft. Opposite of **overdrive.** (Also see **direct drive**).

**universal joint** A joint or coupling that permits a swing of limited angle in any direction; used to transmit rotary motion from one shaft to another not in line with it.

**unstable cargo** Cargo that cannot be completely secured against movement, such as cattle, swinging meat, liquids.

**unstable freight** See **unstable cargo.**

**urban** Of or characteristic of the city (as opposed to **rural**).

**vacuum brake system** A brake system in which the brake mechanism is activated by a vacuum.

**valuation, actual** Actual value of goods required to be shown on bill of lading by shipper, when rate to be applied is dependent on that fact.

**valve** A device that opens and closes openings in a pipe, tube, or cylinder.

**V-belt drive** Power transmitted from the drive wheels to a dead axle by means of a V-belt connection* See **belt drive axle.**

**V.C.R.** Driver's daily vehicle condition report.

**via** By the way of.

**viscosity** Resistance of a fluid to flow, as in engine oils.

**volt** A unit of measurement of electrical potential.

**voltage** The electromotive force that causes electrons to flow. Voltage is the difference between two opposing charges, such as the positive and negative plates of a storage battery. Voltage can be present without current flow. But current cannot flow unless voltage is present.

**voltage drop** The "using up" of voltage in a circuit. Voltage drop can be caused by resistance in the circuit wiring, current consuming devices (such as lamps, motors etc.) and by resistors.

**voltage regulator** A device that controls the voltage output of a generator*

**voltmeter** Indicates output of alternator in volts.

**warehouse** A place for the reception and storage of goods.

**warehouse receipt** A receipt for goods placed in a warehouse (may be issued as a negotiable or non-negotiable document).

**warehouseman** A person in the business of receiving goods and merchandise to be stored in his warehouse.

**warehousing** The storing of goods.

**warning labels** See **LABELS, D.O.T. HAZARDOUS MATERIALS WARNING.**

**water level warning light** Lights up when coolant level in radiator drops below required level. Similar lights will indicate low oil pressure or high coolant temperature, depending on the type of engine.

**water pump** Pump that circulates the coolant through the engine cooling system.

**water reactive material** See **HAZARDOUS MATERIAL.**

**water temperature gauge** Indicates temperature of engine coolant.

**watt** Unit of measurement of electrical power.

**waybill** A document prepared by a transportation line at the point of origin of a shipment, showing the point of origin, destination, route, consignor, consignee, description of shipment and amount charged for the transportation service. Forwarded with the shipment, or sometimes direct by mail, to the agent at the transfer point or waybill destination. The waybill is basically a description of goods and shipping instructions.

**weighmaster** A person who operates a scale for the weighing of freight or motor vehicles. A certified weightmaster is one who has been licensed by some governmental authority as skilled in the art of proper weighing.

**weight sheets** Itemized list furnished by shippers to weighing bureaus, itemizing articles in each consignment.

**wet clutch** A type of clutch that operates in an oil bath.

**wet goods** Liquids.

**wet tank** Part of the air brake system. Compressed air produced by the compressor goes to the wet tank, which collects any water and engine oil that the air has in it. This tank must be drained at least once a day.

**wheelbase** Distance (in inches) from center of hub of front wheel of a vehicle to center of hub of back wheels or the center of the space between the tandems.

**winch rig** Straight truck or tractor with a winch and/or a hoist.

**woodchuck** (Slang) Driver with low job seniority.

**wrecker** Truck designed for hoisting and towing disabled vehicles.

**yardbird** (Slang) A driver who connects and disconnects tractor-semi-trailer combinations and moves vehicles around the terminal yard.

**yard goat** (Slang) See **yard mule.**

**yard jockey** (Slang) Person who operates a yard tractor or yard mule, a special tractor used to move semi-trailer around the terminal yard.

**yard mule** (Slang) Tractor used to move semi-trailers around the terminal yard.

# LIST OF ABBREVIATIONS

**amt**.....amount
**amp**..... ampere
**APU**..... ..authorize d pickup
**arr**..... ...(l) arrive, (2) arrival
**art**.....article
**ATA**..America n Trucking Associations, Inc.
**av**.....average
**avg**..... average
**A/W**..... ..actua 1 weight
**BB**.....break bulk
**BBC**.... ..lengt h of tractor in inches from bumper to back of cab
**bbl**.....barrel
BC.....distanc e in inches from back of cab to end of frame
**BHP**..... ..brak e horsepower
**BL or B/L**..... ..bill of lading
**bls**.....bales
**BMCS**..... ..Burea u of Motor Carrier Safety
BTW.....behind-the-whee 1
**bu**.....(1) bushel, (2) bureau
**bx**..... box
**CA**.. ..distanc e in inches from back of cab to centerline rear axle
**CAE**..... ..cab-alongside-engin e
COE..... ..cab-over-engin e
**CBE**..... ..cab-beside-engin e or cab-behind-engine
**con**.....conventional
**chg**..... charge
**ck**..... ...(l) cask(s), (2) check
**CL**.....(1) connecting line, (2) car load
c/o..... care of
COD..... ..cas h (or collect) on delivery
**coll**.....collect
**comb**..... combination
**com'l**.....commercial
**cr**.....(1) credit, (2) creditor
**CR**..... ..carrier's risk
**cty**..... county
**cu ft**.....(1) cubic foot, (2) cubic feet
**cwt**..... ..hundre d weight
**cyl**..... cylinder
dba.....doin g business as
**dely**.....delivery
**diam**.....diameter
diff.....differentia 1
**disc**..... discount
**disp**.....(1) dispatch, (2) dispatcher
**dist**.....(1) district, (2) distance
**div**.....division
**dk**.....dock
**D.O.T.** .... ..Departmen t of Transportation
**EB**.....eastbound
**eg**..... ..exempl i gratia (for example)
**eq**..... equal
**est**.....estimated
**est wt**..... ..estimate d weight
**ETA**.....estimated time of arrival
**etc**..... ..e t cetera (and other things; and so forth)
**ETD**..... ..estimate d time of departure
ex..... (1) exchange, (2) example
**ex BL**..... ..exchang e bill of lading
exp..(l) export, (2) express, (3) expense
**FA**....(1) free astray, (2) freight astray
**FB**.....Freight Bill
**FHWA**..... ..Federa 1 Highway Administration
**FMCSR**..... Federal Motor Carrier Safety Regulations
FOB.....fre e on board
**frt**.....freight
**ft**.....(1) feet, (2) foot, (3) fort
**gal**.....gallon
Gcw..... gross combination weight
**gen'l**.....general
**gr**..... gross
**GT**..... gross ton
**GVW**..... ..gros s vehicle weight
hdqrs.....headquarter s
**hgt**..... height
**hhd**.....hogshead
**HP**..... horsepower
**HQ**..... headquarters
**ht**..... ..hea t or height
**ie**..... ..i d est (that is)
**IB**.....(1) inbound, (2)in bond
**ICC**.....Interstate Commerce Commission
**IL**.....Interline
**imp**.....import
**inc**.....(1) inclusive, (2) incorporated
**ins**.....insurance
**inter**.....interstate
**intra**.....intrastate
**inv**.....invoice
**it**.....item
**KD**.....knocked down
LCF..... low cab forward of engine
LCL.....les s than a car load
**liq**.....(1) liquor, (2) liquid
**L&D**..... ..loss and damage
**lg tn**.....lon g ton (2,240 lbs)
**LPG**..... ..liquifie d petroleum gas

lt.....long ton
LTL.....less than truckload
max.....maximum
m'se.....merchandise
m.m.....memorandum
min.....minimum
MC...(1) minimum charge (2) motor carrier
min wt.....minimum weight
misc.....miscellaneous
MO.....money order
mpg.....miles per gallon
mph.....miles per hour
m'ty.....empty
N B .....northbound
no.....number
nos.....numbers
nstd.....nested
nt.....net ton
ntfy.....notify
O/C.....overcharge
OR.....owner's risk
OS&D.....over short and damaged
OTR.....over-the-road
oz.....ounce
pcs.....pieces
PD.....property damage
pkg.....package
PL.....public liability
PL&D.public liability and property damage
PP.....(1) prepay (2) prepaid
PSC.....Public Service Commission
psi.....pounds per square inch
pt.....(1) point (2) pint (3) port
PTCA.....Private Truck Council of America
PU.....pick up
PUC.....Public Utilities Commission
PUD.....pick up and delivery

**qt**.....(1) quart (2) quantity
**R/C**.....reconsignment
**refrig**.....(1) refrigerator
(2) refrigeration
**reg**.....regulations
**rel**.....released
**rep**.....(1) report (2) representative
**rpm**.....revolutions per minute
**rte**.....route
**SB**.....southbound
**shtg**.....shortage
**sh tn**.....short ton (2,000 lbs)
**SL&C**.....shipper's load and count
**SO**.....shipping order
**SR**.....shipping receipt
**st**.....short ton
**sta**.....station
**SU**.....set up
**SC**.....surcharge
**term**.....terminal
**terr**.....territory
**tfr**.....transfer
**TL**.....Truck Load
**tn**.....ton(s)
**tnge**.....tonnage
**tot**.....total
**trans**.....transportation
**UC**.....undercharge
**val**.....value
**viz**.....namely
**vol**.....volume
**wdt**.....width
**WB**.....westbound
**whse**.....warehouse
**wt**.....weight
**yr**.....year

NIT 1
:NTA

# UNIT 1.1 ORIENTATION

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn

- o the major parts of a tractor-trailer.
- o how the trucking industry operates.
- o the objectives of this training course.
- o rules you need to follow in class.
- o safety rules you need to follow on the range and when driving on the street.
- o how you will be rated and graded during the course.
- o what you must do to pass the course and graduate.

## WHAT WILL HAPPEN IN THIS UNIT

Most of the information will be presented in two classroom lessons. There will be a short lab class during which you will examine a tractor-trailer and learn to identify its key parts.

### Outline of Classroom Lessons

Lesson 1 - Orientation to Tractor-Trailer Driving Training

I. Background to Tractor-Trailer Driving
   - A. Importance of Trucking Industry
   - B. Regulation of Trucking Industry
   - C. Definition of a Professional Driver

II. Brief Review of the Course Contents
   - A. Section 1 - Basic Operation
   - B. Section 2 - Safe Operating Practices
   - C. Section 3 - Advanced Operating Practices
   - D. Section 4 - Vehicle Maintenance
   - E. Section 5 - Nonvehicle Activities

III. School Rules for Students

IV. Tips of How to Study

V. Student Evaluation Procedures

Lesson 2 - Introduction to the Tractor-Trailer

I. Vehicle Definitions, Cab Design and Axle Arrangements
   A. Definition and Major Parts of a Truck-Trailer
   B. Basic Cab Designs
   C. Tractor Axles

11. Designing a Tractor
   A. Design Factors
   B. Frame
   C. Engine
   D. Drive Train
   E. Suspension System
   F. Steering System
   G. Wheels and Tires
   H. Fifth Wheel

III. The Trailer
   A. Basic Trailer Design
   B. Semi-trailer Key Components
   C. Full Trailer Coupling
   D. Converting a Semi-trailer to a Full Trailer

IV. Engine Auxiliary Systems
   A. Fuel System
   B. Air Intake System
   C. Superchargers and Turbochargers
   D. Exhaust System
   E. Cooling System
   F. Lubrication System
   G. Electrical System

V. The Air Braking System

## Description of Lab Lesson

Lesson 3 - Orientation to the Tractor-Trailer

This lesson serves as a brief introduction to the tractor-trailer and its key systems and components. The lessons ends with a short question and answer period. The instructor will answer questions of a general nature about vehicle parts and function. More specific questions will be answered later, in Units 1.2, 1.3, and 4.1.

STUDENT **AIDS**

To help you learn the material in this unit, the following items have been included in your student material.

- 0 Course Outline
- o Student Rules
- o Rules for Range Exercises
- o Rules for Onstreet Driving
- o Some Tips on How to Study
- o Student Evaluation Procedures
- o Review Quiz
- o Tractor-Trailer Components Checklist

## COURSE OUTLINE

This course has been designed to train you to become a professional truck driver. You will learn how to handle a tractor-trailer safely and efficiently. Although some instruction will take place in the classroom, most of your time (aproximately 70 percent) will be spent on the vehicles in lab, range and street lessons.

The following is an outline of the course, giving the titles of sections, units, and lessons, and where each lesson is taught. C = Classroom; L = Lab; R = Range; and S = Street.

SECTION 1 - BASIC OPERATION

Unit 1.1 - Orientation

Lesson 1 - Orientation to Tractor-Trailer Driver Training C
Lesson 2 - Introduction to the Tractor-Trailer C
Lesson 3 - Orientation to the Tractor-Trailer L

Unit 1.2 - Control Systems

Lesson 1 - Introduction to Vehicle Instruments and Controls C
Lesson 2 - Instrument and Control Familiarization L

Unit 1.3 - Vehicle Inspection

Lesson 1 - Vehicle Inspections: Procedures C
Lesson 2 - Vehicle Inspections: Practice L

Unit 1.4 - Basic Control

Lesson 1 - Introduction to Basic Control Maneuvers C
Lesson 2 - Starting and Turning Off the Engine R
Lesson 3 - Putting the Vehicle in Motion R
Lesson 4 - Turning the Tractor-Trailer R

Unit 1.5 - Shifting

Lesson 1 - Shifting Procedures C
Lesson 2 - Development of Shifting Skills R

Unit 1.6 - Backing

Lesson 1 - Backing Procedures C
Lesson 2 - Development of Backing Skills R

Unit 1.7 - Coupling and Uncoupling

Lesson 1 - Coupling and Uncoupling Procedures C
Lesson 2 - Coupling and Uncoupling Skills R

Unit 1.8 - Proficiency Development: Basic Control

Lesson 1 - Introduction to Proficiency Development Exercises C
Lesson 2 - Proficiency Development Exercises R
Lesson 3 - Proficiency Development: Practice in Basic Control S

Unit 1.9 - Special Rigs

Lesson 1 - Characteristics of Special Rigs C
Lesson 2 - Observation of Special Rigs L

SECTION 2 - SAFE OPERATING PRACTICES

Unit 2.1 - Visual Search

Lesson 1 - Visual Search Principles C
Lesson 2 - Use of Mirrors L
Lesson 3 - Application of Visual Search S

Unit 2.2 - Communication

Lesson 1 - Principles of Communication C
Lesson 2 - Application of Communication S

Unit 2.3 - Speed Management

Lesson 1 - Speed Management Principles C
Lesson 2 - Speed Management Demonstration R

Unit 2.4 - Space Management

Lesson 1 - Space Management Principles C
Lesson 2 - Application of Space Management S

Unit 2.5 - Night Operation

Lesson 1 - Night Operation C
Lesson 2 - Night Operation: Basic Maneuvers R
Lesson 3 - Night Operation: Onstreet S

Unit 2.6 - Extreme Driving Conditions

Lesson 1 - Operation During Extreme Driving Conditions C
Lesson 2 - Techniques Used During Extreme Condtitions R

Unit 2.7 - Proficiency Development: Safe Operating Procedures

Lesson 1 - Procedures for Safe Operation C
Lesson 2 - Practice in Safe Operation S

SECTION 3 - ADVANCED OPERATING PRACTICES

Unit 3.1 - Hazard Perception

Lesson I - Recognizing Hazards C
Lesson 2 - Application of Hazard Recognition S

Unit 3.2 - Emergency Maneuvers

Lesson 1 - Emergency Procedures C
Lesson 2 - Emergency Skills R

Unit 3.3 - Skid Control and Recovery

Lesson 1 - Techniques of Skid Control and Recovery C
Lesson 2 - Skid Control and Recovery Exercises R

SECTION 4 - VEHICLE MAINTENANCE

Unit 4.1 - Vehicle Systems

Lesson 1 - Vehicle Systems C
Lesson 2 - Vehicle Systems Demonstration L

Unit 4.2 - Preventive Maintenance and Servicing

Lesson 1 - Nature and Importance of Preventive Maintenance C
Lesson 2 - Engine Fluids, Filters, Lights and Fuses L
Lesson 3 - Changing Tires and Checking Tire Air Pressure L
Lesson 4 - Reservoir Drainage and Brake Adjustment L

Unit 4.3 - Diagnosing and Reporting Malunctions

Lesson 1 - Diagnosing and Reporting Malfunctions C
Lesson 2 - Emergency Starting Procedures L

SECTION 5 - NONVEHICLE ACTIVITIES

Unit 5.1 - Handling Cargo

Lesson I - Basic Cargo Handling Procedures and Requirements C
Lesson 2 - Techniques for Loading, Securing, and Unloading Cargo C
Lesson 3 - Demonstration of Cargo Securement L
Lesson 4 - Observation of Cargo Handling Operations L

Unit 5.2 - Cargo Documentation

Lesson I - Cargo Documentation: Basic Forms and Procedures C
Lesson 2 - Cargo Documentat ion Problems C

Unit 5.3 - Hours of Service Requirements

Lesson 1 - Basic Requirements of Hours of Service Regulations C
Lesson 2 - Complying with the Hours of Service Regulations C
Lesson 3 - Log Keeping Exercise C

Unit 5.4 - Accident Procedures

Lesson 1 - Accidents and Accident Reporting C
Lesson 2 - Principles of First Aid C
Lesson 3 - Fires and Firefighting C
Lesson 4 - Firefighting Demonstration L

Unit 5.5 - Personal Health and Safety

Lesson 1 - Personal Health and Driving C
Lesson 2 - Safety Equipment and Practices C
Lesson 3 - The Truck Driver's Environment C

Unit 5.6 - Trip Planning

Lesson 1 - Trip Analysis and Trip Procedures C
Lesson 2 - Trip Planning Exercise C

Unit 5.7 - Public and Employer Relations

Lesson 1 - The Driver's Role in Public Relations C
Lesson 2 - Employer Relations C

## STUDENT RULES

1. Must be on time for each class.
2. No horseplay or practical jokes.
3. No abuse of equipment.
4. Absolutely no use of alcohol or any type of drugs whatsoever.
5. No profanity.
6. Keep grounds and equipment clean.
7. No drink bottles or cans, except in authorized areas. Put in trash containers.
8. No smoking in trucks or around fuel pumps.
9. Shoes off in sleeper berth.
10. Seat belts must always be worn in all trucks, at all times.
11. Stay with your truck or problem that you have been assigned to.
12. Park your car only in designated student parking area(s).
13. Be in classroom every day for dismissal, unless excused by your instructor.
14. Follow instructions fully or else ask for permission to change.
15. Do not argue with instructors for any reason.
16. Keep positive attitude, pay strict attention and keep your mind "open" to the new information that will be presented to you.

### Classroom Procedures

1. Report to assigned classroom each day, promptly for roll call.
2. Review posted daily schedules to learn where you are supposed to be each session, then be there on time.
3. Do not speak until called upon by the instructor, who will recognize you if you raise your hand.
4. Do not create noise or other action to distract fellow students who are trying to 'learn.

## RULES FOR RANGE EXERCISES

1. Operate vehicles only with the permission of the instructor and when an instructor is supervising you.

2. Follow all range exercise procedures exactly. If you do not understand an instruction or exercise, ask for help before proceeding.

3. Only one vehicle may be operated within an exercise layout.

4. In the case of any malfunction, emergency, or problem, stop and alert an instructor.

5. Always check on all sides of the vehicle before moving.

6. When you are observing other students' driving, stay well back from the moving vehicles. Do not stand close to a moving truck and never where the driver cannot see you.

7. Maintain a safe distance between your vehicle and others.

8. No student may drive after drinking any alcoholic beverage nor when taking drugs or other medication that may affect their ability to drive safely.

## RULES FOR ONSTREET DRIVING

1. Operate vehicles only with the permission of the instructor and when an instructor is supervising you.

2. Follow all instructions given by the driving instructor. If you do not understand an instruction, ask for clarification before proceeding.

3. Alert the driving instructor to any malfunction or potential malfunctions indicated by gauges, warning lights, etc.

4. Obey all traffic laws.

5. Carry your drivers license or learners permit, medical certificate, and logbook at all times.

6. No student may drive after drinking any alcoholic beverage or when he/she is taking prescribed drugs or other medication that may affect his/her ability to drive safely.

7. Check your path carefully before moving.

8. Students in the vehicle who are not driving, must be observing the driver and the road ahead. They may not carry on conversations that will distract the driver.

## SOME TIPS ON HOW TO STUDY

The following are tips that can help you in your learning, particularly in the bookwork as opposed to range and road work.

a. First Is Best and Longest Remembered

That which you learn first you learn best and remember the longest. You should always review and rewrite your notes if at all possible.

b. Motivation:

The main thing that keeps many students from developing effective study habits is lack of motivation. Many students who want to do well cannot bring themselves to study when they should, and even when they do settle down to study, they cannot really concentrate on the job. There is no real remedy for this, but there is a method which will make studying more pleasant. This method is as follows:

1) Know exactly what you want to get from your studies. Why are you here?

2) Be really interested in what you are doing. No one can be interested for you. Are you really interested in learning to drive a truck?

3) You will be motivated when you know what you are expected to learn and when you have a strong desire to learn it.

c. Physical Environment:

Besides motivation, what many students lack is a routine for study. This means that the physical environment is a very important part of the study routine. Remember that you have chosen a certain area for study and that you really mean to do nothing here but study. You must, therefore, free that area of distractions. This means that you must be sure that you are studying instead of:

1) talking with your buddies

2) making telephone calls

3) being distracted by TV or radio

You can sum it up by saying that you must surround yourself with a wall if you are to study properly.

d. Study Methods:

There are general rules for the effective study of books and lessons. People who are good at studying make use of these rules in one way or another whether they know it or not. These people will differ in their general style of learning and in the way they depend on different rules, but they do follow certain rules.

One way of phrasing the rules for effective study has been worked out at Ohio State University. According to this study, the essential rules are condensed into a formula: SURVEY Q 3R or merely SQ3R. This means:

SURVEY
QUESTION
READ
RECITE
REVIEW

1) SURVEY:

Survey what you are going to read by glancing through the material, and running through the various chapter headings In this way, you learn, in a general way, what the chapter is about, and you know what to expect. It is also a good idea to read the introduction. This will let you know where you are going. You should also read the summary, if there is one. This will give you the main ideas or important points. When you know where you are going, you become motivated and oriented.

2) QUESTION:

Ask yourself, "What am I expected to learn?" It is also valuable to ask your own questions about the learning material. Try to turn the headings of sections into questions, and read for the answers. This makes you concentrate by giving you something to look for. Questions, then, have several benefits; they maintain interest, make you participate actively, and cause you to test yourself to see what you are learning. If you test yourself before your instructor does, you will do much better.

3) READ:

The next step, of course, is to read and to read carefully. Read to answer the questions you must ask yourself, and continuously challenge yourself to see that you understand. Read to remember, and read everything; that means tables, graphs, and other illustrations. These often emphasize important points and can tell you at a glance what the whole page is about. But, reading like this means taking notes or making an outline.

4) RECITE:

This is one of the most important techniques of effective study. To make sure that you understand and remember, stop periodically and recite to yourself what you have read. After reading a paragraph, topic, or chapter, stop reading, and in your own words, answer the questions that you asked yourself about the subject. This step is where most learning takes place.

5) REVIEW:

Enforce your learning by frequent review. If you learn something perfectly but do not review it, you will find that a few days, or even hours, later, you will remember only a small part of it. FORGETTING TAKES PLACE VERY RAPIDLY.

Remember, no one can study for you. It is your responsibility. The most important problem in studying effectively is development of motivation to study, and only you can supply this. But, organized study routines are helpful, especially when helped through SQ3R.

## STUDENT EVALUATION PROCEDURES

You will be evaluated periodically through the course, and in a three-part final examination at the end of the course.

1. After Section I has been completed, your ability to handle a truck will be tested on the range. All basic maneuvers covered in Section 1 will be included in the test.

2. A written test will be administered following each section.

3. Instructors will monitor and evalaute your progress continuously during onroad driving and range exercises.

4. The final examination will be administered following completion of Section 5. It will cover material and exercises from all sections and units of the course. The final examination will consist of three parts: (a) Written Test, (b) Range Test, and (c) Onstreet Test. You must get a passing score on all three tests in order to graduate from this course.

### The Range Test

The Range Test is used to evaluate your knowledge of the six sides (e.g., top, bottom, front, rear, left and right) of your vehicle in relation to its surroundings. You will take the test twice. First, you will take it to assess your progress in the early part of the course to determine your vehicle handling skills before taking the vehicle on the street. The second time you will take it as part of the end-of-course test. The test is given to one student at a time. You will take the test in an off-street area, where there is no other traffic. The test will be taken in one of the school's training vehicles, which will not be loaded.

The range test will include the following maneuvers:

Backing--You will back the vehicle within a lane marked out on the pavement.

Offset Alley--You will drive down a pair of alleys that are "offset" so as to require a sharp turn to the left or right.

Alley Dock--While backing, you will turn the vehicle 90" from a "street" position in order to back down an alley.

Alley Dock (Jackknifed)--You will back the vehicle into a "jackknife" parking position.

Parallel Parking--You will back into a parking space using a parallel parking maneuver.

Serpentine--You will weave in and out along a "serpentine" course, both forward and backward.

Controlled Stop--You will bring your vehicle to a stop with your front wheels resting on a line painted on the pavement.

Overhead Clearance--You will judge whether your vehicle can pass under an overhead obstacle placed in your path.

Pretrip Inspection--You will perform a complete pretrip inspection in a specified time limit.

Coupling and Uncoupling--You will safely couple and uncouple a trailer in a specified time limit.

You will be tested objectively on how well you perform these specific exercise maneuvers. Most exercises will be scored on four measures:

1. Time to complete the exercise
2. Motion control (stopping or changing directions forward or backward)
3. Distance (from the curb or end of alley in parking exercises)
4. Contact of boundaries (lightly touching or actually hitting exercise barricades, cones or lines)

The scoring standards for this test will be described later in Unit 1.8, Proficiency Development, where practice for the test is given.

## The Onstreet Test

The Onstreet test is used to evaluate your ability to handle a tractor-trailer in roadway situations. The street test is given to one student at a time and will last approximately two hours. You will take the test in one of the school's training vehicles, which will be loaded at the time.

You will be tested on how well you handle specific performance checks in varying roadway situations.

BASIC CONTROL
- Acceleration
- Braking
- Shifting
- Uphill operation
- Downhill operation
- Speed adjustment/curves
- Lane keeping/straight/turns

COMMUNICATION
- Signalling direction changes
- Cancelling signals

VISUAL SEARCH
- Distance scanning
- Intersection scanning
- Mirror usage/scanning
- Mirror usage/speed-direction changes

SPEED MANAGEMENT
- Flowing with traffic
- Upgrades and downgrades
- Adjusting for curves
- Intersections
- Visibility/Traction Adjustments

SPACE MANAGEMENT
- Following distance
- Passing
- Return to lane
- Gap judgment
- Merging

LANE USE
- Upgrades
- Multilane roads
- Turns

NIGHT OPERATION
- Use of high/low beams
- Speed adjustment
- Space management

TRAFFIC LAWS
- Speed limits
- Signs/signals

HAZARD RECOGNITION
- Road conditions
- Traffic conditions

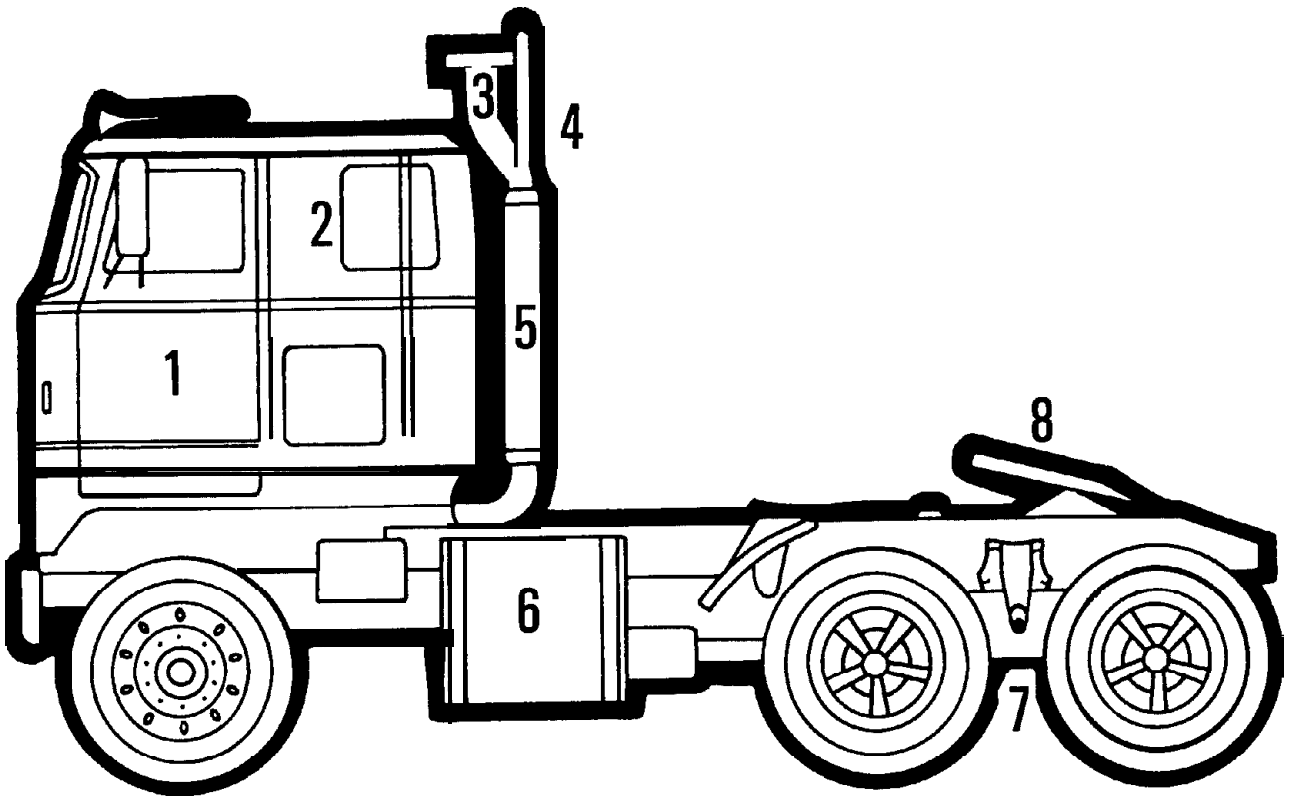
# UNIT 1.1 - REVIEW QUIZ

To be completed in class.

Part A

Identify the numbered parts on the tractor by putting the number in the correct box.

| | | | |
|---|---|---|---|
| [ ] | EXHAUST STACK | [ ] | SLEEPER BERTH |
| [C] [A] | B | [ ] | FIFTH WHEEL |
| [ ] | MUFFLER | [ ] | FUEL TANK |
| [ ] | AIR INTAKE STACK (SNORKEL) | [ ] | TANDEM AXLE |



## UNIT 1.1 - REVIEW QUIZ

Part B

Match the term in Column A with the best identification in Column B.

| Column A | | Column B | |
|---|---|---|---|
| ____ 1. | Tractor with a tag axle | A. | Controls distance that a brake shoe travels to apply force. |
| ____ 2. | Dry tank | B. | A tandem axle assembly in which the forward axle is "live." |
| ____ 3. | Pintle hook | C. | A "blower" driven by exhaust gases. |
| ____ 4. | Slack adjusters | D. | Stores compressed air before it is used in air-braking system. |
| ____ 5. | Drawbar | E. | Connects semi-trailer to a fifth wheel. |
| ____ 6. | Trailer kingpin | F. | Metal fixtures at the end of air hoses and on the trailer body. |
| ____ 7. | Trolley valve | G. | Provides braking to the trailer wheels only. |
| ____ 8. | Gladhands | H. | Air brake connections color code, |
| ____ 9. | Blue service hose | I. | Device on a full trailer that connects it to the towing vehicle. |
| ____10. | Turbocharger | J. | Device on a towing vehicle that a drawbar is connected to. |

# UNIT 1.1 - TRACTOR-TRAILER COMPONENTS CHECKLIST

This checklist is to help you identify tractor-trailer components in the lab.

## Under the Hood/Cab

Oil and coolant level indicators
Engine
Radiator
Cranking motor
Fuel pump
Filters
Belts

## Key Cab Parts

Sleeper berth
Storage compartment
Instrument panel
Vehicle controls

## Tractor

Front wheels
Steering linkage
Front suspension
Brake parts
- Drums or discs
- Brake chambers
- Slack adjusters
- Air lines

Air compressor

## Tractor (continued)

Air tanks
Fuel tanks
Exhaust stack and muffler
Intake stack and air cleaner assembly
Batteries
Air horns, lights, and reflectors
Coupling device
Mud flaps
Rear axles, wheels and tire
Rear suspension
Fifth wheel

## Trailer

Coupling device
Tractor-trailer connections
- Electric lines
- Service and emergency air lines
- Gladhands
- Landing gear
- Spare tire carrier

Lamps and reflectors
Trailer suspension
Trailer axles, wheels, and tires
Brake parts, including air tank
Mud flaps
Rear end protection device

Notes:

# UNIT 1.2
# CONTROL SYSTEMS

# UNIT 1.2 CONTROL SYSTEMS

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn

- o the name, location, and function of each of the primary controls including those required for steering, accelerating, shifting, braking, and parking.
- o the name, location, and function of each of the secondary controls including those required for control of lights, signals, windshield wipers and washers, interior climate, engine starting and shutdown.
- o the name, location, function, and the acceptable reading range of the various, gauges and instruments required to monitor vehicle and engine speed, as well as status of fuel, oil, air, cooling, exhaust, and electrical systems.
- o the importance of checking the instrument panel regularly so that you can spot problems early.

## WHAT WILL HAPPEN IN THIS UNIT

There will be a classroom session to help you become familiar with the purpose and function of the controls and instruments commonly found on a truck tractor. During the lab lesson, the instructor will point out the controls on a truck tractor and, where possible, demonstrate the operations.

## Outline of Classroom Lessons

Lesson 1 - Introduction to Vehicle Instruments and Controls

I. Function and Operation of Vehicle Controls
   A. Controls Related to Starting and Stopping the Engine
   B. Primary Vehicle Controls
      1. Accelerator Pedal
      2. Steering Wheel
      3. Clutch Pedal
      4. Transmission Controls
      5. Brake Controls
      6. Optional Controls
   C. Secondary Vehicle Controls

II. Purpose and Function of Vehicle Instruments
   A. Importance of Instruments
   B. Basic Instruments
   c. Pressure Gauges
   D. Temperature Gauges
   E. Warning Devices
   F. Tachograph

## Description of Lab Lesson

Lesson 2 - Instrument and Control Familarization

In this lesson, the instructor will take three students at a time on a systematic tour of the tractor-trailer's controls. He will also identify the instruments and warning devices on the tractor and indicate instrument readings for proper operation. At the end of the lesson, you will be able to answer questions concerning the function and operation of vehicle controls and instruments.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- o Identification of Vehicle Controls and Instruments
- o Review Quiz

# IDENTIFICATION OF VEHICLE CONTROLS AND INSTRUMENTS

## VEHICLE CONTROLS

You can recognize the function of many of the controls on a tractor because they are the same (or very similar) to those on a car, e.g., the accelerator clutch, gear shift.

Below is a list of some of the more common controls that you will only find in the cab of a truck-trailer.

### Drive Train Controls

Clutch/Brake--On nonsynchronized transmissions. Stops or slows down transmission input shaft and countershaft. Used to engage first or reverse gear when the vehicle is stationary. Engaged in last inch of clutch pedal downstroke.

Twin Sticks--The two gearshift levers when vehicle has main and auxiliary transmission.

Controls on a Single Gear Shift Lever

- o Range Selector. Knob on gearshift lever of transmissions which have high and low range, such as 13-speed Roadranger. Put in low range for low through 4th gear. High range for 5th to 8th gear.

- 0 Splitter Valve. On some transmissions such as 13-speed Roadranger to split high gears (5th to 8th) into direct and overdrive. Flipped to direct for 5th direct, flipped to overdrive for 5th overdrive, etc.

Interaxle Differential Lock Control--Control on twin screws that locks and unlocks rear tandem axles.

- o Unlocked Position. Normal to allow axles in tandem to operate independently of one another on dry surfaces.

- o Locked Position. Equalizes power in axles to prevent wheels from spinning on wet or slippery surfaces. Must be used before wheels begin to spin or with the vehicle stopped and the spinning stopped.

### Brake Controls (Air Brake System)

Foot Brake Control Valve--Operates service brakes on tractor and trailer. When depressed, opens valve to release air pressure to all the brake chambers on the tractor and trailer.

Trailer Brake Control Valve--Hand brake which operates service brakes on trailer only. Used only in special situations.

Trailer Protection Valve--Controls air supply to trailer brakes. Open for normal operation with a trailer and is closed for operation without a trailer. Closes automatically in the event that airlines to the trailer are broken.

You will find these vehicle controls in the cab of some tractor-trailers.

Front Brake Limiting Valve--Option on some tractors. Limits amount of braking force on front axle brakes by about 50 percent when operated. Helps prevent wheel lockup on wet or slippery surfaces.

Engine Brakes--Supplements the service brakes. An example is "Jake Brakes" which open exhaust valve on power stroke to "brake" the engine. Operated when toggle is in "on" position and activated as driver releases foot from accelerator. Properly used on downhill runs. Jake Brakes and other types of exhaust brakes save the service brakes.

## VEHICLE INSTRUMENTS

On the following page is an illustration of a dashboard (instrument panel) of typical twin screw, diesel-powered tractor. There are two main sections, the tell-tale panel and the instruments.

Tell-Tale Panel--Warning lights which light up to indicate a control is operating or that something is wrong.

1. Turn signal left. Flashes when left turn signal is operating.

2. Coolant level. Lights up when coolant level is too low or engine is overheating.

3. Low oil. Lights up to indicate when oil level is too Tow.

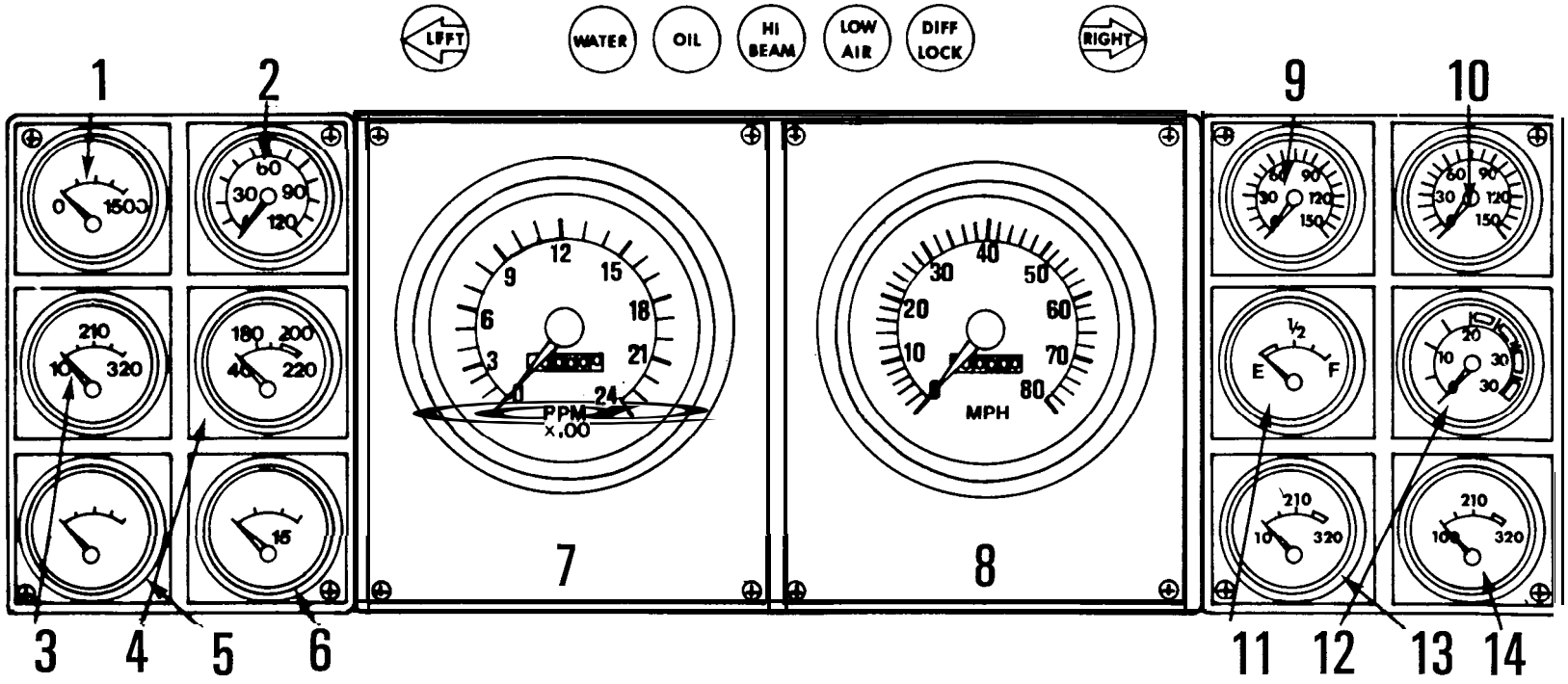
4. High beam. Lights up to indicate when high beams are on.

5. Low air. Lights up when air pressure in braking system drops to 60 psi. Unsafe to operate. There may also be a buzzer which goes off.

6. Differential lock. Flashes when differential lock is in "locked" position.

7. Turn signal right. Flashes when right turn signal is operating.

# *Identification of Vehicle Instruments*




1. Exhaust Pyrometer
2. Engine Oil Pressure
3. Engine Oil Temperature
4. Engine Coolant Temperature
5. Ammeter
6. Voltmeter
7. Tachometer
8. Speedometer/Odometer
9. Air Pressure
10. Air Brake Application Pressure
11. Fuel Gauge
12. Air Filter Restriction
13. Axle Temperature
14. Axle Temperature

## Instruments/Gauges

The following is a list of instruments and gauges shown in the illustration with a brief explanation of each. Safe operating ranges vary somewhat by type of engine. You should always check the Operator's Manual for instructions in the safe and unsafe operating ranges for each instrument/gauge.

Exhaust Pyrometer--Indicates temperature of exhaust gases in exhaust manifold. Safe temperature range shown on panel. Excess temperature could damage turbocharger.

Oil Pressure--Indicates oil pressure. Normal oil pressure depends on type of engine.

Engine Oil Temperature--Indicates engine oil temperature. Usually 20-60 degrees above coolant temperature. Safe range is 180-225 degrees when operating under normal conditions.

Coolant Temperature--Shows temperature of water or coolant in engine block. Normal range 170-195 degrees. When above normal range, indicates engine may be overheating.

Ammeter--Registers amount of charge or discharge the battery is receiving from generator. Should remain at center "zero" when engine and electrical system is off.

Voltmeter--Measures voltage output to show battery condition. Needle should be between 12.0 to 14.5 volts during normal operation.

Tachometer--Indicates engine speed in rpm (revolutions per minute) from 0 to 2,400 rpm. Key to shifting, as rpm indicates proper gear selection,

Speedometer--Indicates vehicle speed in miles per hour.

Air Pressure--Indicates amount of air pressure available in air braking system. Normal operation is from 95-120 psi. 60 psi indicates unsafe, low air pressure.

Air Brake Pressure--Indicates in psi amount of air pressure expended when brake pedal is depressed.

Fuel Gauge--Shows amount of fuel in tank(s). Usually E (Empty) to 1/2 to F (Full).

Air Filter Restriction--Shows condition of filter cartridge in air intake system. If it points to green area on gauge, everything is okay. If needle points to red area, indicates a restriction in system which must be corrected promptly.

Axle Temperature Gauges--Measures temperature of lubricant in front and rear of drive axles in tractor, Normal range is 150-200 degrees although it can run hotter under certain conditions. Front axle usually runs hotter than rear axle in tandem.

## UNIT 1.2 - REVIEW QUIZ

To be completed in class.

### PART A

Match the control or instrument in Column A with the best identification in Column B.

| COLUMN A | COLUMN B |
|---|---|
| ____1. Tachometer | A. Normally in "unlocked" position to allow axles of tandem to turn independently. |
| ____2. Tachograph | B. Prepares a chart that shows activity of vehicle. |
| ____3. Tractor protection valve | C. Uses engine compression to slow speed of the vehicle. |
| ____4. Interaxle differential lock control | D. Measures temperature of engine exhaust. |
| ____5. Pyrometer gauge | E. In "emergency" position activates trailer brakes. |
| ____6. Exhaust brakes | F. Measures engines rpm |

PART B

Read the description of each situation and answer the questions.

The air pressure is dropping. It reaches 60 psi and the low air warning device goes on. The air pressure continues to drop gradually.

1. What does this indicate?_____

_____

2. What should you do?_____

_____

3. What will happen if you don't act fast?_____

_____

The engine oil temperature is rising gradually. It is out of the normal range. At the same time, oil pressure is gradually dropping and it is below the normal range.

1. What does this indicate?_____

_____

2. What should you do?_____

_____

3. What will happen if you fail to act?_____

_____

# Notes:

UNIT 1.3
VEHICLE
SPECTIOI

# UNIT 1.3 VEHICLE INSPECTIONS

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn how to

- o inspect, and check the condition of important parts of the tractor-trailer, including instruments and controls; engine and drive train; chassis and suspension; steering system; braking system; tires, wheels, and rims; lights and signals; coupling system; emergency equipment; and equipment used to secure cargo.
- o make pretrip inspections correctly and quickly.
- o make enroute inspections by checking mirrors for signs of trouble, checking instruments and watching for other signs that there is a problem, and by stopping from time to time for a walk around inspection, especially when you are transporting dangerous cargo.
- o make post-trip inspections by properly noting problems you had on the trip and vehicle parts that aren't working correctly.

You will learn

- o a systematic procedure for making a quick and complete inspection.
- o why an undiscovered malfunction or vehicle problem can be unsafe and cost you time and money.
- o the importance of having malfunctions corrected quickly.
- o Federal, State, and other regulations on inspections, including special regulations for hazardous cargo and the driver's responsibility for inspections.
- o procedures for performing post-trip inspections

## WHAT WILL HAPPEN IN THIS UNIT

The unit begins with a classroom session that covers the objectives of inspections, types of inspections, and proper procedures. The majority of time will be devoted to range demonstration and student practice in making inspections and detecting malfunctions and potential. problems.

## Outline of Classroom Lessons

Lesson I - Vehicle Inspections: Procedures

I. Types of Vehicle Inspections and Their Importance

II* What to Look For When Inspecting Vehicles
- A. Fluid Leaks
- B. Interference with Visibility
- C. Bad Tires
- D. Wheel and Rim Defects
- E. Braking System Defects
- F. Steering System Defects
- G. Suspension System Defects
- H. Exhaust System Defects
- I* Coupling System Defects
- J. Cargo P robl ems

III. Pretrip Inspection Procedures

- A. Characteristics of a Good Pretrip Inspection
- B. Federal Requirements
- C. Inspection Procedures

IV. Enroute and Post-Trip Inspections

V. Additional Procedures for Special Vehicles

- A. Twin Trailers
- B. Tankers
- C. Refrigerated Units

VI. Reporting Your Findings

## Description of Lab Lesson

Lesson 2 - Vehicle Inspections: Practice

This lesson begins with a demonstration of the pretrip inspection procedure by the instructor. You may ask questions any time you don't understand what the instructor is doing or why he is doing it.

In the second part of the lesson, the students will practice the pretrip inspection procedure. One student will inspect the vehicle for real or simulated defects, describing outloud what he is doing as he goes . The remaining students will observe his progress, noting any mistakes he makes* Students will take turns inspecting and observing on different days, to avoid having overly long, fatiguing lab sessions .

STUDENT **AIDS**

To help you learn the material in this unit, the following items have been included in your student material.

- Federal Regulations Which Apply to this Unit
- Pretrip Inspection Check List--for use throughout this course
- Walkaround Sequence--an illustration of the walkaround inspection
- Example of a Driver's Inspection Report Form
- Review Quiz

## FEDERAL REGULATIONS THAT APPLY TO THIS UNIT

You should review the following regulations from the handbook, Federal Motor Carrier Safety Regulations and Noise Emission Requirements

392.7--Equipment inspection and use. (Regulation regarding responsibility of driver to inspect.)

392.8--Emergency equipment, inspection, and use. (Regulation regarding responsibility of driver to check emergency equipment.)

392.9--Safe Loading (Regulations regarding drivers responsibility to inspect cargo securement.)

393.95--Emergency equipment on all power units. (Regulations regarding requirements for emergency equipment.)

393.100--General rules for protection against shifting or falling cargo.

393.102--Securement systems (Regulations regarding cargo tiedown devices)

393.104--Blocking and Bracing (Regulations regarding prevention of cargo movement)

393.106--Front-end structure (Regulations regarding protection of driver compartments from shifting cargo.)

396.7--Unsafe operation forbidden (Regulations forbidding operation of unsafe vheicles)

396.9--Inspection of motor vehicles in operation. (Regulations regarding "out of service" vehicles.)

396.11--Driver vehicle inspection report(s).

396.13--Driver inspection (Regulations requiring driver to review vehicle inspection report and confirm repairs.)

397.17--Tires (Regulations regarding tire inspection on vehicles containing hazardous cargo and what to do if conditions indicate a tire fire.)

## UNIT 1.3 - PRETRIP INSPECTION CHECKLIST

### 1. Approach Vehicle

Check general condition. Note fresh leaks.

### 2. Check Under Hood (or Cab)

First check that brakes are applied and/or wheels chocked. Oil level, coolant level, power steering fluid lines*, windshield washer fluid level, battery fluid level, connections and tiedowns, automatic transmission level*, engine oil makeup reservoir*, belts, leaks in engine compartment, wiring.

### 3. Start Engine and Check Inside Cab

Monitor Instruments--Oil pressure, ammeter/voltmeter, coolant temperature, air pressure, telltale lights, and warning buzzers.

Check Condition of Primary and Secondary Controls--Clutch, accelerator, brakes, transmission, horn, lights, climate controls.

Check Operation of Controls--Steering play, clutch free play, accelerator and brake pedals, horn, windshield wipers, climate controls, interior lights.

Check for Vision--Mirrors and windshields.

Check Emergency Equipment--DOT-required equipment, optional items such as tire-changing equipment, spare lamps, tools, etc.

Turn Off Engine and Leave Cab-- when air pressure has built to governor cut-out pressure, turn off engine, put transmission in lowest forward gear, set parking brake and turn on low beams and four-way flashers.

### 4. Check Lights

Check low and high beam operation and alignment, four-way flashers. Clean and adjust mirrors.

### 5. Conduct Walkaround Inspection

General--Turn off headlights and four-way flashers, turn on parking identification and clearance lights. Activate right turn signals. Conduct walkaround in sequence indicated.

---

* If so equipped

## PRETRIP INSPECTION CHECKLIST (Continued)

Left Side of Cab

Driver's door glass and door latches
Left front wheel, rim, tires, wheel bearing or hub oil seal and level
Left front suspension, spring(s), spring hangers, shackles, U-bolts, shock absorbers
Left front brake*, brake drum, hoses, check slack adjusters.

Front of Cab Area

Front axle, steering system, license plates, windshield, wiper arm tension, wiper blade rubber, 'lights and reflectors. Operation of right turn signal.

Right Side of Cab Area

Check all items as done on left side.
Operation of cab tilt mechanism.*

Right Saddle Tank Area

Right fuel tank(s), visible parts of rear of engine, transmission, exhaust system, frame and cross members, spare tire

Coupling System Area

Fifth wheel (upper and lower), air and electrical lines to trailer, sliding fifth wheel*

Right Rear Tractor Wheels Area

Dual wheels--wheels, rims, tires. Same type and evenly matched tires.
Tandem axles--repeat wheel and tire inspection. Also, check securing of wheel mounting for single wheels
Suspension--spring(s), spring hangers, u-bolts, torque rod arms, bushings, shock absorbers, alignment
Power axles*--not leaking. Retractable axle*--condition of lift mechanism
Brakes--brake drums, hoses. Check slack adjusters, spring brakes

Rear of Tractor Area

Frame and cross members, lights and reflectors, license plate, splashguards*--not chaffing wheels, air and electrical lines

Trailer Frontal Area

Air and electrical connections, license registration holder, header board secured*, canvas or tarp carrier secured*, lights and reflectors

Right Side of Trailer Area

Landing gear, spare tire(s)*, lights and reflectors, cargo securement and covering*, sideboards*, curbside doors secured*, if overwidth are signs mounted and permits in order, frame and cross members

---

* If so equipped

## PRETRIP INSPECTION CHECKLIST (Continued)

Right Rear Trailer Wheels Area

Dual wheels--wheels, rims, tires, Same type and evenly matched.
Tandem axle--repeat tire and wheel inspection. Also check securing of wheel mounting for single wheels.
Sliding axle*--position and alignment, Flexible airlines, suspension spring(s), spring hangers, U-bolts, torque rod arms, bushings, shock absorbers
Brakes--brake drums, hoses,check slack adjusters and spring brake. Drain air tank, close petcock.

Rear of Trailer

Lights and reflectors, license plate(s), splash guard, cargo securement and covering*, overlength or overwidth signs*, additional lights/flags*, rear door secured, required seals in place*

Left Rear Trailer Wheels Area

Same as right rear wheel area except for draining air tank

Left Side of Trailer Area

Same as right side except for "side doors"* instead of "curbside doors"*

Left Saddle Tank Area

Same as right saddle tank area except for spare tire. Also check battery*.

### 6. Check Signal Lights

Turn off all lights. Activate stop lights and left turn signal lights and check condition and operation on both tractor and trailer

### 7. Check Air Brake System

Test Service Brakes

Note air pressure lost while out of cab. With engine off, apply foot pedal. Note if air pressure drops more than 3 psi in one minute (tractor only) or 4 psi in one minute (combination unit)

Test Low Pressure Alarm and/or Light

Fan off air pressure, At about 60 psi, low air pressure warning device should activate

Test Tractor Protection Valve

Continue fanning off air pressure. At approximately 40 psi, tractor protection valve should go from "normal" to "emergency" causing trailer brakes to lock up

---

* If so equipped

## PRETRIP INSPECTION CHECKLIST (Continued)

Check Air Pressure Buildup

Start engine. Air pressure should build up to 105-115 psi within 3 to 3-1/2 minutes, note if low air warning devices shut off at proper time

Fasten Seat Belt

Test Parking Brake

Apply with vehicle rolling slowly to avoid damage

Test Trailer Brake

Apply with vehicle rolling **slowly** to avoid damage

Test for Excessive Slack in Fifth Wheel

Set trailer brake, **carefully** and **gently** rock trailer in first and reverse gears

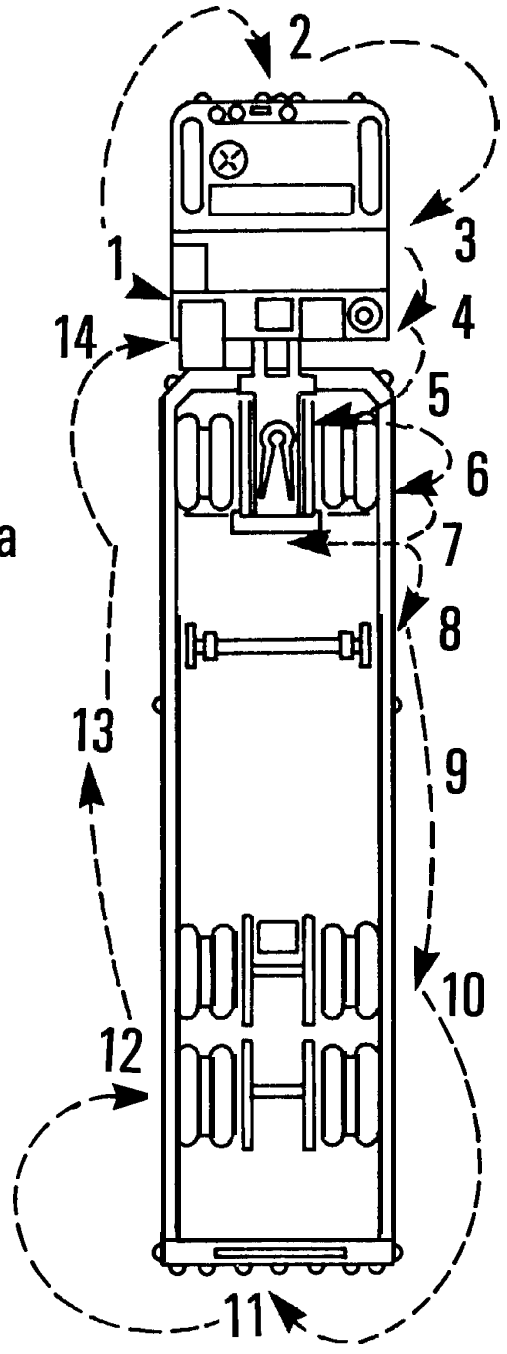
Test Brake System Balance

Build up speed to 5 to 7 mph **maximum** and apply brakes sharply (in yard). Note any "pulling" or mushy feeling that indicates lack of proper adjustment

Complete Pretrip Inspection Report Form (if required by employer)

# *Walkaround Sequence*

1. Left Side of Cab Area
2. Front of Cab Area
3. Right Side of Tractor Area
4. Right Saddle Tank Area
5. Coupling System Area
6. Right Rear Tractor Wheels Area
7. Rear of Tractor Area
8. Trailer Frontal Area
9. Right Side of Trailer Area
10. Right Rear Trailer Wheels Area
11. Rear of Trailer Area
12. Left Rear Trailer Wheels Area
13. Left Side of Trailer Area
14. Left Saddle Tank Area



# Example of Driver's Inspection Report

## DRIVER'S INSPECTION REPORT

MAINTENANCE (SEE INSTRUCTIONS ON REVERSE SIDE)

CHECK DEFECTS ONLY. Explain under REMARKS

COMPLETION OF THIS REPORT REQUIRED BY FEDERAL LAW, 49CFR 396.11 & 396.13.

Mileage (No Tenths)

Truck or Tractor No. _____ | | | | | | | Trailer No. _____

Dolly No. _____ Trailer No. _____ Location: _____

### POWER UNIT

**GENERAL CONDITION**

- ☐ 02 Cab/Doors/Windows
- ☐ 02 Body/Doors
- ☐ ____ Oil Leak _____
- ☐ ____ Grease Leak _____
- ☐ 42 Coolant Leak
- ☐ 44 Fuel Leak
- ☐ ____ Other _____

_____ (IDENTIFY)

**ENGINE COMPARTMENT**

- ☐ 45 Oil Level
- ☐ ____ Belts _____
- ☐ ____ Other _____

_____ (IDENTIFY)

**IN CAB**

- ☐ 03 Gauges/Warning Indicators
- ☐ 02 Windshield Wipers/Washers
- ☐ 54 Horn(s)
- ☐ 01 Heater/Defroster
- ☐ 02 Mirrors
- ☐ 15 Steering
- ☐ Clutch
- ☐ 13 Service Brakes
- ☐ 13 Parking Brake
- ☐ 13 Emergency Brakes
- ☐ 53 Triangles
- ☐ 53 Fire Extinguisher
- ☐ 53 Other Safety Equipment
- ☐ 34 Spare Fuses
- ☐ 02 Seat Belts
- ☐ ____ Other _____

_____ (IDENTIFY)

**EXTERIOR**

- ☐ 34 Lights
- ☐ Reflectors
- ☐ 16 Suspension
- ☐ 17 Tires
- ☐ 18 Wheels/Rims/Lugs
- ☐ 32 Battery
- ☐ 43 Exhaust
- ☐ 13 Brakes
- ☐ 13 Air Lines
- ☐ 34 Light Line
- ☐ 49 Fifth-Wheel
- ☐ 49 Other Coupling
- ☐ 71 Tie-Downs
- ☐ 14 Rear-End Protection
- ☐ ____ Other _____

_____ (IDENTIFY)

☐ NO DEFECTS

### TOWED UNIT(S)

- ☐ 71 Body/Doors
- ☐ 71 Tie-Downs
- ☐ 34 Lights
- ☐ 34 Reflectors
- ☐ 16 Suspension
- ☐ 17 Tires
- ☐ 18 Wheels/Rims/Lugs
- ☐ 13 Brakes
- ☐ 77 Landing Gear
- ☐ 59 Kingpin Upper Plate
- ☐ 59 Fifth-Wheel (Dolly)
- ☐ 59 Other Coupling Devices
- ☐ 79 Rear End Protection
- ☐ ____ Other _____

_____ (IDENTIFY)

☐ NO DEFECTS

REMARKS: _____

REPORTING DRIVER: Date _____

Name _____ Emp. No. _____

REVIEWING DRIVER: Date _____

Name _____ Emp. No. _____

MAINTENANCE ACTION: Date _____

Repairs Made ☐ No Repairs Needed ☐

R.O.#s _____

Certified By: _____

Location: _____

SHOP REMARKS: _____

UNIT 1.3 - REVIEY QUIZ

Part A - Consequences

In Column A, we have listed situations that could occur as a result of a vehicle defect or malfunction. Column B shows a step in a pretrip inspection. Match the step to the situation it might have prevented.

| COLUMN A | COLUMN B |
|---|---|
| A situation you don't want to happen! | An inspection step that might have prevented that situation but was skipped! |
| ____1. Engine failed and serious damage occurred as a result of lubrication loss. | A. Checked under front end of tractor for bent, worn or missing parts. |
| ____2. Vehicle declared "out-of-service" because of defective steering. | B. Checked tire pressure with gauge and inspected tread wear. |
| ____3. Pieces of cargo fell off trailer. | C. Conducted air pressure check of braking system. |
| ____4. A blowout in the right front tire, and vehicle ran off road | D. Looked under the vehicle, under the hood and checked dash instruments. |
| ____5. Brakes reacted too slowly and accident occurred. | E. Inspected cargo chains. |

## Part B - Inspection Sequence

Listed below are seven steps in a pretrip inspection' Put them in an efficient sequence. (Number them 1, 2, 3, 4, 5, 6, 7)

____Shut down the engine, secure the vehicle and check the high low beams and 4-way flashers

____Raise the cab or hood and check the engine compartment

____Start the engine and check the instruments and controls and check for emergency equipment.

____Approach the vehicle and check its overall condition for damage and look for fluid leaks.

____Conduct a walkaround inspection with right turn signal on.

____Conduct a standing and rolling air brake system test and a 'last check of the instruments.

____Check operation of the left turn signal and the stop lights.

## Part C - federal Requirements

In addition to inspecting your vehicle to assure that it is in safe operating condition, Federal regulations require you to

(Place a "T" beside the statements that are true.)

____Complete a Vehicle Condition Report at the end of the day or tour of duty.

____Be able to repair the vehicle defects you identify.

____Inspect for hot tires and low tire pressure every 100 miles or 2 hours when pulling a cargo of hazardous material.

____Assure that you have a CB radio in working condition during pretrip inspection.

____Review the previous Vehicle Condition Report and see if the reported defects were corrected,

Notes:

NIT

# UNIT 1.4 BASIC CONTROL

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- o check the trailer coupling before driving each day.
- o to start, warm up and shut down the engine properly.
- o to put the vehicle in motion and accelerate smoothly, forward and backward.
- o stop the vehicle smoothly.
- o back the vehicle in a straight line.
- o put the vehicle in position to turn and make left and right turns.

You will learn

- o the procedures for starting, warming up, and shutting down the engine; putting the vehicle in motion; and stopping.
- o the problems caused by idling longer than necessary.
- o how the length of your vehicle's wheel base, articulation (tractor and trailer), and the number of axles will affect the path of a turn and the "off-track" of the rear of the vehicle.
- o where to put your vehicle before a turn, how to make a turn correctly and how to recover from a turn.
- 0 manufacturer's specifications for engine operation.

You will learn how to

- o use the accelerator and clutch so that you can accelerate smoothly and avoid clutch <abuse.
- o use air brakes correctly so that you can stop smoothly.
- o steer, brake, and accelerate correctly so that you can keep your vehicle on a proper path forward and back in a straight line.
- o judge the "off-track" of the rear of your vehicle on left and right turns and curves.

## WHAT WILL HAPPEN IN THIS UNIT

Most of the learning in this unit will take place during practice on the range. First, there will be a short classroom session to present the information you will need and to help you get ready for range practice.

### Outline of Classroom Lessons

Lesson 1 - Introduction to Basic Control Maneuvers

I. Starting, Warming Up, and Shutting Down the Engine
   - A. Starting the Diesel Engine
   - B. Starting the Gasoline Engine
   - C. fuel Efficient Starting
   - D. Engine Warmup
   - E. Engine Shutdown
   - F. Excessive Idling

II. Putting the Vehicle in Motion and Stopping
   - A. Putting the Vehicle in Motion
   - B. Testing the Tractor-Trailer Hookup
   - C. Stopping the Tractor-Trailer

III. Backing in a Straight Line
   - A. Positioning the Vehicle Properly
   - B. Proper Speed
   - C. Steering
   - D. Starting Again

IV. Turning the Vehicle
   - A. Basic Rules
   - B. Off-Tracking
   - C. Right Turns
   - D. Left Turns
   - E. Right and Left Curves

## Description of Range Exercises

Lesson 2 - Starting and Turning Off the Engine

This lesson begins with an instructor demonstration of starting procedures, including explanation of proper gauge readings required for operation. Students will then take turns starting, warming and shutting down the engine. The instructor will be in the cab with each student to correct errors in procedure as they occur.

Lesson 3 - Putting the Vehicle in Motion

This lesson is designed to give you practice in putting the vehicle in motion, testing the tractor-trailer hookup, moving forward and backward in a straight line, and stopping.

The lesson begins with a demonstration of the exercise by the instructor. After the demonstration, you will perform the exercise. You will put the vehicle in motion and test the hookup. You will then travel about a third of the exercise area (about 100 feet) and stop. You will begin motion again, stop after 100 feet, start one more time, and travel the remaining 100 feet to the end of the exercise area. Finally, you will back the tractor-trailer, in a straight line, 300 feet back to the starting area.

The instructor will be looking to see how smoothly you can start and stop and how well you can back in a straight line with a minimum of steering corrections.

Lesson 4 - Turning the Tractor-Trailer

This lesson consists of seven exercises designed to give you practice in turning the tractor-trailer. The exercises consist of driving a serpentine course, a restricted Figure 8, turns, restricted turns, sharp turns, and a combination of turns. In all except the first exercise, you will travel the path in both directions.

The exercises are arranged in order of increasing difficulty.

The students will divide into groups of three for each vehicle. The instructor will demonstrate each exercise. Students will then take turns behind the wheel, observing from inside the cab, and observing from the range while counting and resetting course markers. The instructor will be looking at the amount of time it takes you to complete a run, the number of course markers you hit, and the number of excess steering and speed changes you make.

See the diagrams of the range exercises for these exercises at the end of the Student Aids.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Starting Two-Cycle Diesel Engines Checklist
- Starting Four-Cycle Diesel Engines Checklist
- Putting the Tractor-Trailer in Motion Checklist
- Stopping the Tractor-Trailer Checklist
- Testing the Tractor-Trailer Hookup Checklist
- Backing the Tractor-Trailer in a Straight Line Checklist
- Diagrams of Range Exercises

## UNIT 1.4 STARTING TWO-CYCLE DIESEL ENGINES CHECKLIST

1. Apply the parking brakes.
2. Place STOP and EMERGENCY STOP controls in RUN position.
3. Depress clutch and move gearshift lever to neutral.
4. Increase hand throttle to idle position (if used).
5. Turn switch-key on.
6. Depress clutch pedal (prevents starting motor from turning transmission gears).
7. Operate starter--If engine does not start in 15 to 20 seconds, turn starter off at least one minute (to allow it to cool), then try again.
8. Control engine speed with foot throttle until it is running smoothly.
9. Set hand throttle at 1/3 rpm operating range.
10. Gradually reduce hand throttle to idle speed as engine warms.
11. Check instruments for system malfunctions.
12. Continue to warm up engine until manufacturer's specified operating range is reached.
13. Release throttle and get underway.

## STARTING FOUR-CYCLE DIESEL ENGINES CHECKLIST

1. Apply parking brake.
2. Disengage clutch and move gearshift lever to neutral.
3. Close throttle.
4. Pull out compression release valve (if applicable).
5. Depress clutch pedal.
6. Turn switch-key on.

## STARTING FOUR-CYCLE DIESEL ENGINES
(continued)

7. Operate starter--If engine does not start in 15 to 20 seconds, turn starter off at least 1 minute (to allow it to cool). Then try again.

8. Crank for 3 or 4 seconds--close compression release (if so equipped).

9. Check instruments.

10. Warm up engine.

Notes:

## UNIT 1.4 PUTTING THE TRACTOR-TRAILER IN MOTION CHECKLIST

1. Depress clutch fully, place transmission in 'lowest forward gear.
2. Release clutch to "friction point" (point where clutch engages); decrease in rpm is sign that friction point has been reached. Gradually release clutch until it is fully engaged.
3. Gradually speed up engine to move 'load.
4. When vehicle is in motion with clutch fully engaged, take left foot off clutch until ready to shift again or stop.
5. Avoid excessive clutch slipping, engage as quickly as possible without stalling engine.

## STOPPING THE TRACTOR-TRAILER CHECKLIST

1. Release accelerator pedal.
2. Depress brake pedal for maximum valve opening.
3. As the vehicle begins to slow, decrease brake pedal pressure.
4. Stop vehicle smoothly by releasing brake pressure in relation to vehicle stopping rate.
5. As vehicle halts, release pedal completely.
6. Depress clutch pedal as vehicle halts.
7. After halting, place gearshift lever in neutral. Reapply brake just enough to keep vehicle stationary. Release clutch pedal.

## UNIT 1.4 TESTING THE TRACTOR-TRAILER HOOKUP CHECKLIST

### Vehicles Equipped with Independent Trailer Brake Controls

1. Depress clutch, move gearshift to lowest forward gear.
2. Engage independent trailer brake control, applying trailer brakes.
3. Release clutch to friction point.
4. Pull gently forward against locked trailer brakes.
5. Disengage clutch.
6. Repeat procedure.

NOTE: This also shows whether or not trailer brakes are working.

### Vehicles without Independent Trailer Brake Control

1. Depress clutch, move gearshift to lowest forward gear.
2. Switch tractor protection valve from "normal" to "emergency:'
3. Partially engage clutch and pull forward gently against locked trailer brakes.
4. Repeat procedure.

## UNIT 1.4 BACKING THE TRACTOR-TRAILER IN A STRAIGHT LINE CHECKLIST

1. Put vehicle in position by moving forward until tractor-trailer is aligned and front wheels are straight.

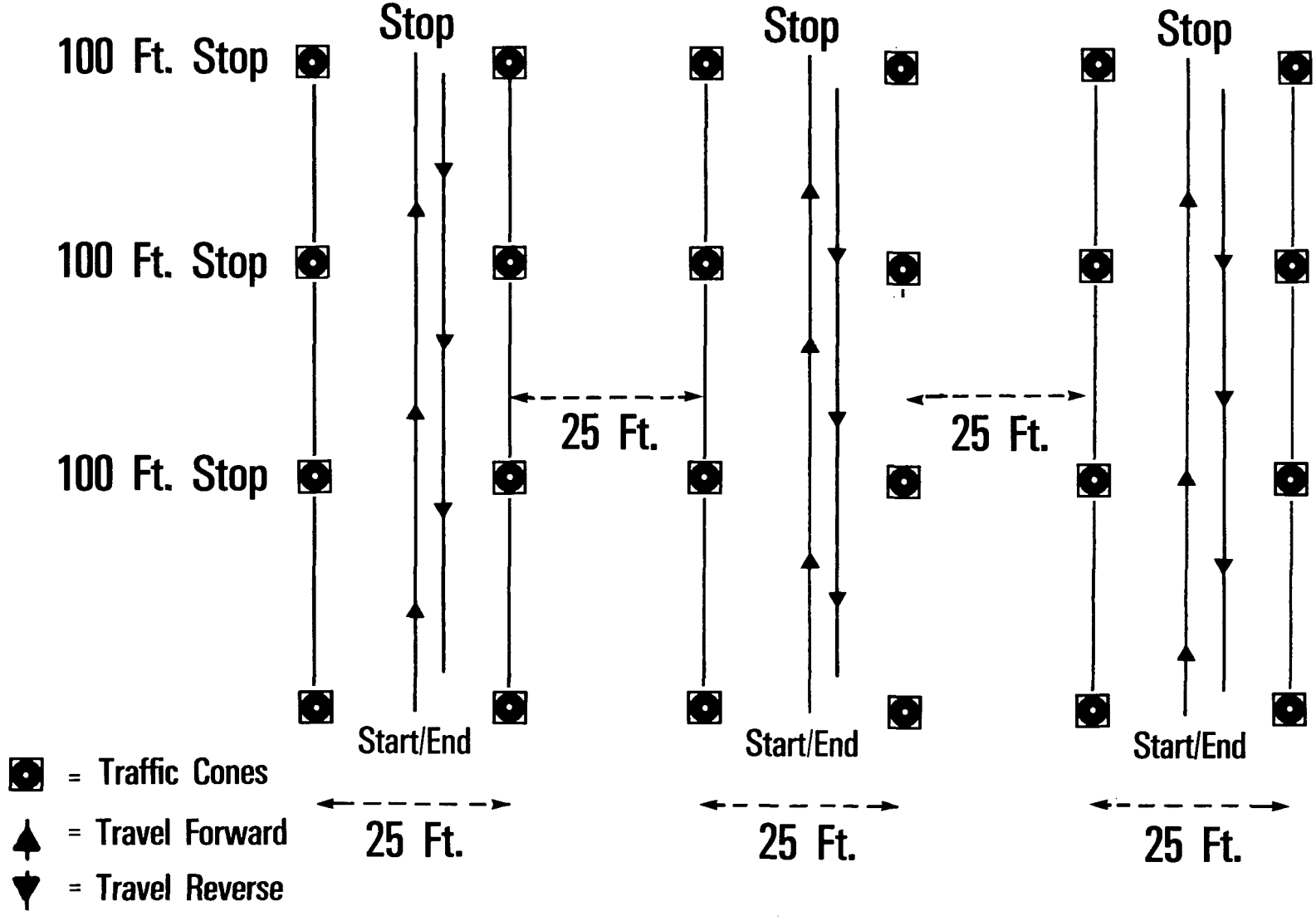
2. Put vehicle in reverse.
   - Back as slowly as possible (use idle speed)
   - Don't ride clutch or brake

3. Constantly check behind when backing.
   - Keep doors closed--always watch both mirrors
   - Make maximum use of mirrors to detect persons/objects crossing into intended path

4. Steering
   - Keep vehicle on path
   - Do not oversteer
   - Correcting drifts
     - Turn steering wheel in direction of drift as soon as it occurs
     - Do not oversteer, only slight movement required if caught right away
     - Little drifts need small correction; big drifts need big ones
     - Use push-pull method of steering to keep trailer in line
   - When trailer drifts, it gets bigger in mirror, push steering wheel towards that mirror to correct
   - Immediately straighten steering wheel
   - If late in catching larger image of trailer, push wheel more
   - Biggest error in push-pull method--not returning wheel to straight position immediately

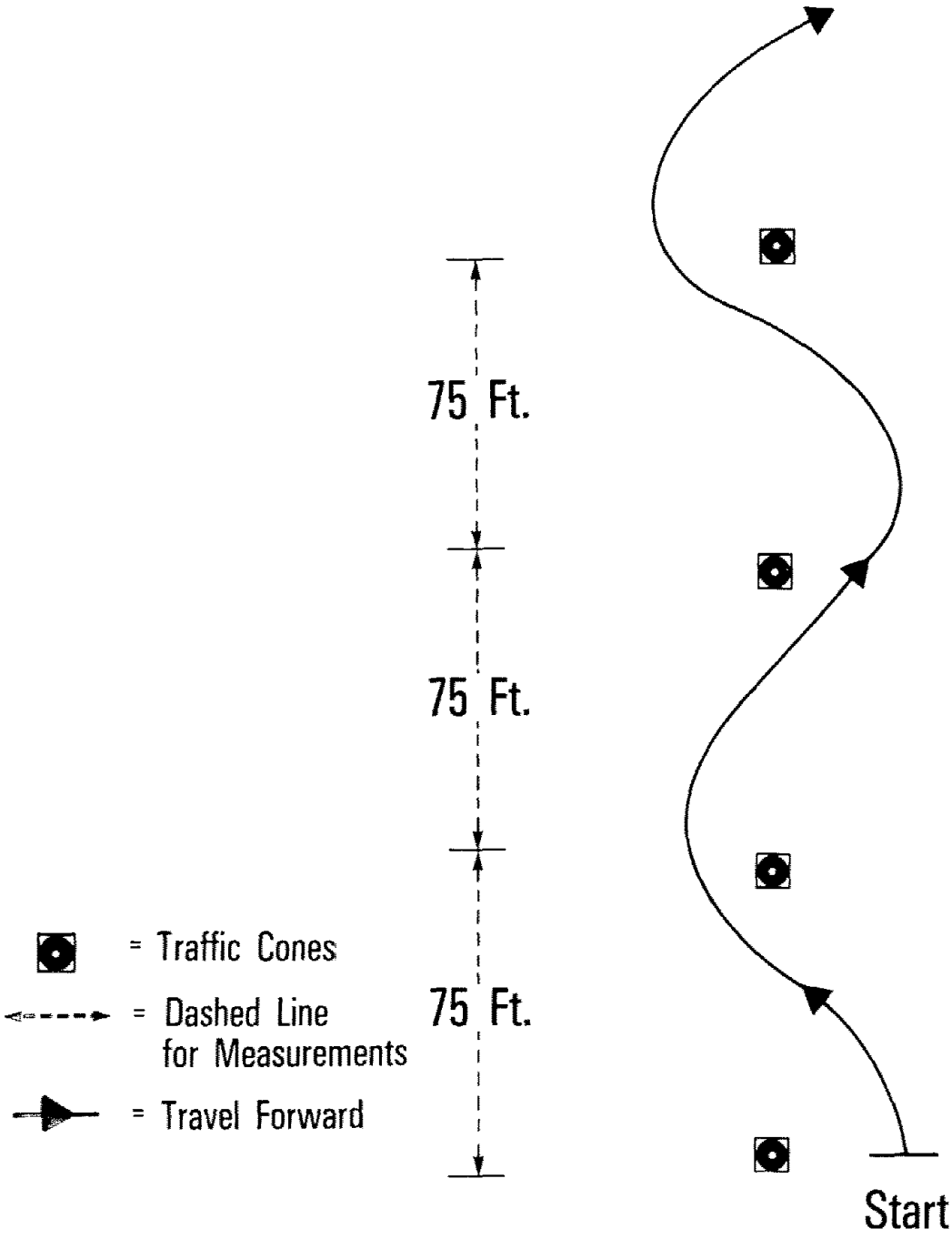
5. Pull up and start again if too far out of position
   - Easier to make corrections moving forward (i.e., get the vehicle back in proper position)
   - When it is not necessary to stop, pull up and make corrections in steering path

# *Range Diagram—Exercise 1 (Putting the Vehicle in Motion)*



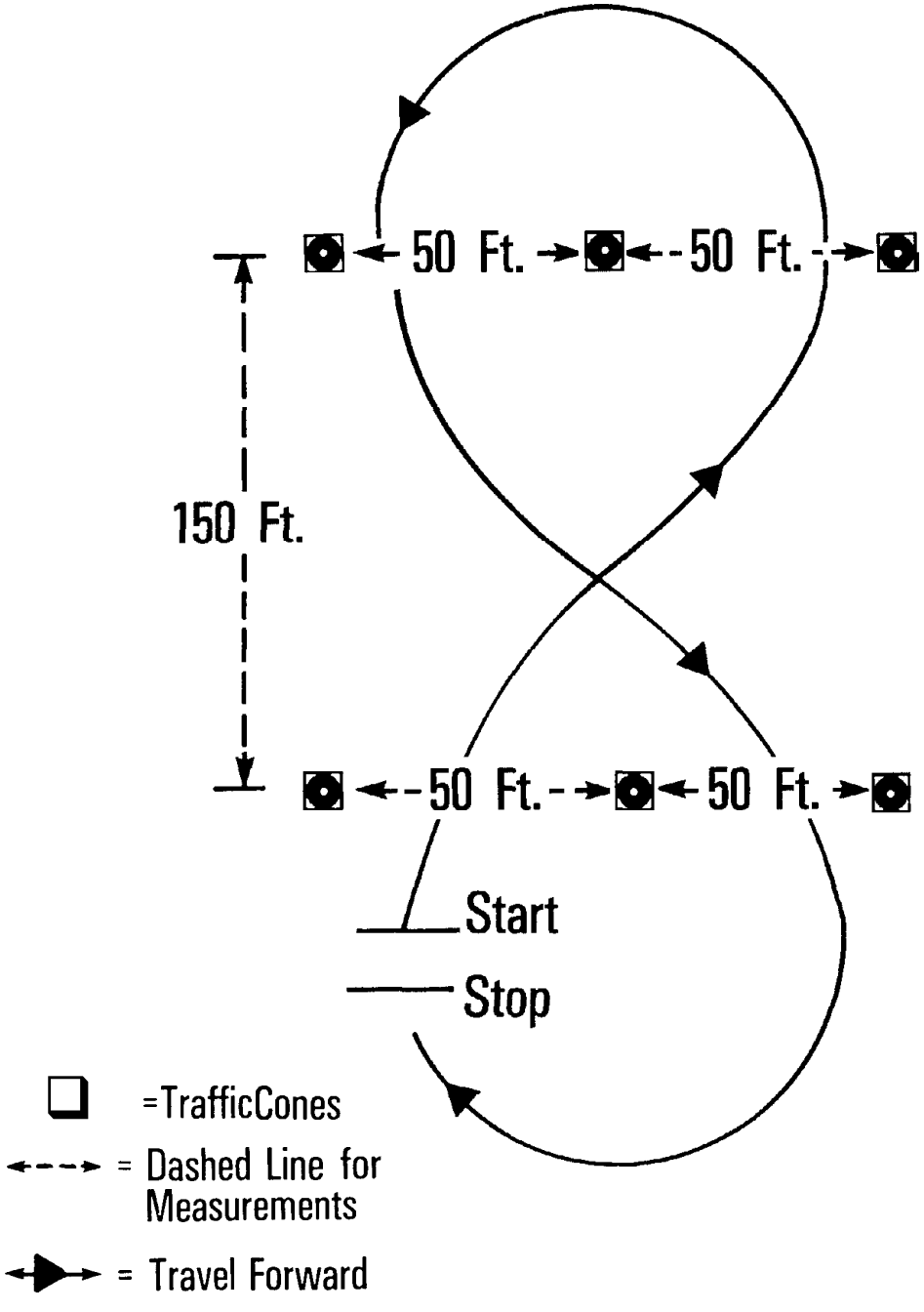

Note: Only Every Other Lane Used, Thus Giving an Empty Lane Between Each Vehicle for a Safety Margin

# *Range Diagram–Exercise 2*
## *(Serpentine)*



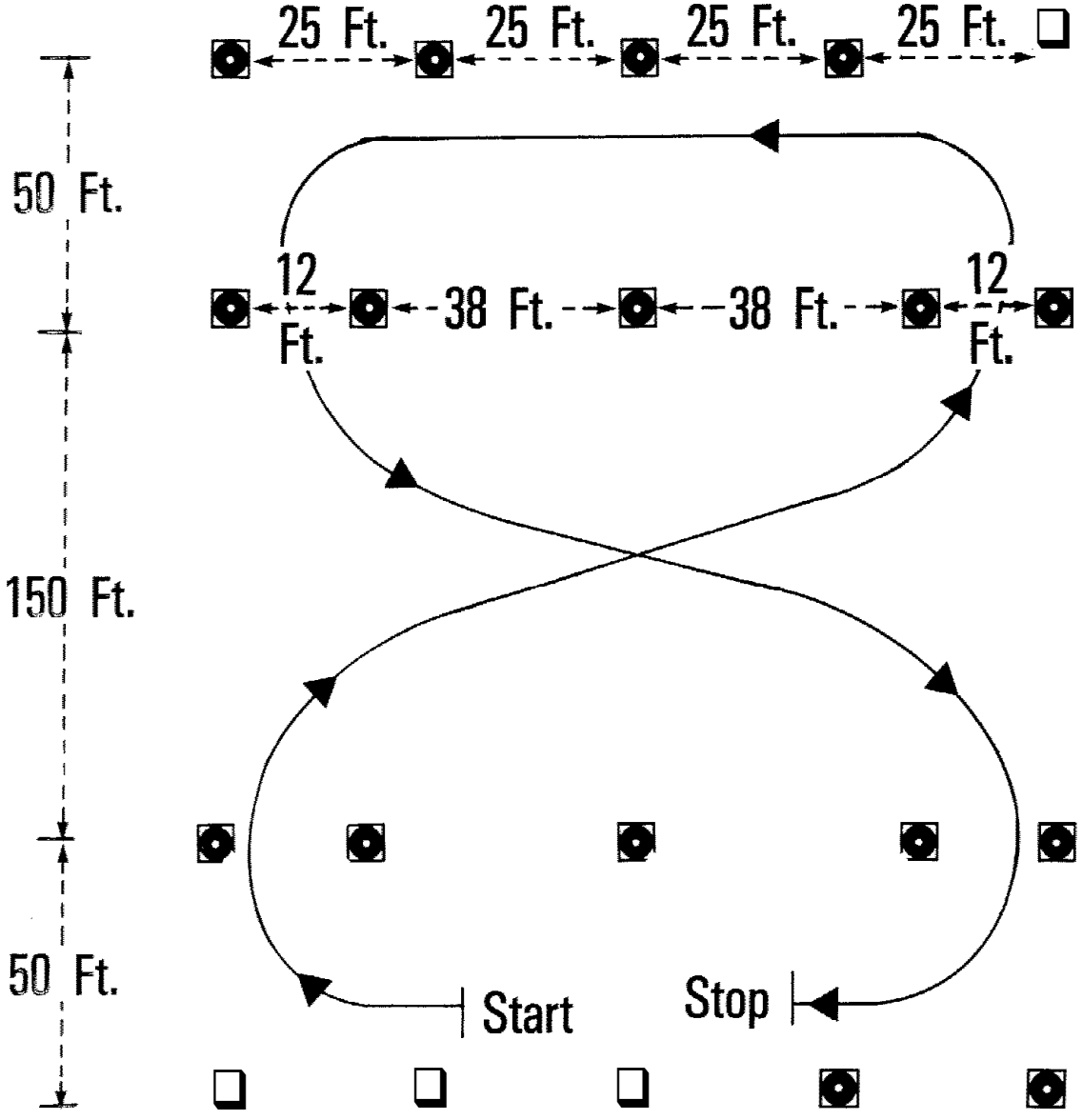
# *Range Diagram–Exercise 3*

*(Figure 8)*



# *Range Diagram–Exercise 4*

## *(Restricted Figure 8)*



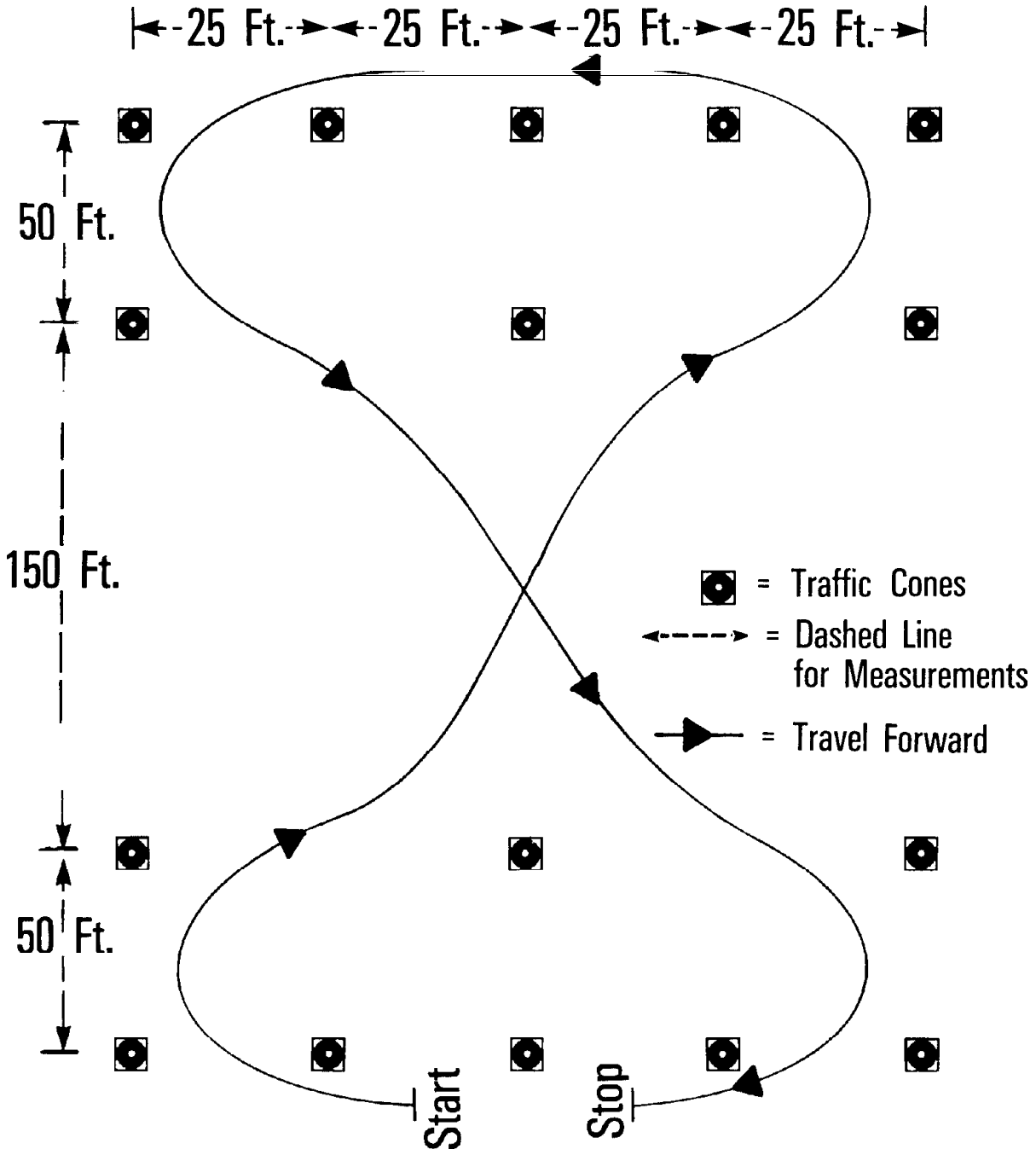

= Traffic Cones

= Dashed Line for Measurements

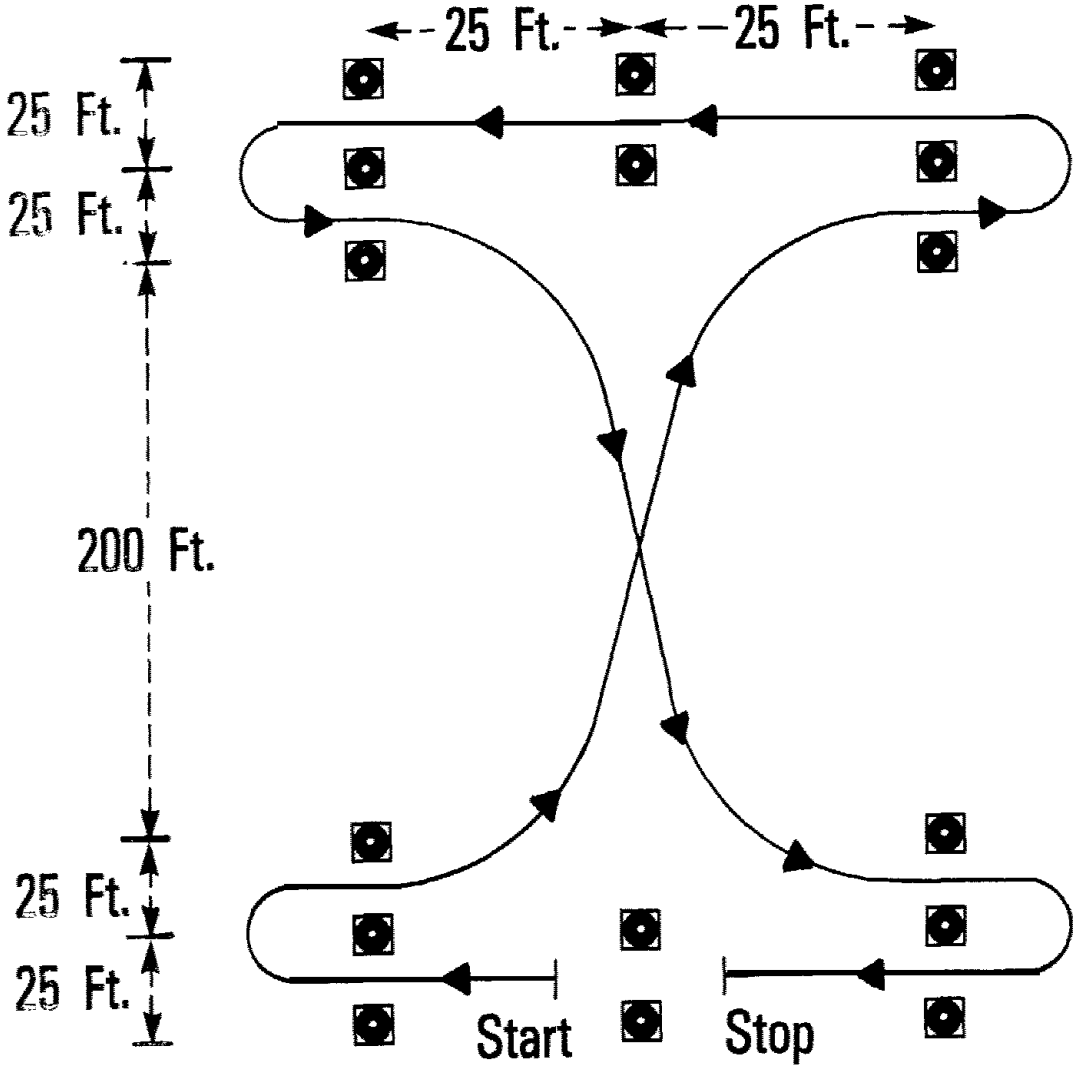
= Travel Forward

# *Range Diagram– Exercise 5*

*(Turns)*



# *Range Diagram—Exercise 6*
## *(Restricted Turns)*



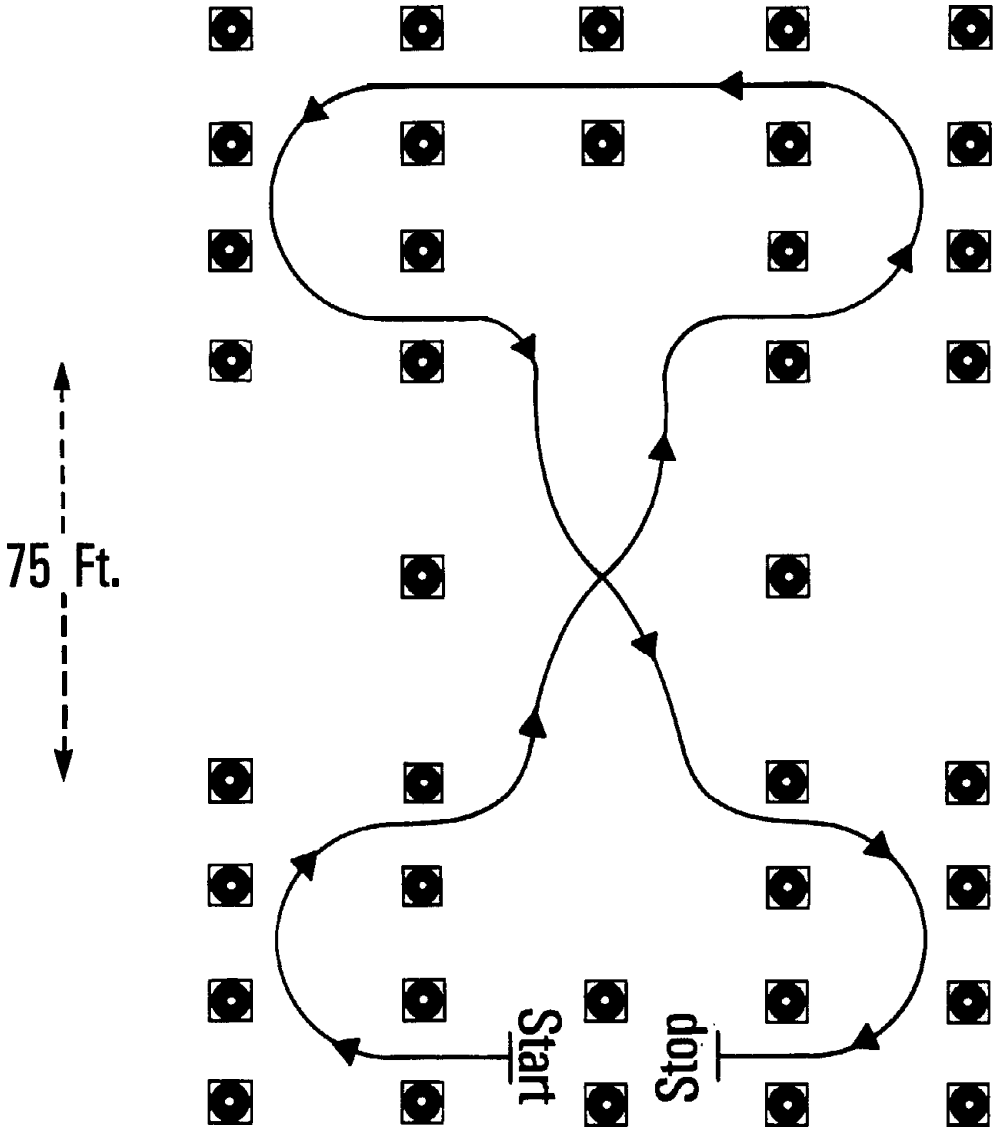

= Traffic Cones

= Dashed Line for Measurements

= Travel Forward

# *Range Diagram– Exercise 7*

## *(Sharp Turns)*



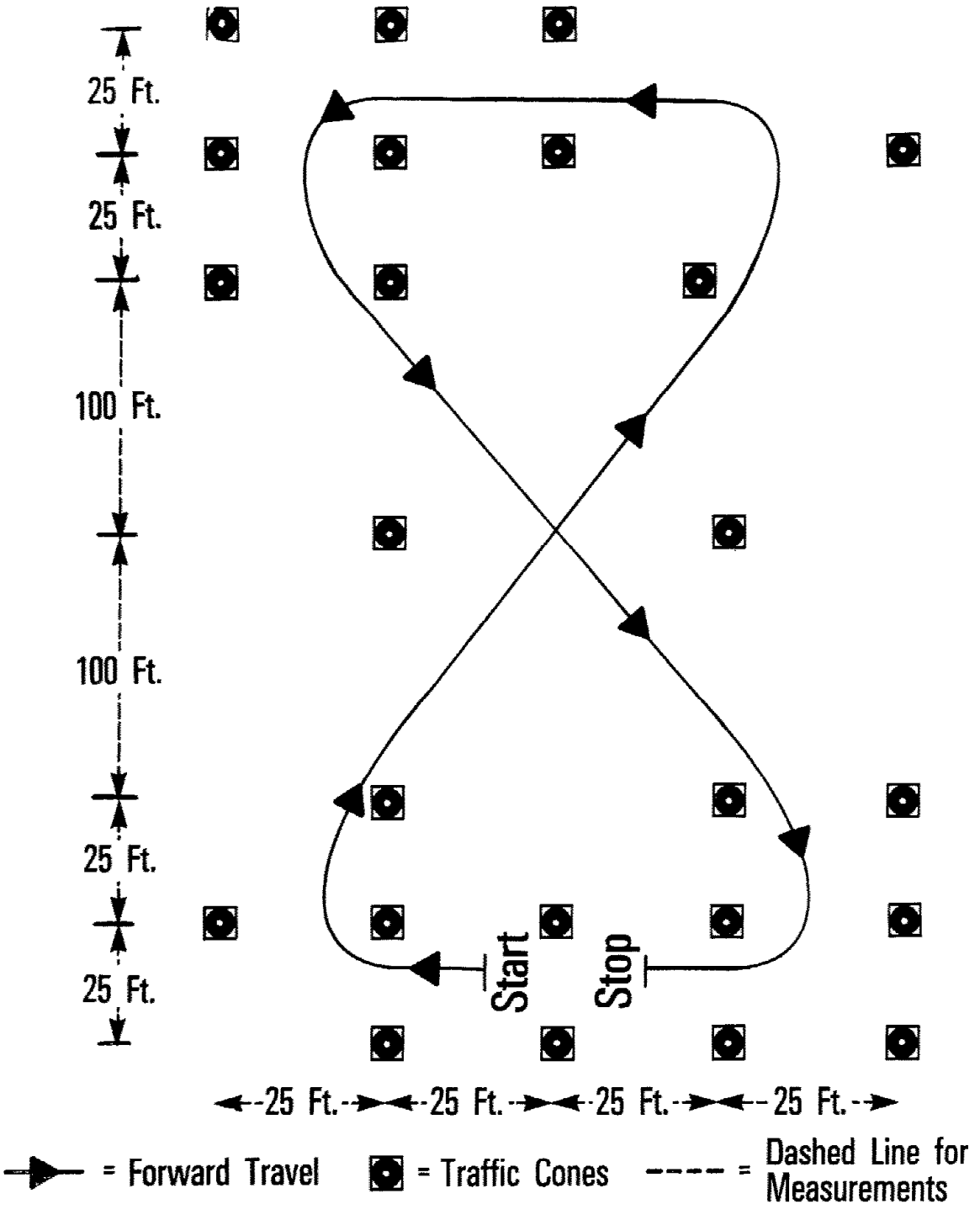

= Traffic Cones

= Dashed Line for Measurements

= Travel Forward

# *Range Diagram—Exercise 8*

## *(Combination Turns)*



UNIT
SHIFTI

# UNIT 1.5 SHIFTING

## **WHAT** YOU WILL LEARN IN THIS UNIT

You will learn to

- o shift up and down through all gears of all major types of conventional transmissions, including axuiliary transmissions and multi-speed axles.
- o double-clutch and time your shifting for smooth and fuel-efficient driving.
- o select the proper gear for speed and highway conditions.
- o operate a fully automatic and semi-automatic transmissions.

You will learn

- o shifting procedures for vehicles used in this training course.
- o the instruments and controls needed for proper shifting.
- o the shift patterns of all major types of conventional transmissions.
- o common shifting errors and the problems they cause.

## WHAT WILL HAPPEN IN THIS UNIT

There will be a short classroom session covering basic shifting rules and terms, and describing shifting patterns and procedures for common transmissions. The rest of the unit will be devoted to gear shifting practice on the range.

## Outline of Classroom Sections

Lesson 1 - Shifting Procedures

I. Key Elements of Shifting
   A* Shifting Controls
   B. When to Shift
   C. Double Clutching

II. Shift Patterns and Procedures
   A* Clark Five Speed
   B. Spicer 4x3
   C. 10 Speed Road Ranger
   D. 13 Speed Road Ranger
   E. Two-Speed Rear Axle

III. Shifting Automatic and Semi-automatic Transmissions
   A* fully Automatic Transmissions
   B. Semi-automatic Controls and Procedures

IV. Consequences of Improper Shifting

## Decription of Range Lesson

Lesson 2 - Development of Shifting Skills

In this lesson, you will accelerate, upshifting to third gear, and decelerate, downshifting back to first. You will then stop and back to your original position. The instructor will be looking to see if you overrev or Tug the engine or if you take too long to shift or if you miss any shifts.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- o Double Clutching Technique
- o Transmission Shifting Checklist
- o Controls and Shift Patterns: Spicer 4x3
- o Controls and Shift Patterns: 10-Speed Road Ranger
- o Controls and Shift Patterns: 13-Speed Road Ranger
- o Controls and Shift Procedures with 2-Speed Rear Axle

# UNIT 1.5 DOUBLE CLUTCHING TECHNIQUE

## Upshifting

Release accelerator
Depress clutch
Move gearshift to neutral position
Release clutch
Depress clutch
Move gearshift to next higher gear
Release clutch
Accelerate

## Downshifting

Release accelerator
Depress clutch
Move gearshift to neutral position
Release clutch
Accelerate engine enough to match rpm with road speed to avoid clashing gears
Depress clutch
Maintain engine speed
Shift into next higher gear
Release clutch

## Trademark of a Professional Driver's Shifting Techniques

Good timing and coordination
Always knows what gear he or she is in at any given time
Knows top mph and rpm for each gear in his rig
Makes all shifts without forcing/raking/grinding gears
Never rides clutch pedal
Always uses the clutch to makes shifts
Always selects proper gear to cruise in that achieves maximum fuel economy
Anticipates changes in terrain and/or traffic

## UNIT 1.5 TRANSMIISION SHIFTING CHECKLIST

UPSHIFTING PROCEDURES

1. Disengage the clutch and release the accelerator as you move the gear shift lever to neutral.

2. Engage the clutch.

3. Disengage the clutch and move the gearshift lever to the next highest gear.

4. Release the clutch pedal and speed the engine up at the same time.

NOTE: If the transmission cannot be shifted smoothly into the next gear, engage the clutch, and get the engine up to proper rpm; disengage the clutch and start again. Never risk clashing gears by trying to force the transmission into gear.

**DOWNSHIFTING PROCEDURES**

1. Disengage the clutch and release the accelerator as you move the gearshift lever to neutral.

2. Engage the clutch.

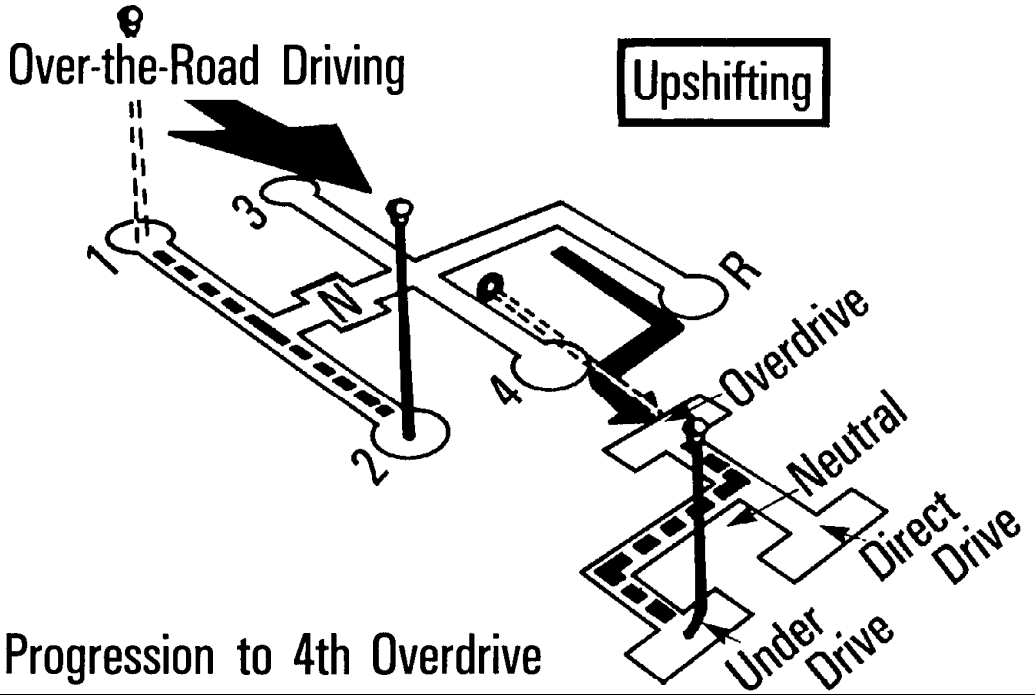
3. With the clutch engaged and the transmission in neutral, accelerate the engine to a speed higher than the speed it was running when it was in the higher gear.

4. Disengage the clutch and move the gearshift lever to the next lower gear.

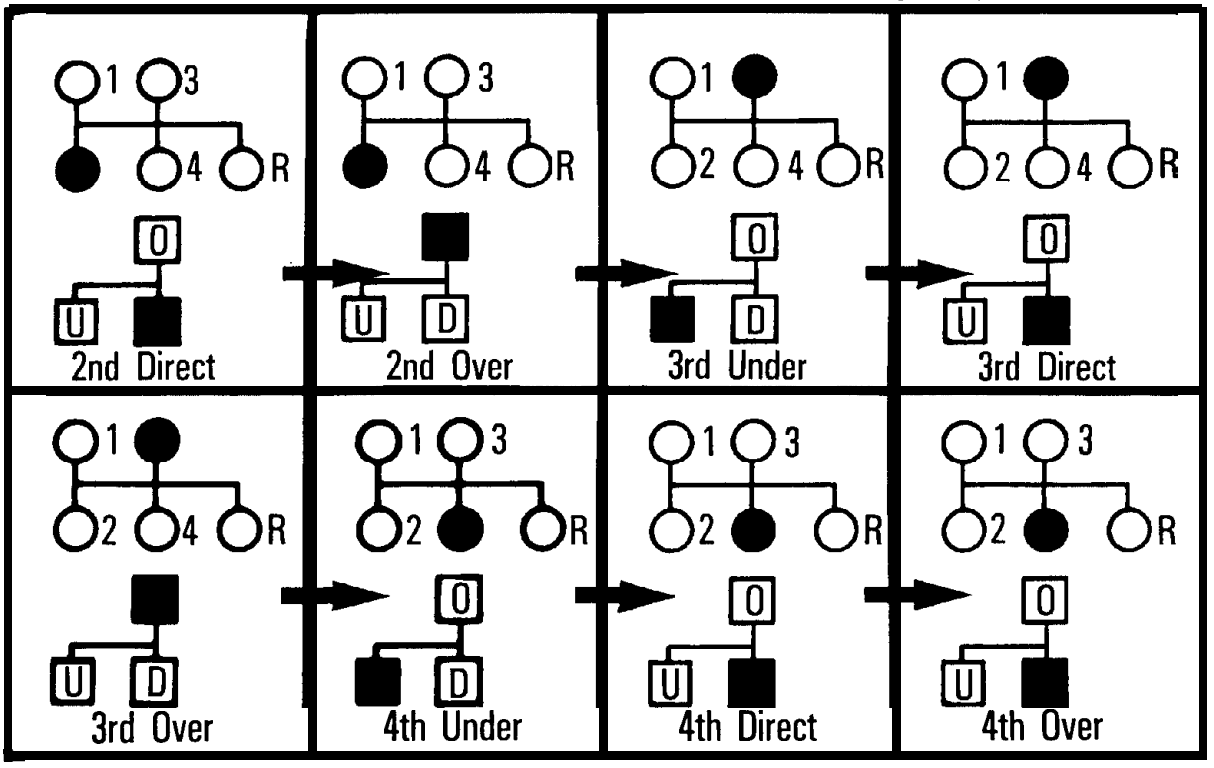
5. Gradually engage the clutch and speed up the engine to take up the shock of engaging the clutch. Keep an eye on the tachometer to avoid over revving.

NOTE: If the transmission cannot be shifted smoothly, leave the gearshift lever in neutral, engage the clutch, accelerate the engine, and then try again.

# *Controls and Shift Patterns: Spicer 4×3*



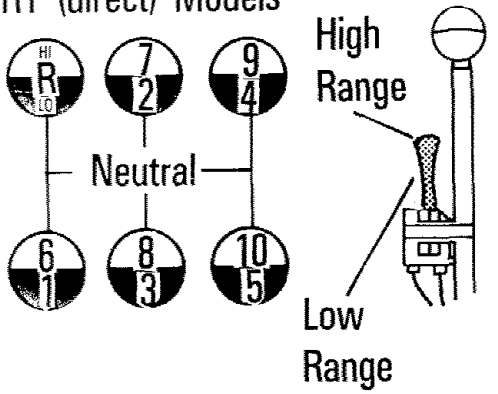

Shift Progression to 4th Overdrive



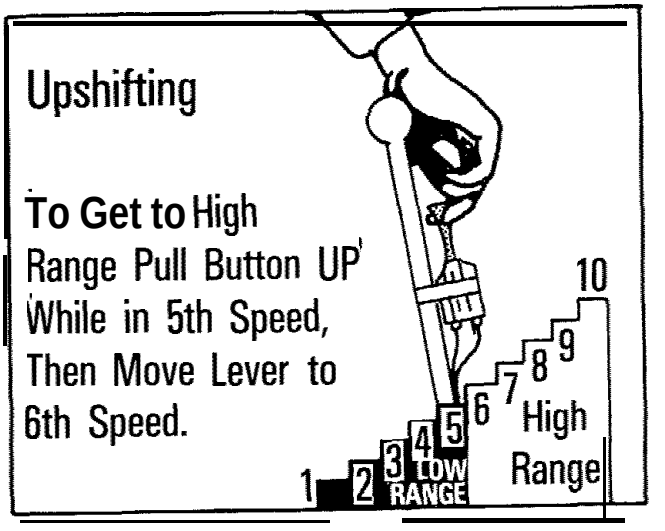
# *Controls and Shift Patterns:*
## *10-Speed RoadRanger*

### Gear Shift Lever Pattern and Range Control Button Positions

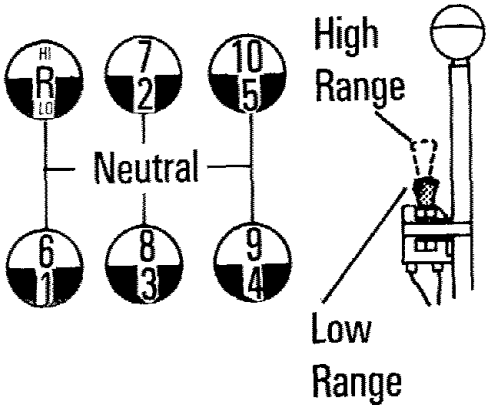
RT (direct) Models

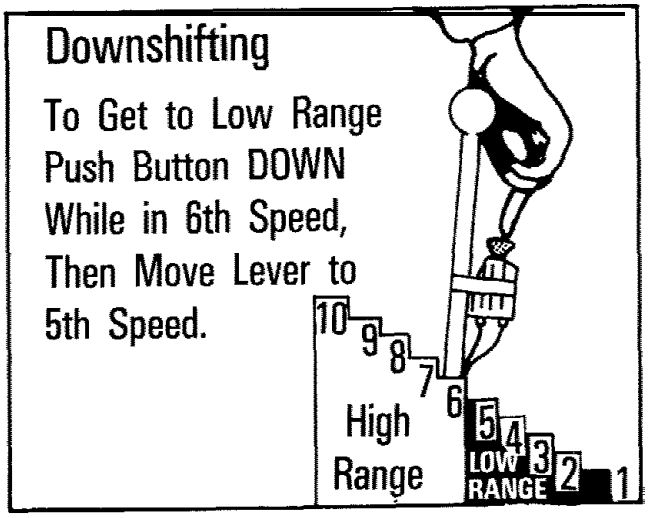



Shift 1-2-3-4-5 in Low Range.
Repeat Pattern in High Range and Shift 6-7-8-9-10



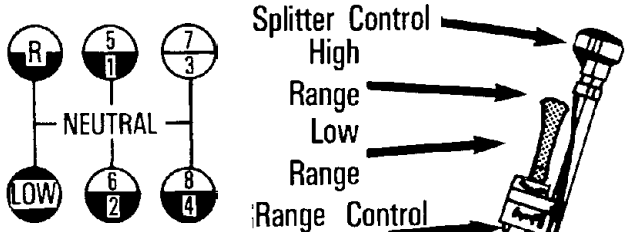

RTO (overdrive) Models



# *Controls and Shift Patterns:*
## *13-Speed* RoadRanger

### Gear Shift Lever Pattern and Selector Valve Positions

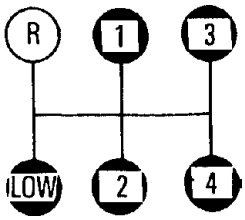


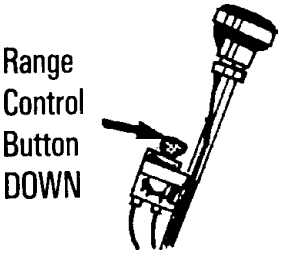

Note: With RT00-9513 Models, the 3/7 and 4/8 Lever Positions Are Reversed

Do Not Range Shift When in Reverse

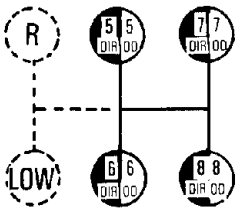
### Shifting Sequence

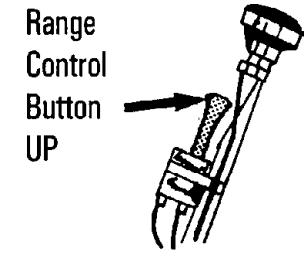
While in Low Range, Shift This Pattern . . . .



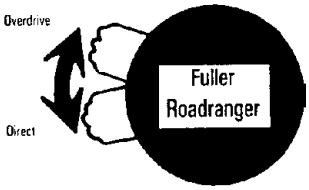



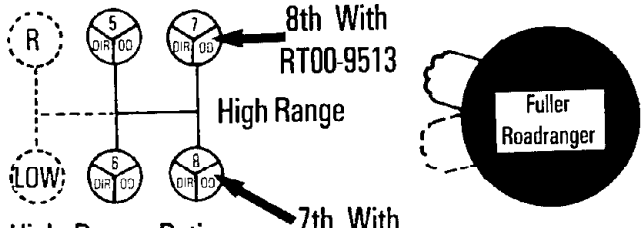

While in 4th speed of Low Range, Pull Up Range Control Button, and Shift This Pattern . . .




. . . Using Splitter Valve to Split the High Range Ratios . . .



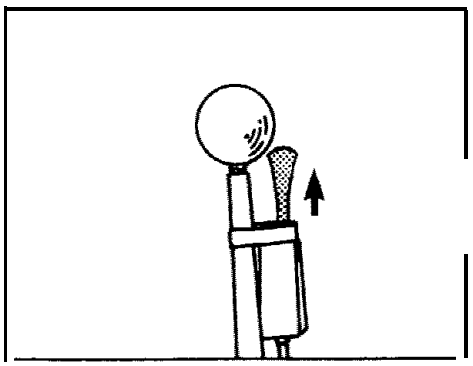

High Range Ratios Are Split With an Overdrive Splitter Gear

### Shift Sequence

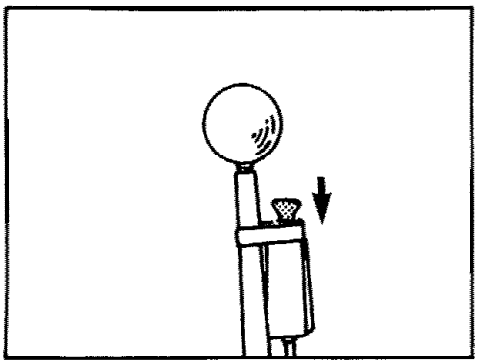
| Low Range | | High Range |
|---|---|---|
| | Low | |
| | 1 | 5D |
| | 2 | 50D |
| | 3 | 6D |
| | 4 | 60D |
| | | 7D |
| | | 70D |
| | | 8D |
| | | 80D |

# *Controls and Shift Procedures With Two-Speed Rear Axle*

## Two-Speed Axle Selector on Shifter Lever

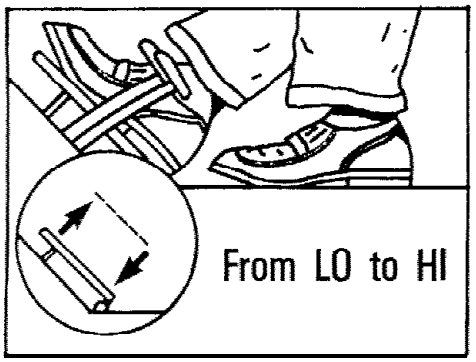


Shifter Button Up (HI)

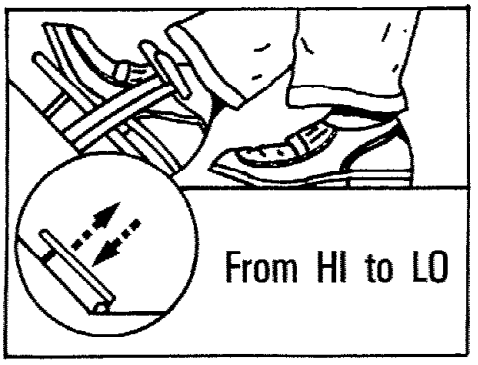


Shifter Button Down (LO)

## Corresponding Accelerator Action for Shifting Above Selection




Up, Pause, and Down on Accelerator.




Up and Down on Accelerator Quickly Without Declutching. Or Hold Accelerator Down While Disengaging and Re-engaging Clutch as Quickly as Possible.

## Typical Shift Sequence Chart

Gear Shift Sequence

1-LO → 1-HI
2-LO → 2-HI
3-LO → 3-HI
4-LO → 4-HI
5-LO → 5-HI

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## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- o back in a straight line and on a curved path.
- o back into an alley dock.
- o parallel park.
- o park in a jackknife position.
- o judge side, rear, and overhead clearances and the path of the trailer.
- o warn others that the truck is backing.
- o check to the rear before backing.

You will learn

- o correct procedures for backing and parking.
- o the position your vehicle should be in before you start to back.
- o the correct way to steer an articulated vehicle (tractor-trailer) in reverse.
- o why backing is dangerous and why you need to avoid all unnecessary backing, particularly blind-side backing.
- o the importance of checking the area before backing and of using a guide or helper whenever possible during backing.

## WHAT WILL HAPPEN IN THIS UNIT

The unit begins with a brief classroom lesson to familiarize you with the procedures for backing maneuvers and to explain the precautions required for backing safely. The rest of the unit is spent in training with tractor-trailers on the driving range.

## Outline of Classroom Lessons

Lesson I - Backing Procedures

I. Backing Principles and Rules
   A. Steering Principles
   B. Types of Backing Maneuvers
   C. Rules for Safe Backing
   D. General Procedures

II. Four Basic Backing Maneuvers
   A. Straight-Line Backing
   B. Alley Dock Backing
   C. Jackknife Parking
   D. Parallel Parking

## Description of Range Lesson

Lesson 2 - Development of Backing Skills

This lesson consists of three range exercises to give you practice in backing and parking maneuvers. You must park without hitting course markers or boundaries and without having to restart the exercise more than three times. You must also park within a certain distance from the curb,

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Principles of Backing Tractor-Trailers
- Safe Backing Checklist

## Unit 1.6 PRINCIPLES OF BACKING TRACTOR-TRAILERS

There are two important terms you need to know while backing which relate to your steering activity with the tractor. They are "jacking" and "chasing."

Jacking (i.e., jackknifing) is employed to change the direction that the trailer wheels are following; that is, you make the trailer jack to the right or to the left depending upon the path you want the trailer to take. The trailer will "jack" in the direction that you turn the steering wheel. If you want the trailer to jack to the right, then turn the wheel to the right.

Chasing (i.e., following the trailer) Once the tractor has "jacked" the trailer into the path (direction) desired, you then must chase the trailer through its path for as long as you desire the trailer to follow that path. You do that the same way you kept the trailer in a straight path in Unit 1.4, Basic Control. If the trailer begins to drift off of the curved path, you turn the wheel away from the drift. For example, if the trailer drifts to the left, you turn the wheel to the right.

Jacking and chasing are two terms you will be hearing over and over again from your instructor while he or she is teaching you the principles of backing. When the instructor says, "O.K., now give it some jack," he or she is telling you to change the direction of the trailer's path. You do this with the tractor it's true, but you are actually steering the trailer. This is why the rear tractor axle is referred to as the "steering" axle when you're in reverse.

When the instructor says, "O.K., now chase it," he or she is telling you that you have now "steered" the trailer into the desired path. Then you must "chase" the trailer along that path. Failure to do so immediately will result in the trailer continuing to jack past the intended path. If you fail to chase it, eventually your rig will end in a full jackknife with the trailer against the side of the cab.

When--All jacking and chasing is a matter of when (timing) and how much (steering input). If you jack too soon or too late the trailer doesn't steer into the path you want it too. Similarly, if you're too late or too soon in chasing, the trailer will not continue along the desired path.

How much--Too much or to little a turn on the steering wheel will start the trailer in the wrong direction. Steering too much or too little, chasing the trailer will cause it to go off course.

# UNIT 1.6 SAFE BACKING CHECKLIST

1. Avoid Backing When Possible

2. Check Clearances Before Starting

   Be sure the vehicle is secured
   Leave the cab
   Check above
   Check to the sides
   Check under the vehicle
   Check behind vehicle for obstructions:
      Before starting
      Recheck if start delayed
      Periodically if long backup
   Check front for adequate swing clearance

3. Use Helper When Possible
   To aid in checking clearance
   To give directions
   The driver is still responsible for results (damage)
   Agree on signals in advance to avoid confusion
   Be in position so that the driver can see helper in mirror(s)
   If the helper is not visible, stop immediately

4. Use Horn and Flashers

   Activate warning flashers prior to moving into reverse gear
   If vehicle is not equipped with a backup alarm, give a gentle tap on the electric horn periodically

5. Keep Window Open and Radio Off

   In order to hear any warning noises

6. Start in Proper Position

   This is the key to backing
   Positions differ by type of backing maneuver
   Put vehicle in position by forward movement
   Stop, secure vehicle, get out and check position
   Appropriate initial position will be discussed for each maneuver

7. Back Slowly

   Back as slowly as possible
   Use lowest reverse gear
   Don't accelerate
   Use idle speed
   Don't ride the clutch
   Keep off all pedals until stopping

8, Constantly Check Behind When Backing

All backing is to be done with mirrors
Watch behind tractor tires during "jack"
  This is particularly important in blind-side backing when objects are not visible until just before collision (e.g., parked cars)
Keep doors closed
Watch for things that could tilt trailer (e.g., curb)
Watch for overhead structures (wires, pipes, tree limbs, window air conditioners)

9. Start Over When Necessary

Pull up and realign trailer with desired path whenever you get too far out of position
Always better to pull forward to correct steering errors than to "fight it" by continuing to back
Select path that will align rig properly to target before pulling forward

UNIT 1.7
COUPLING AND
UNCOUPLING

# UNIT 1.7 COUPLING AND UNCOUPLING

## WHAT YOU WILL LEARN IN MIS UNIT

You will learn how to

- o align the tractor properly to connect with the trailer.
- o secure the trailer to prevent it from moving while coupling and uncoupling.
- o back the tractor properly to the trailer to prevent damage.
- o check to make sure the coupling is secure.
- o connect and disconnect electrical and air lines properly.
- o raise and lower trailer landing gear properly.

You will learn

- o the procedures for proper coupling and uncoupling.
- o the hazards of improper coupling and uncoupling.

## WHAT WILL HAPPEN IN THIS UNIT

There will be a brief classroom session to familiarize you with coupling and uncoupling procedures and required precautions. The rest of the unit is spent in practice on the range.

## Outline of Classroom Lesson

Lesson 1 - Coupling and Uncoupling

I. Overview of Coupling Procedures

II. Detailed Step-by-Step Procedures

III. Uncoupling Procedures

IV. Summary of Safety Hazards

V. Coupling and Uncoupling Twin Trailers

## Description of Range Lessons

Lesson 2 - Coupling and Uncoupling Skills

This lesson begins with an instructor demonstration of coupling and uncoupling procedures. Students will then work in teams of three and practice the procedures. One student will read the procedures from the checklist while the other demonstrates the procedures, describing out loud what he/she is doing as they proceed.

As this course continues, you will receive further practice coupling and uncoupling the school vehicles as they are being prepared for the street and range activities, and at the end of the day when the units are separated for cleaning and maintenance.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Coupling Procedures Checklist
- Uncoupling Procedures Checklist

# UNIT 1.7 COUPLING PROCEDURES CHECKLIST

1. Inspect Fifth Wheel

   Check for damaged/missing parts and proper lubrication
   Make sure fifth wheel is tilted toward rear of tractor, jaws open and release handle in the automatic lock position

2. Position Tractor Squarely in Front of Trailer; Never Drive under Trailer at an Angle

   Use left mirror to line up outside edge of left rear outer dual wheel with outer edge of trailer
   Check alignment by sighting down side of trailer
   Make final check with both mirrors to make sure tractor-trailer is aligned

3. Back Slowly until Jaws Just Touch Pickup Apron of Trailer

4. Secure the Trailer

5. Inspect the Area and Chock Front and Back of Left Trailer Wheels

   Secure any cargo against movement of tractor coupling
   If trailer is equipped with spring loaded brakes, it is not necessary to chock wheels

6. Make Visual Check of Trailer Height

   Trailer should be slightly lower than fifth wheel
   Never go under trailer that is not supported by tractor

7. Connect air lines to trailer

   Check washers (rubber grommets) on all four glad hands to make sure they are not damaged and glad hands are properly seated to prevent air leaks
   Make sure air lines are safely supported so they won't be crushed or caught while tractor is backing under the trailer
   Make sure there is enough slack that glad hands won't become uncoupled

8. Supply Air to Trailer

   Apply and release trailer brake to check for crossed lines
   Check system for signs of excessive air loss

9. Apply Trailer Brakes to Prepare for Backing under Trailer

   Use trailer sprinq brakes if there are no trailer brakes
   If there are no trailer brake or spring brakes, make sure trailer wheels are firmly chocked against movement

10. Back Slowly under Trailer until Fifth Wheel Engages Kingpin

Be prepared for tractor to jump when it squats from trailer weight; if this happens, brake fast to keep air lines from being torn off

11. Check Connection for Security by Pulling Tractor **Gently** Forward

12. Repeat Step 11, Then Release Trailer Brake

13. Secure Vehicle

14. Visually Inspect Coupling

Need to use flashlight and get under trailer
Fifth wheel must be engaged on shank of kingpin and there should be no space between upper and lower fifth wheel
Locking lever must be in "lock" position
Safety catch must be in position over locking lever; sometimes this is done manually or with a cotter pin

15. Connect the Electrical Cable

Don't force the connection if it doesn't fit
If plug is not compatible with trailer connector, use a converter plug
Make sure safety catch or latch is engaged after it plug is firmly seated
Make sure air and electrical lines are properly secured/suspended

16. Raise Landing Gear

Check to make sure there is adequate clearance between rear of tractor frame and landing gear to accommodate arc of tractor frame on sharp turns (especially important with tandem axle tractor and/or sliding fifth wheel)
Landing gear must be fully raised and crank handle safely secured

17. Remove Tractor Wheel Chocks and Stow in Safe Place

Notes:

## UNIT 1.7 UNCOUPLING PROCEDURES CHECKLIST

1. Position Vehicle

   Position tractor directly in front of trailer
   Make sure surface can support trailer; use trailer supports if necessary

2. Apply the Trailer Brake

3. Place Tractor Protection Valve in Emergency Position

4. Secure Landing Gear

5. Lower Landing Gear

   Empty trailer: lower to firm contact with surface
   Loaded trailer: turn crank in lower gear a few extra turns (enough to remove some weight from tractor suspension)

6. Disconnect Air Lines and Electrical Cable

   Secure lines against snagging or other damage

7. Release Fifth Wheel Latch

   If handle will not move, release trailer brake and back tractor gently to ease pressure
   If you cannot reach latch, use pull handle or hook
   Keep feet and legs clear of tractor wheels as tractor can be pushed forward

8. Pull Tractor Partially Clear of Trailer

   Stop with tractor frame stubs under trailer to prevent trailer from falling to ground if landing gear collapses or sinks

9. Secure Tractor

10. Inspect Trailer Supports

    Use trailer safety jack under nose of trailer if necessary

11. Pull Tractor Completely Clear of Trailer

# UNIT 1.8
# PROFICIENCY DEVELOPMENT: BASIC CONTROL

# UNIT 1.8 PROFICIENCY DEVELOPMENT: BASIC CONTROL

## WHAT YOU WILL LEARN IN THIS UNIT

The purpose of this unit is to help you develop and improve your driving skills, including the skills needed to

- o maneuver through a series of sharp turns in both forward and reverse.
- o maneuver into areas that are restricted to the rear, sides and front in both straight-line and jackknife positions.
- o parallel park.
- o judge the position of the right front wheel.
- o judge clearances to the rear, the sides and above your vehicle.
- o accelerate and brake smoothly and control your vehicel well enough to drive on the street safely.

## WHAT WILL HAPPEN IN THIS UNIT

Nearly all activity in this unit will take place on the range. There will be a brief classroom session to familiarize you with the exercises you will perform on the range and how your performance will be rated.

## Outline of Classroom Lesson

Lesson 1 - Introduction to Proficiency Development Exercises

I. Description of Range Exercises and Practice

- A. Purpose
- B. Backing - Straight Line
- C. Offset Alley Exercise
- D. Alley Dock Backing Exercise
- E. Serpentine Exercise - Forward and Reverse
- F. Parallel Parking Exercise
- G. Controlled Stop Line Exercise
- H. Overhead Clearance Exercise

II. Description of Pre-Street Range Test

- A. Purpose
- B. General Description of Exercises
- C. Description of Standards for Range Exercises
- D. Scoring of Pre-Street Range Test

III. Onstreet Proficiency Development Exercises

- A. Purpose
- B. Routes
- C. Procedure
- D. Evaluation

## Description of Range Lesson

Lesson 2- Proficiency Development Exercise

This lesson is intended to give you an opportunity to increase your driving proficiency. You have already practiced some of these exercises in earlier units. The exercises in this lesson also serve as practice for the Pre-Street Range Test.

In this lesson you will be practicing 9 exercises which are:

1. BACKING - STRAIGHT LINE EXERCISE
2. OFFSET ALLEY EXERCISE
3. ALLEY DOCK EXERCISE
4. ALLEY DOCK - JACKKNIFED EXERCISE
5. SERPENTINE - FORWARD EXERCISE
6. SERPENTINE - REVERSE EXERCISE
7. PARALLEL PARKING - JACKKNIFED EXERCISE
8. CONTROLLED STOP LINE EXERCISE
9. OVERHEAD CLEARANCE EXERCISE

Each of these exercises will be performed at three different levels of difficulty. As you master the exercise on one level you will move up to the next, In addition, the serpentine exercise which was performed moving forward in Unit 1.4 will be performed moving forward and backward in this unit.

In the final exercise, Overhead Clearance, you will approach an obstacle across your path and judge whether or not you can move the tractor-trailer under it without hitting it, if you think that the obstacle is too low to pass under safely, you must ask to have it adjusted before you proceed. If you think it is high enough, you must proceed under it.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- o Score Sheet - Range Test In/End of Course
- o Unit 1.8 Range Observer's Checklist--for use in range lesson
- o Unit 1.8 Road Observer's Checklist--for use in street lesson

# SCORE SHEET - RANGE TEST IN/END COURSE

| Exercise | Score | Exercise | Score |
|---|---|---|---|
| **BACKING - STRAIGHT LINE** | | | |
| 1 Motion Control | YES NO | **PRETRIP INSPECTION** | |
| 2 Contact | YES NO | 30 Approaching Vehicle | YES NO |
| 3 Time | YES NO | 31 Under Hood | YES NO |
| | | 32 Inside Cab | YES NO |
| **OFFSET ALLEY** | | 33 Lights | YES NO |
| 4 Motion Control | YES NO | 34 Walkaround Vehicle | YES NO |
| 5 Contact | YES NO | 35 Signal Lights | YES NO |
| 6 Time | YES NO | 36 Air Brake System | YES NO |
| | | 37 Problems Identified | YES NO |
| **ALLEY DOCK** | | 38 Time | YES NO |
| 7 Motion Control | YES NO | | |
| 8 Contact | YES NO | **COUPLING** | |
| 9 Distance | YES NO | (Pre-Couple) | |
| 10 Time | YES NO | 39 Motion Control | YES NO |
| | | 40 Contact | YES NO |
| **ALLEY DOCK - JACKKNIFED** | | 41 Chocks | YES NO |
| 11 Motion Control | YES NO | 42 Air Hookup | YES NO |
| 12 Contact | YES NO | 43 Air Supply | YES NO |
| 13 Distance | YES NO | 44 Trailer Brakes | YES NO |
| 14 Jackknife Posiiton | YES NO | (Couple) | |
| 15 Time | YES NO | 45 Hookup | YES NO |
| | | 46 Test Hookup | YES NO |
| **SERPENTINE/FORWARD** | | 47 Inspects, Coupling | YES NO |
| 16 Motion Control | YES NO | (Post Couple) | |
| 17 Contact | YES NO | 48 Electrical Hookup | YES NO |
| 18 Time | YES NO | 49 Landing Gear | YES NO |
| | | 50 Chocks | YES NO |
| **SERPENTINE/REVERSE** | | 51 Time | YES NO |
| 19 Motion Control | YES NO | | |
| 20 Contact | YES NO | **UNCOUPLING** | |
| 21 Time | YES NO | (Pre-Uncoupling) | |
| | | 52 Positions Vehicle | YES NO |
| **PARALLEL PARKING - JACKKNIFED** | | 53 Trailer Air Off | YES NO |
| 22 Motion Control | YES NO | 54 Secures Tractor | YES NO |
| 23 Contact | YES NO | 55 Lowers Landing Gear | YES NO |
| 24 Distance | YES NO | 56 Disconnect Lines | YES NO |
| 25 Time | YES NO | 57 Stores Li nes | YES NO |
| | | 58 Fifth Wheel Release | YES NO |
| **CONTROLLED STOP LINE** | | (Uncouple) | |
| 26 Distance | YES NO | 59 Pulls Tractor Forward | YES NO |
| 27 Smoothness | YES NO | 60 Secures Tractor | YES NO |
| | | (Post-Uncouple) | |
| **OVERHEAD CLEARANCE** | | 61 Checks Landing Gear | YES NO |
| 28 Correct Decision | YES NO | 62 Pulls Tractor Clear | YES NO |
| 29 Time | YES NO | 63 Time | YES NO |

Total # Passed  Total # Failed)

Percent Correct _____

Student _____ - _____

Examiner _____ - -

An explanation of scoring is provided on the back.

## SUMMARY OF CRITERIA-RANGE TEST IN/END COURSE

BACKING - STRAIGHT LINE
Motion Control: No changes or stops
Contact: Does not touch lane boundaries
Time: 90 sec. in course; 60 sec. at end-of-course

OFFSET ALLEY
Motion Control: No changes or stops
Contact: 2 or less touches; 1 or no hits in course; no touches or hits at end-of-course
Time: 90 sec. in course; 45 sec. at end-of-course

ALLEY DOCK
Motion Control: 4 or less changes or stops in course; 2 or less at end-of-course
Contact: 2 or less boundary/barricade touches or hits in course; none allowed at end-of-course
Distance: Stops 24 in. or less from back of dock; 12. in or less at end-of-course
Time: 4 min. 30 sec. in course; 2 min. 30 sec. at end-of-course

ALLEY DOCK - JACKKNIFED
Motion Control: 4 or less changes or stops in course; 2 or less at end-of-course
Contact: 2 or less boundary/barricade touches in course; none allowed at end-of-course
Distance: Stops 30 in. or less from dock (no hit) in course; 18 in. or less (no hit) end-of-course
Jackknife Position: Leaves tractor 90 degrees to trailer
Time: 4 min. 30 sec. in course; 2 min. 45 sec. at end-of-course

SERPENTINE - FORWARD
Motion Control: No changes or stops
Contact: No touching or hitting drums or street boundary delineators
Time: 60 sec. in course; 45 sec. at end-of-course

SERPENTINE - REVERSE
Motion Control: 4 or less changes or stops in course; 2 or less at end-of-course
Contact: No touching or hitting drums or street boundary delineators
Time: 4 min. or less in course; 2 min. 30 sec. or less at end-of-course

PARALLEL PARKING - JACKKNIFED
Motion Control: 4 or less changes or stops in course; 2 or less changes or stops at end-of-course
Contact: 2 or less curb touches, no curb crosses or barricade hits in course; none at end-of-course
Distance: Trailer 24 in. or less from curb in course; 12 in. or less at end-of-course
Time: 4 min. in course; 2 min. 30 sec. at end-of course

CONTROLLED STOP LINE
Distance: Stops 18 in. or less from line in course; 6 in. or less at end-of-course
Smoothness: Minor nose rebound and audible air release allowed in course; none allowed at end-of-course

OVERHEAD CLEARANCE
Correct decision: Clears within 6 inches or less
Time: 90 sec. in course; 45 sec. at end-of-course

PRETRIP INSPECTION
Inspects required components in Items 30 thru 36 identifies all real and simulated defects
Time: 30 min. in course; 15 min. at end-of-course

COUPLING
(Pre-couple)
Motion Control: 3 or less changes or stops in course; 1 or less at end-of-course
Contact: Tractor backed slowly, 5th wheel jaws just touch (not hit) pickup apron
Chocks: Chocks front and back of left trailer wheels
Air Hookup: Lines not crossed
Air Supply: Supplies air to trailer
Trailer Brakes: Applies trailer brakes
(Couple)
Hookup: Backs slowly until 5th wheel engages king-pin
Test Hookup: Moves forward checking hookup (Twice)
Inspects Coupling: Visually checks by crawling under trailer
(Post Couple)
Electrical Hookup: Hooks up cable
Landing Gear: Raises landing gear fully, secures crank handle
Chocks: Removes trailer wheel chocks
Time: 18 min. in course; 8 min. at end-of-course

UNCOUPLING
(Pre-uncouple)
Positions vehicle
Shuts off trailer air supply
Secures tractor
Lowers landing gear proper distance
Disconnects and properly stores air and electrical lines
Releases fifth wheel latch
(Uncouple)
Pulls tractor forward only until 5th wheel is clear
Secures tractor with frame ends under trailer nose
(Post-Uncouple)
Checks trailer landing gear for stability
Pulls tractor clear from trailer
Time: 10 min. in course; 5 min. at end-of-course

# Notes:

## UNIT 1.8 RANGE OBSERVER'S CHECKLIST

If a driver makes an error during one of the exercises listed below, place a tally mark in the box.

| BACKING - STRAIGHT LINE | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Failure to Adjust Mirrors | | | |
| Improper Coordination | | | |
| Improper Speed Control | | | |
| Improper Mirror Usage | | | |
| Improper Steering Control: Oversteering | | | |
| Late Adjustments | | | |
| Improper Adjustments | | | |
| Stop Line | | | |

| SERPENTINE REVERSE | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Improper Starting Position | | | |
| Failure to Adjust Mirrors | | | |
| Improper Coordination | | | |
| Improper Speed Control | | | |
| Improper Mirror Usage | | | |
| Improper Steering Control: Oversteering | | | |
| Late Adjustments | | | |
| Improper Adjustments | | | |
| Stop Line | | | |

| OFFSET ALLEY | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Speed (Forward) | | | |
| Steering (Forward) | | | |
| Improper Starting Position | | | |
| Failure to Adjust Mirrors | | | |
| Improper Coordination | | | |
| Improper Mirror Usage | | | |
| Improper Steering Control: Oversteering | | | |
| Late Adjustments | | | |
| Improper Adjustments | | | |
| Stop Line | | | |

| PARALLEL PARKING-JACKKNIFED | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Improper Starting Position | | | |
| Failure to Adjust Mirrors | | | |
| Improper Coordination | | | |
| Improper Speed Control | | | |
| Improper Mirror Usage | | | |
| Improper Steering Control: Oversteering | | | |
| Late Adjustments | | | |
| Improper Adjustments | | | |
| Stop Line | | | |

| ALLEY DOCK | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Improper Starting Position | | | |
| Failure to Adjust Mirrors | | | |
| Improper Coordination | | | |
| Improper Speed Control | | | |
| Improper Mirror Usage | | | |
| Improper Steering Control: Oversteering | | | |
| Late Adjustments | | | |
| Improper Adjustments | | | |
| Stop Line | | | |

| CONTROLLED STOP LINE | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Rough Stop | | | |
| More Than One Stop Made | | | |
| Tractor Bumper: Stops Short of Line | | | |
| Tractor Bumper: Goes Over the Line | | | |
| Trailer Bumper: Stops Short of Line | | | |
| Trailer Bumper: Goes Over the Line | | | |

| SERPENTINE FORWARD | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Turning | | | |
| Speed | | | |
| Steering | | | |
| Stop Line | | | |

| OVERHEAD CLEARANCE | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Accepts Unsafe Clearance | | | |
| Refuses Safe Clearance | | | |
| Stop Line | | | |

An explanation of errors is provided on the back.

## Explanation of Driver Errors on Unit 1.8 Range Observer's Checklist

Improper Starting Position--Failing to properly align the tractor- trailer and aim it at its intended target.

Failure to Adjust Mirrors--Failing to adjust mirrors before starting the backing maneuver.

Improper Coordination--Jerky, abrupt acceleration and stalling indicate inability to smoothly coordinate the basic vehicle controls when backing.

Improper Speed Control--Backing too fast, changing speeds or braking during the backing maneuver are errors indicating poor speed control.

Improper Mirror Usage--Opening the door to look out or failing to recognize when steering adjustments should be made indicating errors in mirror usage.

Improper Steering Control

> Oversteering--Making too frequent steering adjustments, such as making a steering adjustment too soon and then immediately following up with a corrective action.
>
> Making Adjustments Too Late--Making steering adjustments too late, resulting in having to pull up and start again.
>
> Making Improper Steering Adjustments--Turning the wheel in the wrong direction to adjust the trailer's path or "jacking" the vehicle too hard, too much, or not soon enough. Or not allowing the vehicle to get back in line once the adjustment has been made, i.e., not straightening out the steering wheel.

Turning--The student turns too little and hits the cones or turns too much which causes continuous widening of the vehicle movements and misses the last cones.

Speed--The student fails to maintain a steady, smooth speed.

Steering--The student makes early or late steering inputs that result in positioning the vehicle improperly.

Stop Line--Fails to stop within required number of inches of the stop line.

Accepts Unsafe Clearance--Attempts to proceed under barrier when it is too low.

Refuses Safe Clearance--Does not proceed when clearance is high enough to allow vehicle to pass underneath.

Notes:

## UNIT 1.8 ROAD OBSERVER'S CHECKLIST

If a driver makes a driving error in one of the categories below, place a tally mark in the box.

| BASIC CONTROL ERRORS | Driver #1 | Driver #2 | Driver #3 |
|---|---|---|---|
| Acceleration | | | |
| Braking | | | |
| Stopping | | | |
| Upshifting | | | |
| Downshifting | | | |
| Uphill Operation | | | |
| Downhill Operation | | | |
| Speed Adjustment/Curves | | | |
| Lane-Keeping/Straight | | | |
| Lane-Keeping/Right Turn | | | |
| Lane-Keeping/Left Turn | | | |
| Lane-Keeping/Curves | | | |

An explanation of errors is provided on the back.

## Explanation of Driver Errors on Unit 1.8 Road Observer's Checklist

Acceleration--Jerky and abrupt, from a standing start or when increasing speed.

Braking--Smooth controlled stop, no rebound of front end or sound of exhausting air.

Stop Line--Stopping beyond stop line or other designated stopping point.

Upshifting--Includes the following errors:
- o stalling
- o operating out of the desjgnated rpm range
- O lugging
- o delayed shift between gears (losing over 500 rpm)
- o missed shift (having to drop back into another gear)
- o gear clash

Downshifting--Includes the following errors:
- o operating out of the designated rpm range
- o gear/engine mismatch resulting in lurch as clutch is released
- o delayed shift
- o over or under revving between gears
- o gear clash

Uphill Operation--Includes the following errors:
- o lugging (failure to shift soon enough)
- o excessive loss of speed (having to reaccelerate on hill)
- o roll-back when starting from a standing point

Downhill Operation--Includes the following errors:
- o starting down the hill in too high a gear
- o failing to maintain steady brake pressure (e.g., fanning)

Speed Adjustment/Curves--Entering curve or turn too fast, indicated by:
- o sharp lateral acceleration (passengers thrown sideways)
- o braking while within the curve or turn

Lane-Keeping/Straight--Wandering back and forth between lines or touching, crossing lane marking on straightaway.

Lane-Keeping/Turns--Operating outside of the designated lane in turns.
- Right Turn: right rear wheels cutting across curb or road edge
- Left Turn: beginning left turn too early (cutting across 'lanes approaching from the left)
- Curves: Wheels not kept within lane markings, failes to steer far left/right to compensate for the off-tracking of the trailer

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# UNIT 1.9 SPECIAL RIGS

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- o recognize the most frequently encountered special rigs.
- o determine whether you can safely operate any type of special rig.

You will learn

- o the function, operating characteristics, physical dimensions, special features and hazards of special rigs.
- o the hazards of attempting to operate a rig that you are not qualified to operate.

## WHAT WILL HAPPEN IN THIS UNIT

This unit will begin with a classroom session in which the common types of special rigs will be described. This unit may also include a field trip to allow you to see special rigs first hand.

## Outline of Classroom Lesson

Lesson 1 - Characteristics of Special Rigs

I. Multiple Articulation Vehicles

II. Oversized Vehicles

III. Low Clearance Vehicles

IV. High Center of Gravity Vehicles

V. Special Cargo Vehicles

VI. Special Handling Vehicles

## Description of Lab Lesson

Lesson 2 - Observation of Special Rigs

This is a field trip lesson designed to give you an opportunity to observe special rigs. Your instructor may elect to omit this lesson if suitable facilities and sufficient time cannot be found to include it.

Throughout this course, during the onstreet activities, the instructor may ask you to identify and describe special rigs that you see.

## STUDENT AIDS

There are no student aids for this unit.

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# UNIT 2.1 VISUAL SEARCH

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- o maintain a minimum 12-second eye lead time.
- o scan both sides of the road using quick glances to observe roadside activity and vehicles near you.
- o check mirrors for hazards frequently, particularly before changing speed or direction.
- o check your instrument panel frequently.
- o look ahead as far as possible during turns and on curves.
- o check to the side before turning or changing lanes.
- o monitor overtaking traffic in order to be aware of vehicles behind you and in blind spots at the side of your vehicle.
- o avoid diverting your attention from the path ahead of you for longer than a second at a time.
- o adjust mirrors properly.
- o maintain a straight line path whenever taking your eyes off the road ahead.

You will learn

- o about the differences between flat and convex mirrors and how to use them.
- o the importance of checking mirrors and checking to the sides and rear quickly in order to limit the time that your eyes are off the road ahead.
- o the relationship between speed and sight distance.
- o the search patterns appropriate for straight driving, changing speed or direction and entering or crossing traffic.

## WHAT WILL HAPPEN IN THIS UNIT

The unit will begin with a classroom lesson covering the importance of proper visual search and proper methods. Following a range exercise, you will practice search activities during onroad driving.

## Outline of Classroom Lesson

Lesson 1 - Visual Search Principles in Driving

I. Seeing Ahead and to the Sides
   A. Importance of Seeing Properly
   B. Distance Scanning
   C. Scanning to the Sides
   D. Problem-Solving Exercises 1 and 2

II. Use of Mirrors
   A. Importance of Mirrors
   B. Two Types of Side Mirrors
   C. Taking Care of Mirrors
   D. Problem-Solving Exercise 3

III. Seeing to the Rear
   A* Using Mirrors to Monitor to the Rear
   B. Using Mirrors to Check to the Rear When Changing Speed or Position
   C. Problem-Solving Exercise 4

IV* Commentary Driving
   A. The Basic Process
   B. General Rules

## Description of Lab Lesson

Lesson 2 - Use of Mirrors

In this lesson, you will learn how to adjust your vehicle's mirrors to reflect the proper view of the roadway and how to judge distances using mirrors.

## Description of Street Lesson

Lesson 3 - Application of Visual Search

This lesson is intended to give you an opportunity to apply principles of visual search to onstreet operation* In the first part of the lesson you will be driving in light traffic. Later, you will be using commentary driving techniques to let the instructor know where you are looking as you drive, Rules for commentary driving are included in your student material for this unit.

Students will be in groups of three students for every instructor. You will take turns driving and observing the other student's driving. While you are an observer, you will keep track of the driver's performance using the observer checklist in your student material.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student materials.

- Mirror Adjustment Procedures
- Unit 2.1 Visual Search Checklist--for use in street lesson
- Rules for Commentary Driving: Visual Search

## UNIT 2.7 MIRROR ADJUSTMENT PROCEDURES

Left Side Mirrors

Plane — The inside vertical edge of the mirror (approximately 3/4 inches-1 inch) should reflect the trailer body; the remaining portion of the reflected view should be at least 15 feet to the left side.

Convex — The inside vertical edge should reflect a portion of the trailer, the top horizontal edge should reflect a view overlapping the plane mirror by 5 feet and extending to the end of the trailer.

### Right Side Mirrors

Plane — The inside vertical edge of the mirror (approximately 3/4 inches - 1 inch) should reflect the trailer body; the remaining portion of the reflected view should be at least 15 feet to the right of the trailer.

Convex — The inside vertical edge should reflect a portion of the trailer, the top horizontal edge should reflect a view overlapping the plane mirror by 5 feet and extending to the end of the trailer.

### Fender Mirrors

Convex Fender Mirrors (right/left)
Adjusted to see trailer tires, curbs and other objects when turning

Remember: All mirrors should be adjusted to show some part of the vehicle (trailer body, tires) in order to gain a reference point for judging the position of other reflected images.

## RULES FOR COMMENTARY DRIVING: VISUAL SEARCH

In commentary driving you will be asked to identify (out loud) obstacles and potential obstacles to your vehicle as you drive. The following are some general rules for commentary driving.

1. Identify obstacles with short phrases, such as "Stop sign," "upcoming stop light," or "vehicle passing ahead."

2. Identify only the most important obstacles. It's impossible to point out all obstacles without getting distracted.

3. Don't look at the instructor while talking.

4. Identify, don't explain.

   Correct: "Intersection, stop sign"
   Incorrect: "There is an intersection ahead about 400 feet. I need to start to slow down."
   (The fact that you slow down is all the explanation the instructor needs.)

Notice:

UNIT 2.1 VISUAL **SEARCH** CHECKLIST

If a driver makes a driving error in one of the categories below, place a tally mark in the box.

| BASIC CONTROL ERRORS | Driver #1 | Driver #2 | Driver #3 |
|---|---|---|---|
| Acceleration | | | |
| Braking | | | |
| Stopping | | | |
| Upshifting | | | |
| Downshifting | | | |
| Uphill Operation | | | |
| Downhill Operation | | | |
| Speed Adjustment/Curves | | | |
| Lane-Keeping/Straight | | | |
| Lane-Keeping/Turns | | | |
| Lane-Keeping/Curves | | | |
| VISUAL **SEARCH** | | | |
| Distance Scanning | | | |
| Turn Path Search | | | |
| Roadside Scanning | | | |
| Blind Intersection, Privileged | | | |
| Blind Intersection, Burdened | | | |
| Mirror Usage, General | | | |
| Mirror Usage, Slowing | | | |
| Mirror Usage, Lane Change | | | |
| Mirror Usage, Merge | | | |
| Positioning, Merge | | | |

An explanation of errors is provided on the back.

## Explanation of Driver Errors on Unit 2.1 Checklist

Distance Scanning--Failure to respond to a visible requirement for a speed or direction change, at least 12 seconds in advance, Situations would include the following:

- o Red light
- o Red flashing light
- o Warning sign
- o Lane drop
- o Barricade or other obstruction
- o Parked vehicle (in travel lane)

Turn Path Search--Failure to search the path ahead in a right or left turn.

Roadside Scanning--Failure to respond to signs over or alongside the road, including:

- o Posted speed limits
- o Lane control signs and signals
- o Warning signs

Blind Intersection, Privileged--Failure to slow and search for cross traffic when approaching a blind intersection as the privileged vehicle (having the right-of-way).

Blind Intersection, Burdened--Failure to move to a position where cross traffic can be seen when stopped at a blind intersection as the burdened vehicle (the vehicle that must yield the right-of-way).

Mirror Usage, General--Failure to observe right and left rearview mirror at least every 5-8 seconds.

Mirror Usage, Slowing--Failure to check the right and left rearview mirrors before slowing where following drivers would not anticipate it (e.g., tight turn, parallel parking).

Mirror, Lane Change--Failure to use the rearview mirror in the direction the lane change is to be made before initiating the lane change.

Mirror, Merge--Insufficient or excessive monitoring of rearview mirror prior to merging onto a highway from an access or acceleration lane.

Positioning, Merge--Failure to align the tractor and trailer sufficiently parallel to the main highway to be able to observe through traffic on the main roadway prior to a merge.

[redacted]

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# UNIT 2.2 COMMUNICATION

## WHAT YOU WILL LEARN IN MIS UNIT

You will learn to

- cancel turn signals after the trailer has completed a turn and is straightened out.
- flash brake lights to warn following drivers that your vehicle is slowing or stopping.
- use four-way flashers according to State laws and company policies.
- use headlights in daytime under conditions of low visibility.
- position your vehicle where it can be seen by other drivers.
- use your horn and lights properly to prevent collisions.

You will learn

- the importance of using signals to tell other drivers when you plan to change your position in traffic.
- the importance of limiting the use of the CB radio to communications that are important to safety and for maintaining traffic flow.
- laws and regulations on the use of signals and lights.
- why good communication helps to avoid collisions and violations.
- how to send and receive communications with other highway users.

## WHAT WILL HAPPEN IN THIS UNIT

The unit will begin with a classroom lesson dealing with the principles and procedures for proper communications and the hazards of failure to signal properly. The remainder of the unit is devoted to practice of proper communication during onroad driving.

## Outline of Classroom Lesson

Lesson I - Principles of Communication

I. Communicating Intent
   A. Signaling When Changing Position in Traffic
   B. Communicating Intent to Slow or Stop
   C. Keeping the Size of Your Vehicle in Mind
   D. Inadvertent Signals

II. Communicating Presence
   A. Using Your Horn to Communicate Your Presence
   B. Using Your Horn to Communicate Danger
   C. Using Your Lights to Communicate Your Presence

III. Misuse of Communications
   A. The Horn
   B. The CB Radio

IV. Communications from Others

V. Problem-Solving Exercises
   A. Application of Basic Rules for Signaling
   B. Discussion of Problems Created by Poor Signaling

## Description of Street Lesson

Lesson 2 - Application of Communication

In this lesson you will apply the principles of communication taught in the classroom to onstreet driving. Students will be in groups of threes and will take turns driving and observing. While you are an observer, you will keep track of the driver's performance using the observer checklist included in your student materials.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- o federal Motor Carrier Safety (FMCS) Regulations which apply to this unit
- o Unit 2.2 Communication Checklist--for use in street lesson

## FEDERAL MOTOR CARRIER SAFETY REGULATIONS WHICH APPLY TO THIS UNIT

You should review the following regulations from the handbook, **Federal Motor Carrier Safety Regulations and Noise Emission Requirements.**

392.15--Required and Prohibited Use of Turn Signals

393 Subpart B--Lighting Devices, Reflectors and Electrical Equipment

## UNIT 2.2 COMMUNICATION CHECKLIST

If a driver makes a driving error in one of the categories below, place a tally mark in the box.

| | DRIVER | | |
|---|---|---|---|
| BASIC CONTROL | #1 | #2 | #3 |
| Acceleration | | | |
| Braking | | | |
| Stopping | | | |
| Upshifting | | | |
| Downshifting | | | |
| Uphill Operation | | | |
| Downhill Operation | | | |
| Speed Adjustment/Curves | | | |
| Lane-Keeping/Straight | | | |
| Lane-Keeping/Turns | | | |
| Lane-Keeping/Curves | | | |

| | DRIVER | | |
|---|---|---|---|
| VISUAL SEARCH | #1 | #2 | #3 |
| Distance Scanning | | | |
| Turn Path Search | | | |
| Roadside Scanning | | | |
| Blind Intersect., Priv. | | | |
| Blind Intersect., Burd. | | | |
| Mirror Usage, General | | | |
| Mirror Usage, Slowing | | | |
| Mirror Usage, Lane Ch. | | | |
| Mirror Usage, Merge | | | |
| Positioning, Merge | | | |

| | | DRIVER | | |
|---|---|---|---|---|
| COMMUNICATION | | #1 | #2 | #3 |
| Signaling Turns: | None | | | |
| | Late | | | |
| | Early | | | |
| Lane Changing: | None | | | |
| | Late | | | |
| | Inappropriate | | | |
| | Position | | | |
| Canceling: | Late | | | |
| | Early | | | |
| Flashers | | | | |
| Brake Lights | | | | |
| Use of Horn: | | | | |
| | Insufficient | | | |
| | Improper | | | |
| Interpreting Communi-cations | | | | |
| | Receiving | | | |
| | Misinterpreting | | | |

An explanation of errors on the Communication Checklist is provided on the back.

## Explanation of Driver Errors on Unit 2.2 Checklist

Signaling Turns--errors in signaling right and left turns at intersections

None--failure to activate the signal at any point in the turn

Late--failure to activate the signal before reaching the intersection

Early--misleading other road users by an early signal

Canceling--failure to cancel a signal properly

Late--canceling more than 5 seconds after a turn is completed

Early--canceling the signal while in a turn

Lane Changing--errors in signaling lane changes.

None--failure to activate the signal at any point in the lane change

Late--failure to activate signal soon enough before starting lane change

Inappropriate--Signaling a lane change when there is no gap to move into and enough time to wait for a gap to appear

Position--Failure to use vehicle position to communicate intention to change lanes

Flashers--failure to activate emergency flashers when slowing or stopped as provided for by State law

Brake Lights--failure to flash brake lights when slowing or stopping unexpectedly, including:

- o Stalled traffic ahead
- o Midblock (e.g., alley)
- o Prior to parallel parking

Use of Horn--errors in using electric or air horns

Insufficient--failure to use horn under appropriate circumstances

Improper--using the horn improperly or using the wrong horn

Interpreting Communication--errors involving recognition and interpretation of communication from others.

Receiving--failure to react and adjust to communications of others

Misinterpreting--misinterpreting communications from others reacting accordingly

# UNIT 2.3
# SPEED MANAGEMENT

# UNIT 2.3 SPEED MANAGEMENT

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- o adjust your speed to the configuration and condition of the roadway; weather and visibility conditions; traffic conditions; vehicle and cargo conditions; and your own condition.
- o obey the legal speed limit.

You will learn

- o how speed is related to stopping distance, hydroplaning, crash severity, the ability to maneuver and fuel economy.
- o how maximum safe speed depends on vehicle weight, center of gravity, stability, available sight distance and road surface conditions.
- o how to judge maximum safe speed, including the speed at which a curve can be entered.
- o why the posted speed limit is not always safe.

## WHAT WILL HAPPEN IN THIS UNIT

Most of the learning in this unit will take place in the classroom. There will be a brief lab session demonstrating the effects of speed upon stopping distance and vehicle maneuverability.

## Outline of Classroom Lesson

Lesson 1 - Speed Management Principles

I. Speed and Stopping Distance
   - A. Importance of Speed Management
   - B. Braking Distance
   - C. Driver Response Time
   - D. Stopping Distance

II. Speed and Surface Conditions
   - A. Friction and Traction
   - B. Hydroplaning
   - C. Icy or Snowy Roads

III. Speed and the Shape of the Road
   A. Adjusting Speed for Curves
   B. Adjusting Speed for Grades

IV. Speed and Visibility
   A. Speed and Sight Distance
   B. Speed and Field of Vision
   C. Adjusting Speed to Reduced Sight Distance

V. Speed and Traffic flow
   A. Influence of Traffic on Speed Management
   B. Speed Management When Entering and Exiting Traffic

VI. Obeying the Speed Limit
   A* Speed Limits Based on Principles of Speed Management
   B. Reasons for National Speed Limit
   C. Speed and Risks
   D. Penalties for Speeding
   E. Why Drivers Exceed Speed Limit

VII. Class Discussion: Problems Created by Speed

## Description of Lab Lesson

Lesson 2 - Speed Management Demonstration

This lesson is a demonstration of the effects of speed on stopping distance and maneuverability.

In the first demonstration, a student driver will drive a school vehicle in four runs at 10, 15, 20, and 25 mph. An instructor will ride with the student. At a certain point in each run, he or she will be instructed to stop as quickly as possible. You will then compare the student's reaction time distance, braking distance and total stopping distance for each run,

In the second demonstration a student driver will attempt to drive a serpentine course in three runs at 10, 15, and 20 mph. You will then discuss the effects that speed had on the student's ability to maneuver in each run.

## STUDENT AIDS

There are no student aids for this unit.

# UNIT 2.4 SPACE MANAGEMENT

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- o select the traffic lane that offers the best mobility and least traffic interruption.
- o choose a safe gap for changing lanes, passing other vehicles, and crossing or entering traffic.
- o position your vehicle correctly within a lane and relative to crosswalks, so that you don't create hazards for other road users.
- o position the tractor and trailer correctly before and during a turn to prevent other vehicles from passing on the wrong side and to prevent problems caused by off-tracking.
- o maintain a safe following distance according to amount of traffic, condition of the road, visibility and vehicle weight.
- o avoid structures having inadequate overhead clearance.

You will learn

- o the importance of separating your vehicle from traffic on the roadway when it is disabled.
- o the appropriate following distance for various conditions.
- o State regulations about following distance, lane use, changing lanes and passing.
- o the importance of maintaining space around your vehicle so that you have room to maneuver in an emergency.
- o the importance of checking the position of your vehicle and of other vehicles by using your mirrors.
- o the dangers created by overhead obstructions.

## WHAT WILL HAPPEN IN THIS UNIT

This unit begins with a classroom lesson in which you will learn techniques for, and the importance of, controlling the space around your vehicle. In the second lesson you will apply the principles learned in the classroom to actual street operation.

## Outline of Classroom Lesson

I. The Importance of Space Management

II. Space Cushion Concept Space Ahead
   A. Following Distance
   B. Managing Space to the Rear
   C. Legal Requirements for Following Distances
   D. Class Discussion: Why Do Some Tractor-Trailer Operators Follow Too Closely?

III. Space to the Sides

IV. Manage Space to the Sides
   A. Positioning the Vehicle Properly
   B. Compromising Space
   C. Separating Hazards

V. Space for Traffic Gaps
   A. Definition of Gap
   B. Difficult Skill to Master
   C. Differences Betweeen Car and Tractor-Trailer for Handling Gaps
   D. Situations Requiring Adequate Gaps
      1. Crossing and Entering Traffic
      2. Passing
      3. Merging
      4. Railroad Crossings

VI. Giving Space to Others
   A. Principles of Right-of-Way
   B. Avoid Hindering Traffic
   C. Discussion of Space Management Principles

## Description of Street Lesson

Lesson 1 - Application of Space Management

In the first exercise of this lesson, you will be recording the length of time it takes to cross traffic at an intersection, enter traffic at an intersection and pass a vehicle ahead. A student will drive while the instructor times the maneuvers with a stopwatch.

In the second exercise of this lesson, you will practice deciding when a gap is 'large enough to allow you to enter traffic, cross traffic or pass a vehicle ahead. To practice judging gaps in crossing and entering traffic, you will be stopped at an intersection. The instructor will pick out an approaching car. You will say "now" at the last moment that you think you could safely pull out into the street and enter or cross traffic. The

instructor will time the interval between when you say "now" and when the car crosses your path. He will then compare the time it took you in the first exercise, to pull into or across traffic, to the length of the gap you chose in this exercise.

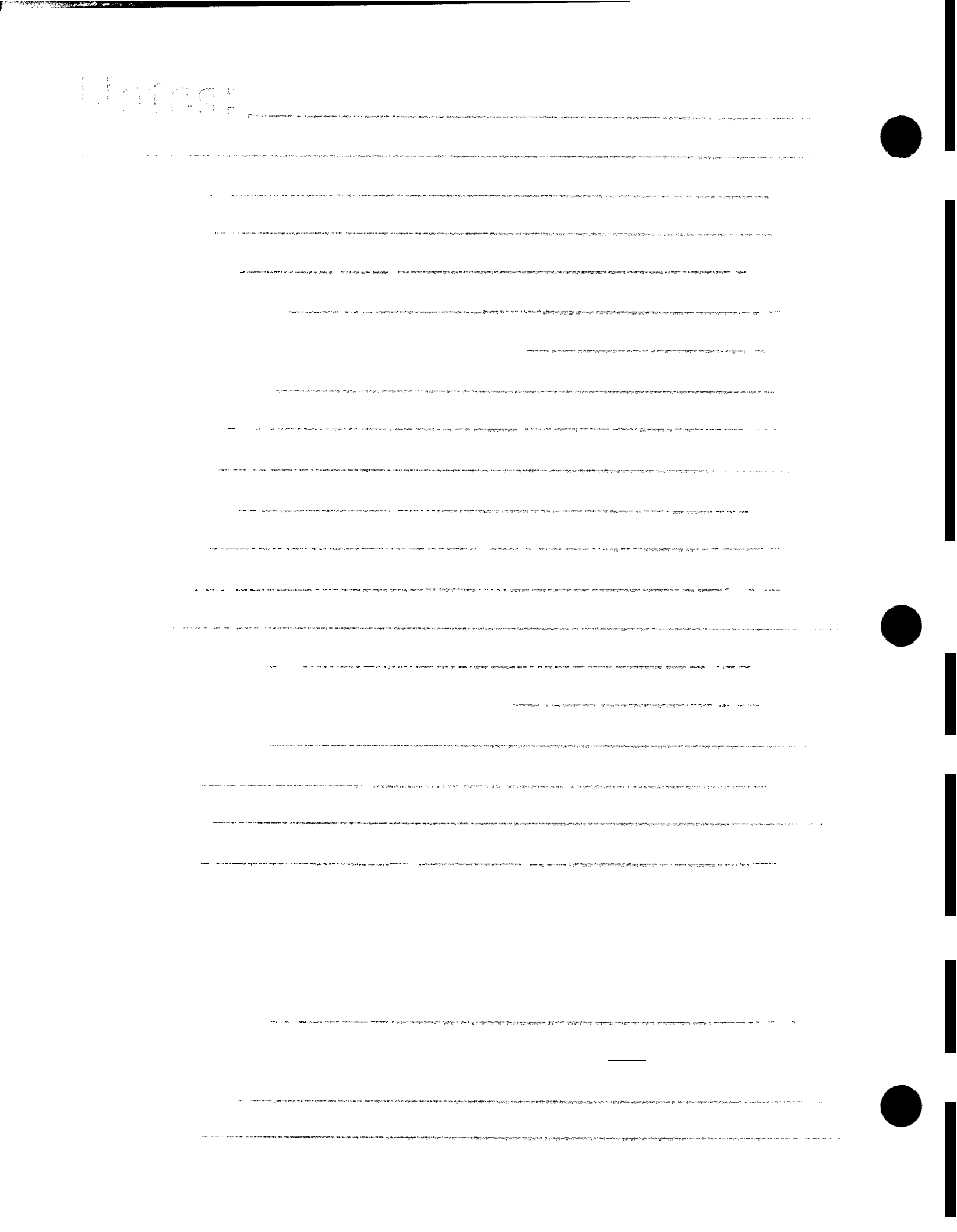
To practice judging gaps in passing, you will drive down a two-lane road. As a car approaches in the opposite direction, you will say "now" at the last moment that you think you could safely pull out, pass a vehicle ahead and pull back into your lane. The instructor will time the interval between when you say "now" and when the oncoming car passes by. He will then compare the time it took you in the first exercise to pass a vehicle ahead, to the length of the gap you chose in this exercise.

In the third exercise in this lesson you will apply the principles of space management taught in the classroom to onstreet operation. Students will take turns driving and observing. While you are an observer, you will keep track of the driver's performance using the observer checklist included in your student material.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Timed Interval Driving
- Unit 2.4 Space Management Checklist--for use in street lesson



# UNIT 2.4 TIMED INTERVAL DRIVING

## HOW TO DO IT

Pick out a stationary object up ahead such as a tree, sign or a shadow on the road

Start counting the seconds as the rear bumper of the vehicle ahead of you passes that stationary object

Count the seconds out loud by saying "one thousand and one, one thousand and two' etc.

The time it takes the front bumper of your rig to get to that stationary object is the timed interval

## FORMULA

Basic formula is one full second for every 10 feet of vehicle length (or fraction thereof) for speeds up to 40 mph

Example: Tractor-trailer

40-foot vehicle requires 4 seconds
50-foot vehicle requires 5 seconds
60-foot vehicle requires 6 seconds
Round the length of vehicle up (e.g., 36-foot long rig equals 40 feet, V-foot long rig equals 50 feet, etc.)

For speeds above 40 mph, you must add another second to the basic formula

Example: 50-foot rig traveling 48 mph

Basic requirement (50 feet) = 5 seconds
Above 40 mph requirement = 1 second
Total time needed = 6 seconds

For bad weather, poor visibility or slick road conditions, you must add at least one additional second to the formula, and depending upon the severity of the conditions, you may need to add additional seconds

Example: 63-foot rig traveling 55 mph in bad visibility (a very dangerous thing to do)

Basic requirement (70 feet) = 7 seconds
Above 40 mph requirement = 1 second
Bad weather/visibility/road requirement = 1 second
Total time needed = 9 seconds

For night driving always add 1 second to the basic formula (because of reduced visibility)

Examples of need to increase the number of seconds:

When following another rig need more space to see around him

When visibility is bad (rain, fog, snow)

When driving at night

When roads are wet, add at least 2 seconds to basic formula

When roads are ice or snow covered, add at least 4 seconds (or more) to the basic formula

When bobtailing, pulling an empty trailer, an unstable load, or an unevenly balanced load you must add extra seconds to the basic formula

Remember these on the **Absolute Minimum Seconds Required to Get the Necessary**

Seeing Time (SPACE)
Thinking Time (SPACE)
Reacting Time (SPACE)
Braking Time (SPACE)

# Notes:

## UNIT 2.2 SPACE MANAGEMENT CHECKLIST

If a driver makes a driving error in one of the categories below, place a tally mark in the box.

| BASIC CONTROL | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Acceleration | | | |
| Braking | | | |
| Stopping | | | |
| Upshifting | | | |
| Downshifting | | | |
| Uphill Operation | | | |
| Downhill Operation | | | |
| Speed Adjustment/Curves | | | |
| Lane-Keeping/Straight | | | |
| Lane-Keeping/Turns | | | |
| Lane-Keeping/Curves | | | |

| VISUAL SEARCH | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Distance Scanning | | | |
| Turn Path Search | | | |
| Roadside Scanning | | | |
| Blind Intersect., Priv. | | | |
| Blind Intersect., Burd. | | | |
| Mirror Usage, General | | | |
| Mirror Usage, Slowing | | | |
| Mirror Usage, Lane Ch. | | | |
| Mirror Usage, Merge | | | |
| Positioning, Merge | | | |

| COMMUNICATION | | DRIVER #1 | #2 | #3 |
|---|---|---|---|---|
| Signaling Turns: | None | | | |
| | Late | | | |
| | Early | | | |
| Lane Changing: | None | | | |
| | Late | | | |
| | Inappropriate | | | |
| | Position | | | |
| Canceling: | Late | | | |
| | Early | | | |
| Flashers | | | | |
| Brake Lights | | | | |
| Use of Horn: | | | | |
| | Insufficient | | | |
| | Improper | | | |
| Interpreting Communications | | | | |
| | Receiving | | | |
| | Misinterpreting | | | |

| SPACE MANAGEMENT | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Separation | | | |
| Following Distance | | | |
| Lateral Separation | | | |
| Passing Distance | | | |
| Overhead Clearance | | | |
| Lane Use | | | |
| Upgrade | | | |
| Multi-lane Roads | | | |
| Cross Streets | | | |
| Right Turn | | | |
| Left Turn | | | |
| Multi-lane Turns | | | |
| Gaps | | | |
| Too Close | | | |
| Too Far | | | |
| Merging | | | |
| Barging | | | |
| Stopping | | | |
| Alignment | | | |
| Traffic Adjustments | | | |
| Compromising | | | |
| Adjacent Operation | | | |

An explanation of errors is provided on the back.

## UNIT 2.4 SPACE MANAGEMENT CHECKLIST

Separation

Following Distance--not allowing the proper number of seconds in following distance for vehicle length and speed involved.
Lateral Separation--failure to maintain a center lane position when passing parked vehicles, or being passed by oncoming or overtaking vehicles.
Passing Distance--changing lanes (returning to the right lane) too quickly in front of a vehicle that has been passed.
Overhead Clearance--having to be stopped by the instructor to prevent collision with an overhead object.

Lane Use

Upgrade--impeding other traffic by failure to enter the right-most lane on an upgrade.
Multi-lane Roads--failure to enter the lane most appropriate to the truck speed and intended maneuver.
Cross Streets--attempting to traverse or enter a cross street when there is insufficient space to accommodate the tractor-trailer.
Right Turn--swinging left too far or too early and failing to close off the right side to overtaking traffic.
Left Turn--swinging right before starting turn, (buttonhook where unnecessary) or cutting diagonally across the intersection.
Multi-lane Turns--using inside lane where traffic turns in two lan

Gaps

Too close--attempting to cross or enter an insufficient gap.
Too far--passing up an acceptable opportunity to cross or enter traffic.

Merging

Barging--vausing a vehicle to alter speed/direction in order to avoid an accident during a merge attempt.
Stopping--slowing or stopping when an earlier speed adjustment would have permitted a continuous merge.
Alignment--not aligning rig parallel to highway for optimum rear vision.

Traffic Adjustments

Compromising--passing two potential hazards simultaneously when a speed adjustment would have allowed them to be passed in sequence.
Adjacent Operation--unnecessarily prolonged operation alongside an adjacent vehicle or vehicles.

# UNIT 2.5 NIGHT OPERATION

## **WHAT YOU** WILL **LEARN** IN MIS UNIT

You will learn to

- o adjust speed, following distance, and gap selection to nighttime conditions.
- o use high beams wherever legally permitted.
- o dim headlights in accordance with State laws and to minimize glare for other drivers.
- o respond safely to the glare of other vehicles by averting your eyes.
- o use auxiliary lighting properly.

You will learn

- o how the level of illumination affects your ability to see.
- o State laws on the use of headlights and other vehicle lights.
- o the symptoms and danger of fatigue.
- o the effects of glare on vision.
- o factors that can reduce night vision.
- o how to judge speed, distances and separation at night.

## **WHAT** WILL **HAPPEN** IN THIS UNIT

The unit begins with a brief classroom lesson covering preparation and procedures for night driving. During exercises on the range, you will have an opportunity to practice preparation for night driving and to perform basic maneuvers in darkness prior to onroad night driving. During onstreet night operation, you will drive in a variety of nighttime conditions.

## Outline of Classroom Lesson

Lesson 1 - Night Operation

I. Night Driving Factors
   A. Driver Factors
      1. Vision
      2. Glare
      3. Fatigue
      4. Driver Inexperience
   B. Roadway Factors
      1. Law Illumination
      2. Variation in Illumination
      3. Familiarity with Roads
      4. Other Road Users
      5. Drinking Drivers
   C. Vehicle Factors
      1. Headlights
      2. Auxiliary Lights
      3. Turn Signals
      4. Windshields
      5. Mirrors

II. Night Driving Procedures
   A. Preparing to Drive at Night
      1. Getting Yourself Ready
      2. Plan Your Route
      3. Getting the Vehicle Ready
   8. Driving at Night
      1. Avoiding Blinding Others
      2. Avoiding Glare
      3. Maximizing Visibility
      4. Adjusting Basic Driving Techniques

## Description of Range Exercises

Lesson 2 - Night Operation: Basic Maneuvers

This lesson is intended to give you practice inspecting, coupling, and uncoupling, and driving a tractor-trailer in the dark. In the first exercise, you will practice coupling, inspecting and uncoupling in an unilluminated area. In the second exercise, you will practice basic driving techniques including staying in a lane, following, crossing and meeting other vehicles, and dealing with glare. This exercise will take place either on the range or on the street in light traffic, In the third exercise, you will practice backing and parking in the dark.

## Description of Street Lesson

Lesson 3 - Night Operation: Onstreet

This lesson is provided to give you the opportunity to practice basic driving procedures (shifting, braking, etc.) under a variety of nighttime conditions. In the first exercise you will be driving on suburban or rural highways with light traffic, wide lanes, uncontrolled intersections and road edges that are easy to see. In the second exerise you will be driving on two-lane rural rounds with narrower lanes, little or no street lighting and road edges that are harder to see. In the third exercise you will be driving in city traffic with parked cars on the side of the road, and a high level of background lighting from street lights, neon signs, oncoming cars, etc.

Students will take turns driving and observing. While you are an observer, you will keep track of the driver's performance using the Observer Checklist included in your student material.

**STUDENT** AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Night Operations Checklist--for use in street lesson

Notes:

## UNIT 2.5 NIGHT OPERATIONS CHECKLIST

If a driver makes a driving error in one of the categories below, place a tally mark in the box.

| BASIC CONTROL | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Acceleration | | | |
| Braking | | | |
| Stopping | | | |
| Upshifting | | | |
| Downshifting | | | |
| Uphill Operation | | | |
| Downhill Operation | | | |
| Speed Adjustment/Curves | | | |
| Lane-Keeping/Straight | | | |
| Lane-Keeping/Turns | | | |
| Lane-Keeping/Curves | | | |

| VISUAL SEARCH | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Distance Scanning | | | |
| Turn Path Search | | | |
| Roadside Scanning | | | |
| Blind Intersect., Priv. | | | |
| Blind Intersect., Burd. | | | |
| Mirror Usage, General | | | |
| Mirror Usage, Slowing | | | |
| Mirror Usage, Lane Ch. | | | |
| Mirror Usage, Merge | | | |
| Positioning, Merge | | | |

| COMMUNICATION | | DRIVER #1 | #2 | #3 |
|---|---|---|---|---|
| Signaling Turns: | None | | | |
| | Late | | | |
| | Early | | | |
| Lane Changing: | None | | | |
| | Late | | | |
| | Inappropriate Position | | | |
| Canceling: | Late | | | |
| | Early | | | |
| Flashers | | | | |
| Brake Lights | | | | |
| Use of Horn: | Insufficient | | | |
| | Improper | | | |
| Interpreting Communications | Receiving | | | |
| | Misinterpreting | | | |

| SPACE MANAGEMENT | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Separation | | | |
| Following Distance | | | |
| Lateral Separation | | | |
| Passing Distance | | | |
| **Overhead Clearance** | | | |
| Lane Use | | | |
| Upgrade | | | |
| Multi-lane Roads | | | |
| Cross Streets | | | |
| Right Turn | | | |
| Left Turn | | | |
| Multi-lane Turns | | | |
| Gaps | | | |
| Too Close | | | |
| Too Far | | | |
| Merging | | | |
| Barging | | | |
| Stopping | | | |
| Alignment | | | |
| Traffic Adjustments | | | |
| Compromising | | | |
| Adjacent Operation | | | |

| NIGHT OPERATION | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Lights/High Beam | | | |
| Lights/Dimming | | | |
| Speed Adjustment | | | |
| Following Distance | | | |
| Gap Selection | | | |

An explanation of errors is provided on the back.

## Explanation of Driver Errors on Unit 2.5 Checklist

Lights High Beam--Failure to return the lights to high beam after passing or overtaking another vehicle.

Lights Dimming--Failure to dim headlights according to law meeting or overtaking another road user.

Speed Adjustment--Failure to reduce speed at night where required because of lowered visibility.

Following Distance--Failure to increase following distance to compensate for reduced nighttime visibility.

Gap Selection--Acceptance of an insufficient gap when entering or crossing traffic where it can be attributed to reduced nighttime visibility.

UNIT 2.6
EXTREMI
DRIVING
)NDITIOI

# UNIT 2.6 EXTREME DRIVING CONDITIONS

## WHAT YOU WILL LEARN IN THIS UNIT

Driving in Adverse Weather

You will learn to

- o prepare for operation in cold weather including activating the front brake limiting valve; removing snow and ice from windows, mirrors, brakes, lights, hand and toe holds, etc.; and installing tire chains when necessary.
- o inspect for cold weather operation by paying special attention to coolant level and mixture, heater, defrosters, wipers, washers, tire tread, brakes, lights, reflectors, wiring system, hoses, fuel, exhaust system and fifth wheel.
- o provide adverse weather equipment including chains, scraper, shovel and warm clothing.
- o make sure that moisture is expelled from the air tanks after each trip.
- o obtain weather information before and during trips and adjust trip plan accordingly.
- o check for ice accumulation on brakes, slack adjuster, air hoses, electrical wiring and radiator shutters during operation.
- o adjust operation of your vehicle to weather conditions, including speed selection, braking, making direction changes, and adjusting following distance, to maintain control and avoid jackknifing.
- o assure safe operation of brakes after driving through deep water.
- o use windshield wipers, washers, and defrosters to maintain visibility.
- o observe the road surface for changes in conditions.

You will learn

- o the conditions that produce low traction including rain, ice, and mud.
- o the effects of rain, snow and ice upon the ability to maneuver and stop the vehicle.
- o causes of, and procedures for, avoiding skidding and jackknifing.

- o the effect of ice, snow, water, mud, snow and debris on operation of the brakes,
- o the need to make sure all wheels are free to turn.

Driving in Hot Weather

You will learn to

- o check tires, lubrication, levels and operation of cooling system, fan belts, fans and hoses, and see that the radiator is clear of debris,
- o carry an ample supply of drinking water.
- o inspect tires frequently.
- o avoid leaving the vehicle if it is disabled in the desert.

You will learn

- o procedures for hot weather driving.
- o the hazards of hot weather driving.
- o the effect of hot weather upon the vehicle operation.
- o the effect of hot weather upon tire pressure and tire life.

Driving in Mountains

You will learn to

- o check brake adjustment before driving in the mountains.
- o use right lane or special truck lane when going up grades.
- o place the transmission in the appropriate gear for engine braking before starting down a grade.
- o use proper braking techniques for long downgrades.
- o properly use special speed reduction devices (e.g., engine exhaust brakes),
- o use a truck escape ramp if one is available when brakes fail on a downgrade.
- o check the temperature gauge frequently when pulling heavy loads up long grades.

You will learn

- the effect of vehicle weight and speed upon braking and shifting ability on long downgrades.
- the function and value of escape ramps.
- the meaning and use of percent of grade signs.

## WHAT WILL HAPPEN IN THIS UNIT

Basic information on operating in extreme driving conditions and the hazards that are encountered in extreme conditions will be presented in the classroom. The unit concludes with a range lesson demonstrating the proper procedures for mounting snow chains and for using tow chains and cables to free stuck vehicles.

## Outline of Classroom Sessions

Lesson 1 - Operation During Extreme Driving Conditions

I. Adverse Weather
   A. Tire Chains
   B. Cold Weather Starting
   C. Foul Weather Operating Hazards
   D. Freeing a Stuck Vehicle

II. Hot Weather
   A. Vehicle Inspection
   B. Driving in Desert Conditions

III. Mountain Driving
   A. Gravity
   B. Mountain Preinspection
   C. Operating on Upgrades
   D. Operating on Downgrades
   E. Auxiliary Brakes (Speed Retarders)
   F. Truck Escape Ramps

IV. Summary

## Description of Range Lesson

Lesson 2 - Techniques Used During Extreme Conditions

This lesson begins with an instructor demonstration of procedures for mounting snow chains. After the demonstration, each student will have an opportunity to mount and remove a set of snow chains. In the second part of the lesson, two instructors will demonstrate procedures for using tow chains or cables to free stuck vehicles. The students will then divide into groups

of threes and practice the procedures. Students will take turns hooking up the chains or cables driving the towing vehicle and driving the "stuck" vehicle.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- o Adverse Conditions Inspection Checklist
- o Checklist for Mounting and Removing Snow Chains and Freeing Stuck Vehicles Checklist

## ADVERSE CONDITIONS INSPECTION CHECKLIST

In preparing for operation under adverse conditions, special care must be taken in inspecting the following critical items.

### Adverse Weather

1. Coolant level and antifreeze concentration
2. Air reservoirs
3. Heating equipment (heater, defroster, mirror heaters)
4. Wipers and washers
5. Tires
6. Snow chains
7. Brake parts and balance
8. Lights
9. Windows, mirrors and reflectors
10. Hand and toe holds
11. Weather fronts and radiator shutters
12. Air and electrical lines
13. Exposed wiring and hoses
14. Fuel tank
15. Muffler and exhaust system
16. Fifth wheel
17. Interaxle differential lock
18. Emergency equipment (scrapers, shovels, etc.)
19. Drivers's emergency gear (extra food, water, clothing)

### Hot Weather

1. Tires
2. Lubrication system
3. Cooling system
4. Belts and hoses
5. Extra coolant
6. Drivers emergency gear (extra food, water)
7. Compressor
8. Slack adjusters
9. Glad hands
10. Air lines
11. Drums or discs
12. All other brake parts
13. Clutch

Of course, simply checking the above items is not a substitute for a complete, daily pretrip inspection. And preparing for driving under adverse conditions is not the only time it is important to check them. This is only a list of some of the most important items to check for adverse weather, hot weather and mountain driving.

## MOUNTING AND REMOVING SNOW CHAINS AND FREEING STUCK VEHICLES CHECKLIST

### Mounting Snow Chains

1. Check chain condition
2. Eliminate twists
3. Drape chains over tire
4. Open ends of cross-chainhooks away from tire
5. Fasteners can be on the trailing ends of side chains
6. Tuck first cross-chain under front of tire
7. Move vehicle until fasteners are hub-high
8. Avoid driving over fasteners
9. Straighten and center
10. Lift ends of side chains to deetermine which links will be hooked into fasteners
11. If installing on duals, fasten
    a. center chain
    b. inner chain
    c. outer chain

    If installing on singles, fasten
    a. inner chain
    b. outer chain .
12. Be sure chains are snug but not too tight
13. After driving about five miles, stop and tighten chains again, loose chains wear faster

### Removing Snow Chains

1. Unhook cross chains from side chain fasteners on the outside (whether on duals or singles)
2. Unhook inside cross chains (duals)
3. Spread chains on ground
4. Drive vehicle off chains
5. Do not run over fasteners
6. Remove chains

Notes:

## Using Tow Chains or Cables to Free Stuck Vehicles

Play out enough cable or chain and hook tow hooks (if available.) If not, hook to frame or frame cross member.

## Driving the Towing Vehicle

1. Place in low gear
2. Creep forward till chain or cable is tight
3. Do not spin wheels
4. Gradually pull vehicle onto firm surface

## Driving the Towed Vehicle

1. Place transmission in low gear (or reverse)
2. Release clutch
3. Accelerate gradually (assisting tow vehicle)
4. Do not spin wheels
5. Straighten wheels
6. When on firm surface
   a. Honk horn signalling tow truck to stop
   b. Move vehicle up slightly, slacking cable or chain

# UNIT 2.7 PROFICIENCY DEVELOPMENT: SAFE OPERATING PROCEDURES

# UNIT 2.7 PROFICIENCY DEVELOPMENT: SAFE OPERATING PROCEDURES

## WHAT YOU WILL LEARN IN THIS UNIT

The purpose of this unit is to permit you to practice what you have learned in other units so that you can reach the level of skill required to drive a tractor-trailer safely.

## WHAT WILL HAPPEN IN THIS UNIT

This unit begins with a brief classroom lesson describing basic procedures for safe driving. Driving practice will take place in all kinds of traffic, on all kinds of streets, in all kinds of weather, during daytime and nighttime. By the time you finish this unit you will have completed the minimum requirement of 38.5 hours and 1,000 miles of actual behind-the-wheel time necessary to graduate.

## Outline of Classroom Lesson

Lesson 1 - Procedures for Safe Operation

I. Lane Changing and Passing

II. Passing

III. Merging

IV. Exiting

V. Turning
   A. Right Turns
   B. Left Turns

VI. Parking Procedures

VII. Preparation for Street Lessons
   A. Description of Street Lessons
   B. Questions

## Description of Street Lessons

Lesson 2 - Proficiency Development: Safe Operating Practices

In this lesson you will be working toward developing proficiency in all the safe driving practices (visual search, communications, speed and space management) that you have been taught in this course. You will drive on all types of roads and in a variety of traffic and weather conditions. Throughout the practice sessions in Unit 2.7, the instructor will observe you as

you drive and help you to correct any errors you are making. You will complete additional course units involving classroom, range, and street lessons while you continue your onstreet practice in Unit 2.7.

Throughout this lesson you will take turns driving and observing. As an observer, you will continue to use the Observer Checklist included in your student material.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Safe Operating Procedures Checklist--for use in s.reet lessons

## UNIT 2.7 SAFE OPERATING PROCEDURES CHECKLIST

If a driver makes a driving error in one of the categories below, place a tally mark in the box.

| BASIC CONTROL | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Acceleration | | | |
| Braking | | | |
| Stopping | | | |
| Upshifting | | | |
| Downshifting | | | |
| Uphill Operation | | | |
| Downhill Operation | | | |
| Speed Adjustment/Curves | | | |
| Lane-Keeping/Straight | | | |
| Lane-Keeping/Turns | | | |
| Lane-Keeping/Curves | | | |

| VISUAL SEARCH | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Distance Scanning | | | |
| Turn Path Search | | | |
| Roadside Scanning | | | |
| Blind Intersect., Priv. | | | |
| Blind Intersect., Burd. | | | |
| Mirror Usage, General | | | |
| Mirror Usage, Slowing | | | |
| Mirror Usage, Lane Ch. | | | |
| Mirror Usage, Merge | | | |
| Positioning, Merge | | | |

| COMMUNICATION None | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Signal Turns: Late | | | |
| Early | | | |
| Lane Changing: None | | | |
| Late | | | |
| Inappropriate | | | |
| Position | | | |
| Canceling: Late | | | |
| Early | | | |
| Flashers | | | |
| Brake Lights | | | |
| Use of Horn: Insufficient | | | |
| Improper | | | |
| Interpreting Communications: Receiving | | | |
| Misinterpreting | | | |

| SPACE MANAGEMENT | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Separation | | | |
| Following Distance | | | |
| Lateral Separation | | | |
| Passing Distance | | | |
| Overhead Clearance | | | |
| Lane Use | | | |
| Upgrade | | | |
| Multi-lane Roads | | | |
| Cross Streets | | | |
| Right Turn | | | |
| Left Turn | | | |
| Multi-lane Turns | | | |
| Gaps | | | |
| Too Close | | | |
| Too Far | | | |
| Merging | | | |
| Barging | | | |
| Stopping | | | |
| Alignment | | | |
| Traffic Adjustments | | | |
| Compromising | | | |
| Adjacent Operation | | | |

| NIGHT OPERATION | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Lights/High Beam | | | |
| Lights/Dimming | | | |
| Speed Adjustment | | | |
| Following Distance | | | |
| Gap Selection | | | |

| TRAFFIC LAWS | DRIVER #1 | #2 | #3 |
|---|---|---|---|
| Speed Limit | | | |
| Sign or Signal | | | |
| Other | | | |

UNIT 3.1
HAZARD
RCEPTIO

# UNIT 3.1 HAZARD PERCEPTION

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to identify conditions and other road users that might or will cause a problem for you.

You will learn to

- o recognize things that could cause you a problem, such as road conditions; low clearances; and other road users who are not looking at you, cannot see your truck, not paying attention, unable to control their vehicle, or could suddenly change their position in traffic.

- o take quick defensive or evasive action to avoid problems caused by other road users.

You will learn

- o how likely a particular kind of situation is to cause you to have an accident.

- o how weather, visibility and light (for example, glare in your eyes) can make it hard for you to see.

## WHAT WILL HAPPEN IN THIS UNIT

There will be a brief classroom session to present basic information on hazard perception and clues for recognition of hazards. Commentary driving will be explained to prepare you for onstreet practice. The remainder of the unit will be devoted to onstreet driving during which you will practice recognizing and dealing with hazards.

## Outline of Classroom Lesson

Lesson 1 - Hazard Perception

I. Importance of Hazard Recognition
   - A. What is a Hazard
   - B. Role of Hazard Perception
   - C. Method of Hazard Perception
   - D. Learning Hazard Perception
   - E. Source of Clues

II. Road Characteristics
   - A. Nature of Problem
   - B. Surface Conditions
   - c. Shape and Contour

III. Road User Characteristics
   A. Obstructed Vision
   B. Distracted Drivers
   C. Confused Drivers
   D. Low Speed
   E. Impatient Drivers
   F. Drunk Drivers Impairment

IV. Road User Activities
   A. Driver Movement
   B. Vehicle Movement
   C. Pedestrians/Cyclists
   D. Conflicts

V. Commentary Driving

## Description of Street Lesson

Lesson 2 - Application of Hazard Recognition

This lesson is included to give you an opportunity to apply the principles of hazard recognition taught in the classroom to onstreet operation. You will be driving on all types of roads and in a variety of traffic conditions.

Students will take turns driving and observing. While you are an observer, you will keep track of the driver's performance using the observer checklist included in your student manual.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Rules for Commentary Driving: Hazard Perception
- Unit 3.1 Hazard Perception Checklist--for use instreet lesson

# UNIT 3.1 RULES FOR COMMENTARY DRIVING: HAZARD PERCEPTION

"Commentary driving" means that while you are driving, you will be commenting or talking out loud about what is happening on the road. During onstreet practice in hazard perception, you will be commenting on the various situations and road users that present a potential hazard to you and your vehicle. The procedure will be explained in detail in class. The rules below will help you to learn the procedure.

1. Identify any hazard (any road condition or road user) that is a potential threat to you and to which you must respond.

2. Describe the hazard in a few words. Describe it by nature and location.

   "Child in the street on the left."
   "Yellow Volkswagen on the right."
   "Pavement in the shade of that culvert."
   "Green car in left lane."

3. Describe in a few words what makes it a hazard.

   ". ..is looking the other way."
   ". ..is going to back up."
   ". ..is likely to be very slippery."
   ". ..may be forced into my lane by the merging car."

4. Identify and describe only those hazards to which you must respond in some way. If no response is required, it is not a hazard. You do not have to describe how you are responding to the hazards you identify.

5. When there is no hazard, say nothing. You do not have to announce the absence of any hazard. In other words, there is no need to say, "Clear path."

6. In conflict situations, comment only on the vehicle in conflict with your vehicle. You do not need to comment on the situation or third vehicle that puts the vehicle in conflict with your vehicle.

## UNIT 3.1

## HAZARD PERCEPTION CHECKLIST

During Commentary Driving, check "Yes" if the driver correctly identifies and describes a driving hazard. Check "No" if the driver does not correctly identify and describe a hazard,

During Onstreet Driving Without Commentary Driving, use the checklist to indicate whether or not the driver responds correctly to a hazard.

| HAZARD RECOGNITION | Driver #1 | | Driver #2 | | Driver #3 | |
|---|---|---|---|---|---|---|
| DRIVER'S RESPONSE | YES | NO | YES | NO | YES | NO |
| Road Characteristics | | | | | | |
| Surface | | | | | | |
| Configuration | | | | | | |
| Road User Characteristics | | | | | | |
| Obstructed Vision | | | | | | |
| Distraction | | | | | | |
| Confusion | | | | | | |
| Low Speed | | | | | | |
| Incapacity | | | | | | |
| Road User Activities | | | | | | |
| Driver Movement | | | | | | |
| Vehicle Movement | | | | | | |
| Pedestrians/Cyclists | | | | | | |
| Conflicts | | | | | | |
| Obstructions | | | | | | |
| Merging | | | | | | |
| Intersecting | | | | | | |

Explanation of errors on back.

## HAZARD PERCEPTION

### Explanation of Categories of Hazards on Unit 3.1 Checklist

Road Characteristics--Characteristics of the road that provide hazard clues, including:

Surface--The appearance of the road surface providing clues to the following hazards:

Slippery Surfaces--Surfaces that could induce a skid.

Soft Surfaces--Surfaces that may not support the weight of the truck.

Sloping Surfaces--Surfaces that slope across the truck's path including the danger of skidding, rollover, or collision between the trailer and the roadside objects (high colonnades, sloping edges, unbanked curves).

Configuration--Clues to potentially dangerous roadway configuration including sharp curves, dangerous offramps, leave exits.

Road User Characteristics-Characteristics of road users that identify them as potential hazards, including:

Obstructed Vision--Clues indicating the inability of a road user to see the truck.

Distraction--Clues indicating that another road user may be distracted and, therefore, unable to devote attention to the truck.

Confusion--Clues that another road user may be confused and, therefore, a candidate for some unexpected action.

Low Speed--Clues indicating that a vehicle ahead is traveling at a speed that would cause the truck to overtake very quickly.

Incapacity--Clues that another driver is unable to respond appropriately to the truck because of intoxication, fatigue, or some other incapacity.

Road User Activities--Activity on the part of any road user that indicates a potentially hazardous course of action, including:

Driver Movement--Any motion on the part of the driver that signals an impending change in speed or direction.

Vehicle Movement--Any motion on the part of the vehicle that signals an impending change in speed or direction.

Pedestrian/Cyclists--Any motion on the part of a pedestrian, bicyclist, or moped rider that signals an impending change in speed or direction.

Conflict--Any vehicle that is on a collision course with an object or other road user, signaling an impending change in speed or direction, including conflicts with:

Obstructions--Roadway configurations with fixed objects in the path of the other vehicle.

Merges--Vehicles merging into the path of the other vehicle.

Intersections--Vehicles intersecting with the road user.

UNIT 3.2
EMERGENC
MANEUVER

# UNIT 3.2 EMERGENCY MANEUVERS

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn how to

- o bring your truck to a stop in the shortest possible distance on a dry surface while controlling your direction.
- o make a quick evasive turn on a dry surface.
- o make an evasive turn off of the roadway and back onto it while controlling your direction.
- o stop your vehicle if your brakes fail.
- o keep control of your vehicle if a tire blows out.

You will learn

- o why it is easier to turn your vehicle than to stop it.
- o why it is generally safer to leave the roadway rather than risk striking another vehicle head on.
- o the critical importance of seatbelts in driver safety and vehicle control.

## WHAT WILL HAPPEN IN THIS UNIT

Basic information concerning when and how to make emergency maneuvers will be presented in the classroom lesson. The unit concludes with a range lesson during which you will practice three emergency maneuvers.

## Outline of Classroom Lesson

Lesson 1 - Emergency Procedures

I. Role of Emergency Maneuvers

II. Evasive Steering

III. Emergency Stop

IV. Off-Road Recovery

V. Brake Failure

VI. Blowouts

VII. Emergency Maneuver Exercise

VIII. Range Procedures

**Description of Range Lesson**

Lesson 2 - Emergency Skills

This lesson is designed to give you practice at three essential emergency maneuvers: The Emergency Stop, Evasive Steering, and the Offroad Recovery. In each exercise, an instructor will ride with you to give you tips on improving your performance. See the diagrams of Range exercises included in your student material.

In the first exercise you will practice stopping by locking up all the brakes at 10 mph. Then you will practice "stab" breaking techniques at 10, 20 and 30 mph.

In the second exercise you will practice evasive steering. You will accelerate to 30-35 mph toward a barrier (simulated with cones). On the command of the instructor, you will have to turn either right or left around the barrier. You will perform this maneuver three different ways: once without stopping, once stopping as quickly as possible after making the turn, and once slowing down before making the turn and stopping as quickly as possible after making the turn.

In the third exercise, you will practice driving off the road, on to a simulated "shoulder" area and then back on to the road again. You will perform this exercise at 10, 20, and 30 mph. At each speed, you will practice both driving completely off the road and driving with just the right wheels off the road.

**STUDENT AIDS**

To help you learn the material in this unit, there follows an Emergency Maneuver Checklist covering:

- o evasive steering
- o emergency stopping
- o offroad recovery
- o brake failure
- o front tire blowouts

# UNIT 3.2 EMERGENCY MANEUVERS CHECKLIST

## Evasive Steering

1. Minimize the turn
   - Start as early as possible
   - Turn only as much as needed
   - This minimizes the chance of rollover or jackknife
2. Turn quickly using the hand-over-hand technique
   - Each turn approximately 180"
     - Turns the front wheels quicker than several short turns
     - It is hard to turn a truck too quickly
   - This is the reason for hands on 9 o'clock-3 o'clock position in normal driving
     - This position allows wheel to turn 180° without your letting go of the wheel
     - Your hands won't be in this position unless this is done in normal driving
3. Avoid braking in the turn
   - Avoid braking while-steering
   - Brake before turning if distance permits
4. Countersteer
   - You must be prepared to countersteer quickly
     - Countersteer is the term give to a turn back toward the intended path of travel
     - A quick countersteer is needed to keep from going out of the escape path (e.g., off the shoulder)
     - Initiate the countersteer as soon as the front of the trailer clears the obstacle

## Emergency Stopping

1. Controlled braking

   - Apply the brakes just short of lockup
   - Maintain steady pressure
   - NOTE: It is difficult to anticipate the point of lockup precisely because it is different for each rig.) Controlled braking requires practice in the vehicle to be operated without an opportunity to practice, "stab" brakfding best

2. "Stab" braking

   - Apply the brakes fully
   - Release brake partially when wheels lock. This achieves maximum braking while brakes are applied. Releasing avoids a skid.
   - Repeat "stab" braking sequence until vehicle slows sufficiently
   - Allow time for the brake system to recover between stabs

## Off-Road Recovery

1. Brake before turning
   - Reduce speed as much as possible
   - Use controlled or stab braking to prevent loss of control
2. Avoid braking while turning
   - The vehicle is vulnerable to a skid while turning
   - Steering control is particularly important while entering the roadside
3. Minimize turning
   - Keep left wheels on pavement if possible
   - This reduces the amount of turning required once you are on the roadside
4. Countersteer (turn in direction of roadway)
   - Turn quickly as soon as the right front wheel rides up on the surface
   - Both turns should be executed as a single, integrated steering maneuver

NOTE: When right front wheel drops off edge of pavement, you must come to a complete stop before attempting to steer back on to pavement. Failure to do so may cause vehicle to overturn.

## Brake Failure

1. Downshift
2. Apply the parking brake to help indownshifting
   - Keep hand on the parking brake
   - Release it if the vehicle begins to skid or veer
3. Find an escape path
   - Begin looking immediately
   - Use the best path available. Don't wait to see if the vehicle can be stopped* There may be no good path available.
4. Create drag
5. Repeat downshifting unit the vehicle is moving slowly enough to stop with the parking brake
6. Inspect the brakes before continuing

## Front Tire Blowouts

1. Grasp wheel tightly
2. Avoid braking hard
3. Allow the vehicle to slow gradually
4. Brake gently to a stop

# Notes:

# UNIT 3.3
# SKID CONTROL
# AND RECOVERY

# UNIT 3.3 SKID CONTROL AND RECOVERY

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- keep control of your vehicle when you are driving on a slippery surface.
- stop your vehicle in the shortest possible distance on a slippery surface while controlling your direction.
- recover from a tractor or trailer skid or jackknife caused by snow, ice, water, oil or sand.

You will learn

- how skid control prevents accidents.
- the importance of checking mirrors often so you can spot a jackknife skid immediately.
- what happens in a tractor or trailer jackknife and how they happen.

## WHAT WILL HAPPEN IN THIS UNIT

The unit begins with a classroom lesson, during which information will be presented on the causes and major types of skids, along with procedures for recovering from skids. The rest of the unit will be devoted to practice on the range.

## Outline of Classroom Lesson

Lesson 1 - Techniques of Skid Control and Recovery

I. Role of Skidding in Accidents

II. Skid Dynamics
   - A. Friction (Traction)
   - B. Wheel Load
   - c. Forces of Motion
   - D. Three Basic Types of Skids
     1. Braking
     2. Turning
     3. Accelerating
   - E. Preventing Skids

III. Tractor-Trailer Skids
   A. Trailer Jackknife
   B. Tractor Jackknife
   C. Front Wheel Skids
   D. All Wheels Skids
   E. Summary of Skid Prevention
   F. Antijackknife Devices

IV. Skid Recovery
   A. Speed Control
   B. Corrective Steering
   C. Countersteering
   D. Braking to Stop

V. Range Procedures
   A, Maneuvers
   B. Range Safety Rules

## Description of Range Exercises

Lesson 2 - Skid Control and Recovery (An Optional Lesson)

This lesson begins with a review of the Range Safety Rules. All range exercises in this lesson take place on an area of the range that has been wetted to reduce traction. An instructor will be with you in the cab during each exercise,

The range exercises begin with three exercises in controlling just the tractor under slippery conditions. The first exercise is the "Tractor Skid" exercise. The first time through this exercise you will completely lock the brakes at 20 mph but will not attempt to control the tractor during the skid. This way you can observe the natural effects of a full skid. After the first run you will make several more, locking up the brakes and trying to keep the tractor under control and moving in a straight line. You will continue doing this until you are able to control the tractor with the wheels locked. When you have mastered this maneuver at 20 mph, the speed will be raised to 25, 30 and 35 mph.

The next exercise is the "Tractor Stop" exercise, You will enter the wet portion of the range at 20 mph and attempt to come to a smooth, controlled stop as quickly as possible, keeping the tractor under control and moving in a straight line, You will repeat this exercise at 25 and 30 mph.

The third exercise, is the "Tractor Turn and Stop" exercise. You will enter the wet portion of the range at 15 mph. When the instructor tells you to, you will apply the brakes to slow the tractor down, release the brake and make a quick lane change and then come to a complete stop in a straight line. You will repeat this exercise at 20, 25, and 30 mph.

The last two exercises, the "Tractor-Trailer Stop" and "Tractor-Trailer Turn and Stop" are performed with a tractor-trailer combination. The Tractor-Trailer Stop is basically the same as the "Tractor Stop" exercise. The "Tractor-Trailer Stop and Turn" is basically the same as the "Tractor Stop and Turn." If your school does not have a tractor-trailer combination equipped with an antijackknife device, these last two exercises will not be included in the lesson.

## **STUDENT** AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Special Range Safety Rules for Skid Control and Recovery
- Range safety rules from Unit 1.1

## Unit 3 .3 SPECIAL RANGE SAFETY RULES FOR SKID CONTROL AND RECOVERY

During practice of skid control and recovery on the range, four additional rules must be followed to ensure safety. All of the general range safety rules also must be observed,

### Four Additional Rul es

1. No student may enter a maneuver area until that area is clear of all vehicles, and no student may begin an exercise until specifically instructed to do so by an instructor.

2. During an exercise, a student whose vehicle is clearly sliding out of the special skid area must apply the brakes firmly and hold them in order to stop the vehicle, Once the vehicle reaches dry pavement, it will stop* This rule applies to emergencies only. While the vehicle remains within the skid area, the student driver should complete the exercise according to instructions.

3. Only the driver and instructors are permitted in the vehicle during maneuvers

4. Observer students shall stay behind the safety lines or barricades at all times.

UNIT 4.1
VEHICLE
SYSTEMS

# UNIT 4.1 VEHICLE SYSTEMS

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn the location, function, and purpose of

- the frame, suspension systems and axles.
- various types of internal combustion engines.
- the fuel systems.
- the air intake and exhaust systems.
- the lubrication systems.
- the cooling systems.
- the electrical systems.
- the drive train.
- the brake systems.
- the wheels, wheel bearings, rims, and tires.
- the steering systems.
- the coupling systems.

## WHAT WILL HAPPEN IN THIS UNIT

This lesson consists of two lessons. The first lesson is in the classroom. You will learn the theory of operation and purpose of each vehicle system, the function of major system components and the importance of each system to safety and economy of operation. The second lesson is a lab lesson in which you will have an opportunity to see the workings of vehicle systems on an actual tractor-trailer.

## Outline of Classroom Sessions

Lesson I - Vehicle Systems

I. Frame, Suspension Systems and Axles

II. Engines

III. Fuel Systems

IV. Air Intake and Exhaust Systems

V. Lubrication Systems

VI. Cooling Systems

VII. Electrical Systems

VII. Drive Trains

IX. Brake Systems

X. Wheels, Bearings, Rims and Tires

XI. Steering Systems

XII. Coupling Systems

## Description of Lab Lesson

In this lesson your instructor will take small groups of students around a tractor-trailer, pointing out the vehicle systems and system components. Then the instructor will name vehicle components and ask individual students to find them and explain their purpose and function.

## STUDENT AIDS

To help you 'learn the material in this unit, a brief illustrated description of the systems and components of a tractor-trailer follow.

# VEHICLE SYSTEMS

This is a description of the major systems of a tractor-trailer. It is provided to help you prepare for Unit 4.1, Vehicle Systems. By reading this material before class, you'll be able to follow the instructor's presentation better and gain a better understanding of the way in which a tractor-trailer combination works.

The description of the various systems appear in the same order in which they will be discussed in class.

- Frame, suspension systems and axle
- Engines
- Fuel systems
- Air intakeand exhaust systems
- Lubrication system
- Cooling system
- Electrical systems
- Drive trains
- Braking systems
- Tires and wheels
- Steering systems
- Coupling systems

## FRAME, SUSPENSION SYSTEMS AND AXLES

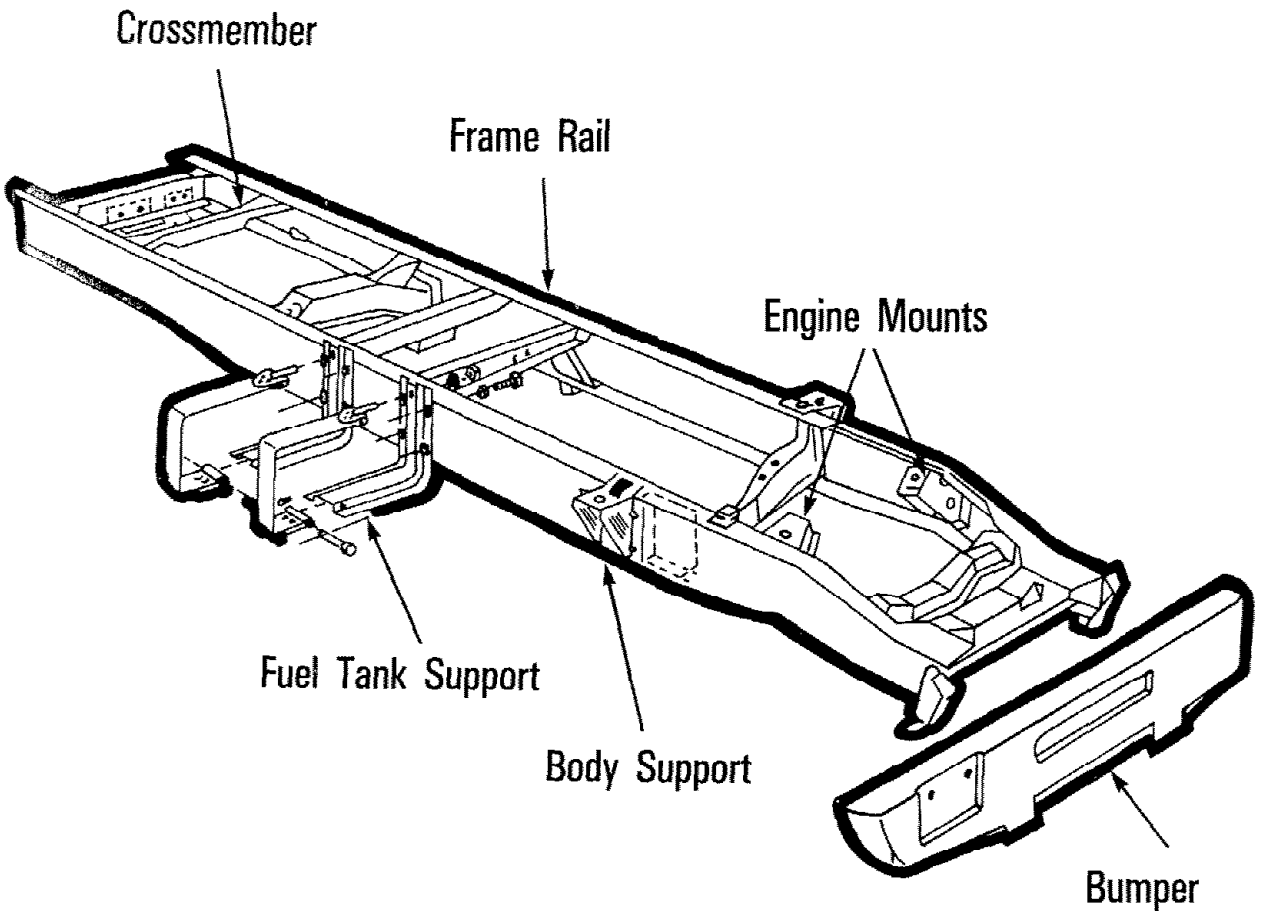
### Frame

The vehicle's frame is the "backbone" of the vehicle. The body is connected to it. The engine is held in place by the engine mounts that are attached to the frame. It is the unit to which the axles, wheels and tires are connected by the suspension system.

This foundation is made up of many different components. First, there are the two steel rails that run the entire length of the vehicle, the frame rails. These can also be made of aluminum alloy for lightweight tractors or special steel for trucks with oversized and overweight loads. Crossmembers cross these two rails to provide support and strengthen the frame. Engine mounts are brackets that are used to bolt the engine to the frame rails. Suspension hangers connect the suspension to the frame rails. The body supports attach the truck body to the frame.

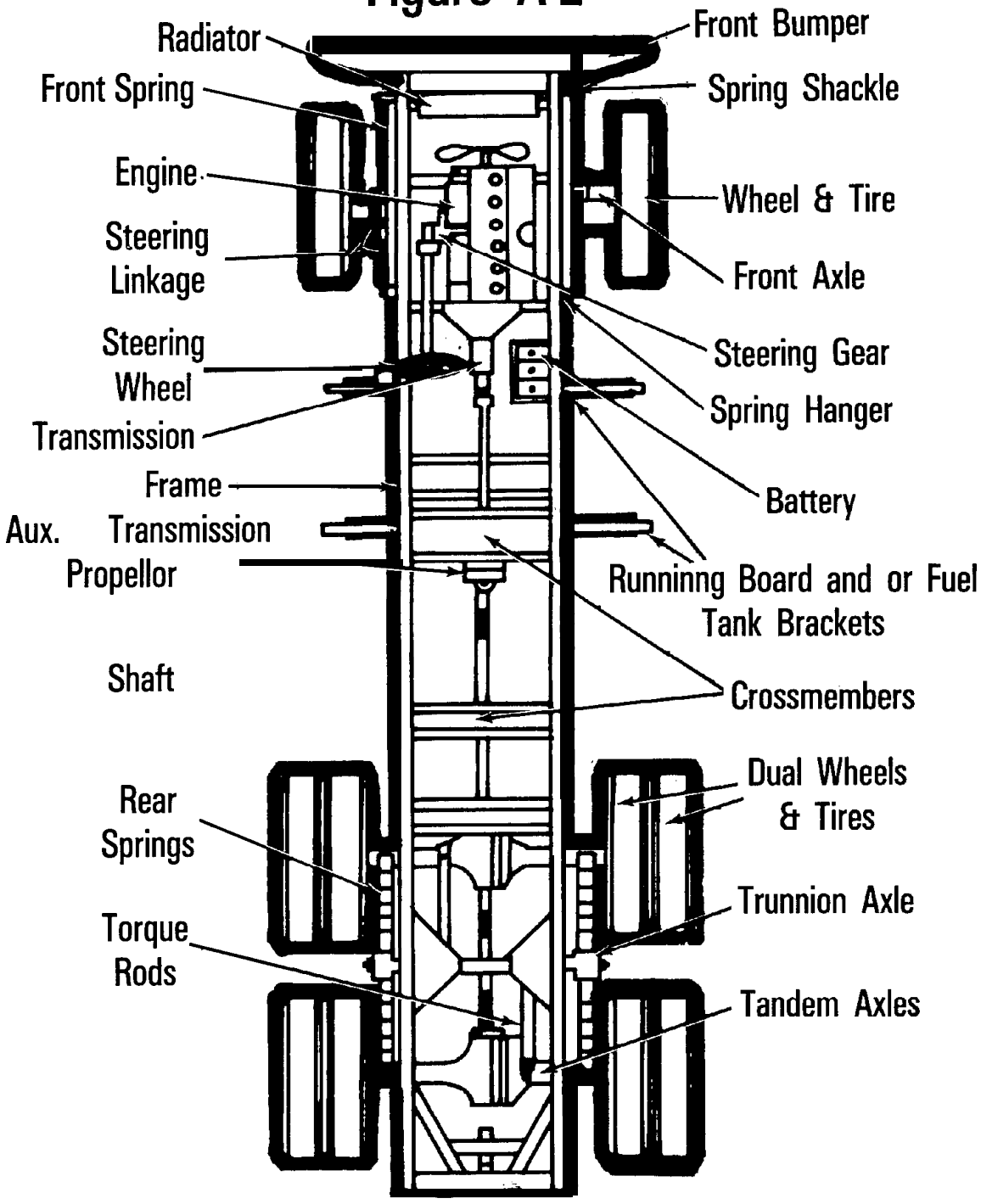
**(SEE FIGURE A-1 AND A-2)**

# *Frame*
## Figure A-1



# *Overhead View of Frame Showing Various Attachments*

## Figure A-2



## Suspension

The purpose of the suspensjon system is to support the body and frame of the truck. It consists of the springs and the mounting brackets or hangers. The front or rear axles are attached to the suspensjon system on top of which rests the frame. With this arrangement, the axles can move up and down in response to ground changes without seriously affecting its load. By securing the suspensjon system at points spread throughout the frame, the stress of absorbing the shocks can be well-distributed. The weight and durability of the suspension system, obviously, must increase if the truck is quite large and the cargo heavy. If the truck is smaller, the system does not have to be quite so sturdy.

The following characteristics are necessary for a good suspension system: the capacity to support the load; the ability to transmit full brake and tractive effort to the chassis frame; separate and responsive components on both axles for all conditions; a cushioned ride for driver and cargo, laden or unladen; secure axles to assure correct driveline alignment; and easy maintenance and lightweight parts.

There has been an increase in tandem suspensjon since the increased gross vehicle weight in most States. The majority of suspensions employ the leaf spring for deadening shocks, but air ride and independent coil use are increasing steadily.

### Leaf Springs

Most trucks use the leaf spring suspensjon system. A leaf spring is a series of narrow metal strips of varying lengths that are bolted together and attached to frame hangers.

There are many types of leaf springs. Two of the most common types are the stack or multi-leaf spring which is used in heavy-duty systems, and the tapered leaf spring which is used in lighter weight tandem axle vehicles for highway service.

Many times leaf springs will need an additional spring, torque rods, or both to help the main spring. Torque rods help secure the axle and, through a twisting action, serve as springs.

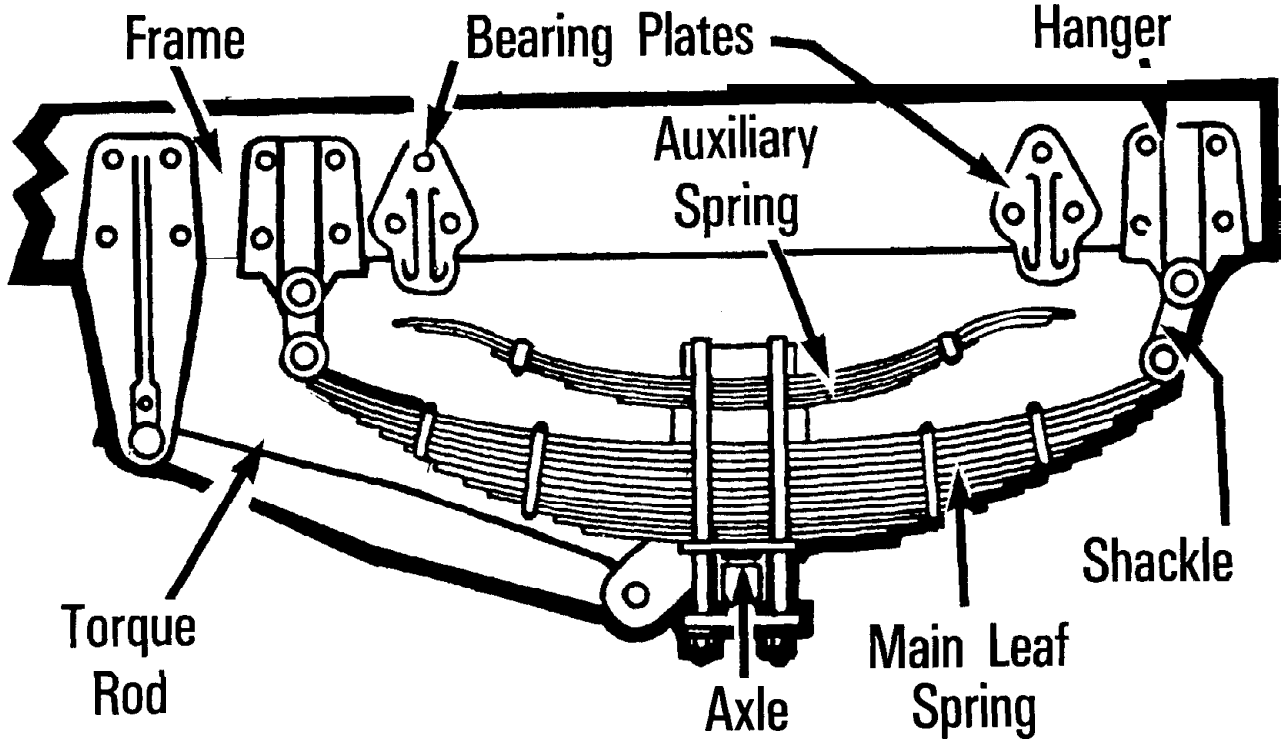
**(SEE FIGURE A-3)**

### Air Suspension

Air suspensions are essentially air cushions placed between the axle and frame. They are progressively gaining popularity on motor trucks; nevertheless, they are most popular with trailers. This type of system provides a smooth ride while decreasing damage to both the equipment and the commodity. Additionally, there is a limited different between the ride when the vehicle is loaded and when it is empty.

# *Leaf Springs and Torque Rod*

## Figure A-3



The air pressure needed to maintain the suspension comes from the tractor air compressor. The driver can adjust this air pressure for specific loads with a system of valves. Frame height can also be changed for different loads.

An effective and popular air suspension system is the combination of air suspension and leaf spring suspension. With this there is the sturdiness of the leaf spring and the comprehensive absorption of shock of the air cushions on each axle. It results in a smooth, yet secure ride. This combination can be installed with a single, dual, or third axle setup.

The combination of the two systems reduces many common problems of the air cushion system. However, you should still keep a close watch on some trouble spots. There can be leaks and other troubles around the leveling valves and the linkage. And an important consideration is the stability of the load with a high center of gravity; it is very likely to rock. The leaf springs can especially help in just such a situation.

**(SEE FIGURE A-4)**

## Independent Coil Springs

This type of spring is coiled in a circular fashion. The stiffness of the spring may vary depending on the axle weight. Each of the coiled springs acts independently of the others, giving a more evenly cushioned ride.

## Shock Absorbers

Shock absorbers serve primarily to check and reduce the motions of the vehicle body and wheels from uneven road surfaces. The shock absorbers accomplish this task operating under the principles that liquid is practically impossible to compress and energy is needed in order to force liquid through an aperture.

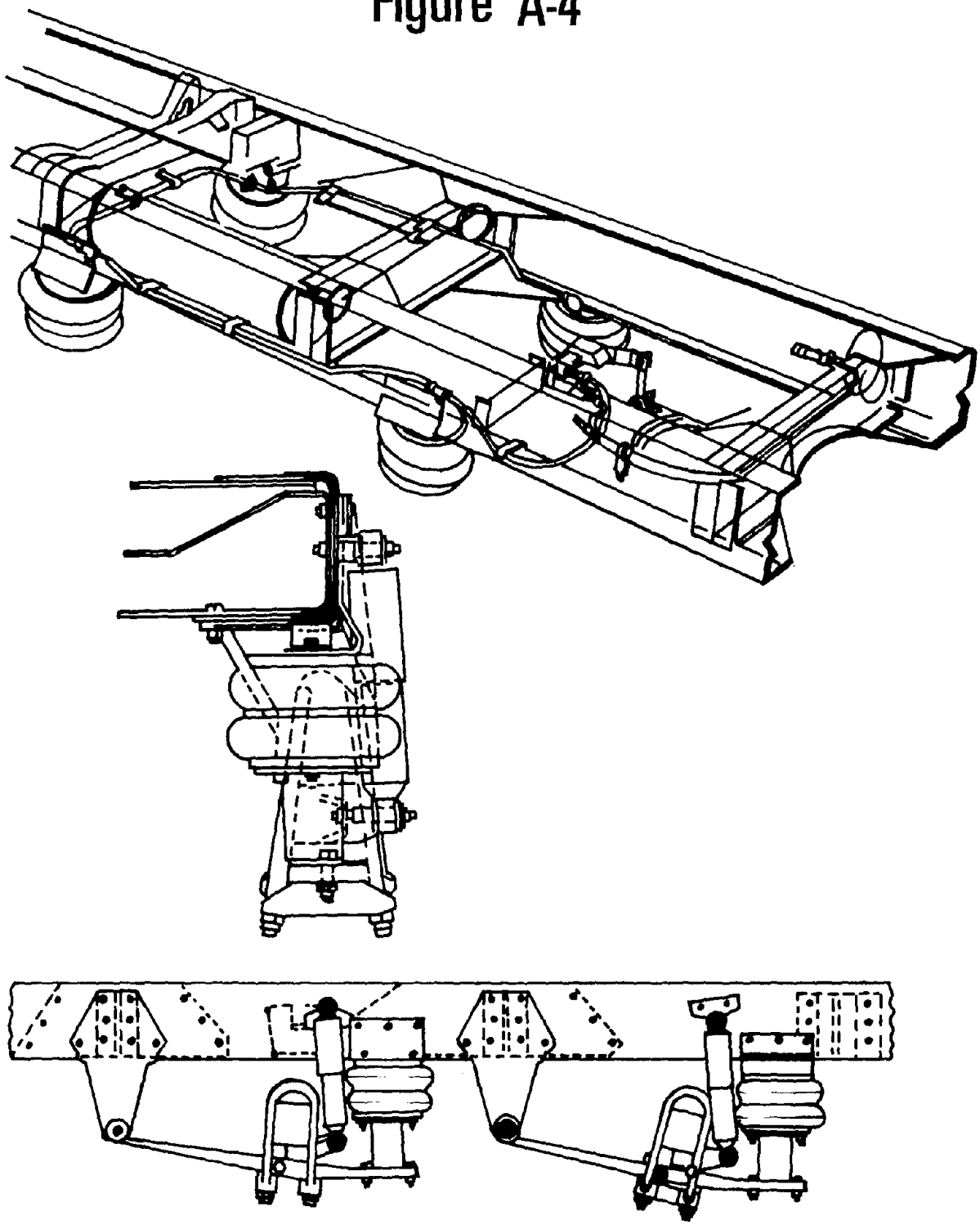
Shock absorbers operate in a similar fashion to a piston in a cylinder with holes in the top of it. However, there is liquid in the compression chamber, and it resists the shocks of the suspension system which could otherwise become quite turbulent.

Because of the nature of the independent coils and the air cushions, shock absorbers are needed much more in these systems than in the leaf spring suspension system.

**(SEE FIGURE A-5)**

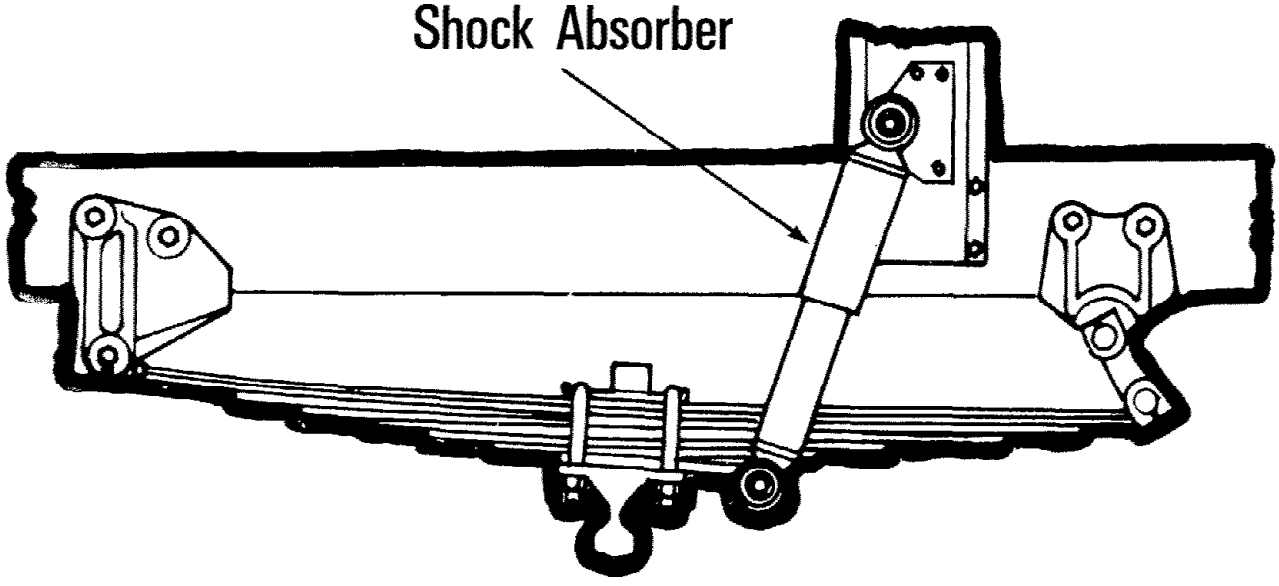
# *Air Suspension System*

## Figure A-4



# *Shock Absorber in Leaf Spring Suspension System*

## Figure A-5



## Internal Combustion Engine

An internal combustion engine clearly defines itself in its name. The fuel burns inside or in an enclosed chamber. The combustion or burning of the fuel takes place in the same container which produces the power. This is contrasted with a steam engine which is an example of an internal combustion engine. The fuel can burn anywhere so long as the water is then converted to steam.

The basic parts of the internal combustion engine are a cylinder which is sealed at one end and a piston which is another cylindrical piece that fits inside the cylinder. When combustion takes place in the cylinder, it forces the piston out with air pressure. That is where the work is created for the operation of the rest of the engine.

In order to use this power, there is a connecting rod and a crankshaft. The connecting rod is fastened at one end by a pin to the piston, so that its other end can swing back and forth like a pendulum. The crankshaft fits through this other end of the connecting rod, its offset section centered in the hole and oiled for rotation.

Therefore, when the piston is forced downward by the mounting pressure due to combustion, it moves the connecting rod downward. In turn, the crank rotates for that is its only course of action, turning the shaft. In this manner, direct back-and-forth motion is converted to circular or rotary motion.

**(SEE FIGURE B-1)**

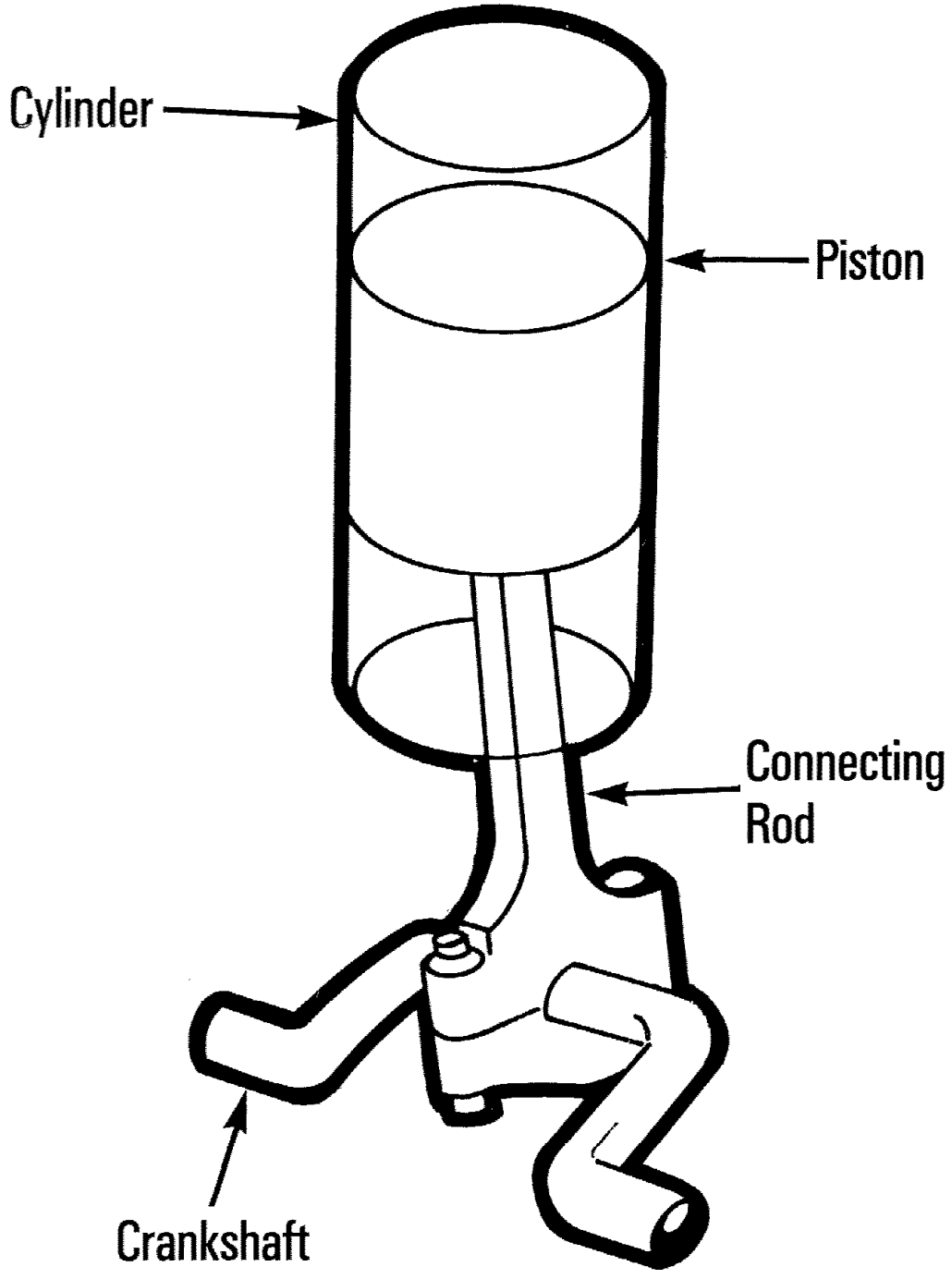
We can now see the basic principals of most contemporary engines using the cylinder, piston, connecting rod and crankshaft.

## Four-Cycle Engine

The process of timing the crankshaft must be repeated over and over to move the vehicle. But to understand its full operation, you only have to see one series of events, or cycle. Most engines of today are "four-cycle" engines. This name is a bit deceiving, since there is only one repeating cycle. Originally, though, it was called a "four-stroke" cycle and this was more accurate. The cycle consists of four strokes of the piston, two up and two down.

# *An Internal Combustion Engine Cylinder*

Figure B-1



The piston starts at the top of the cylinder with just a little room between it and the sealed end. This is the maximum height enabled by the crankshaft. For the first stroke, the piston is moving down, increasing the space between it and the top. This is the intake stroke because, as it occurs, air or a mixture of air and fuel are drawn through a valve in the top into the cylinder. Then the intake valve is closed and the piston starts to go up again in the compression stroke. The contents are compressed into a much denser mixture in that small space at the top. The crankshaft has completed one rotation and the piston is where it was initially.

At this point, the mixture is ignited which causes it to expand, and the piston moves downward. This third stroke is called the power stroke. This is the stroke for which all of the preparation has been made. This moving down to its bottom position again creates the power which makes the engine run.

The fourth and final stroke of the cycle is called the exhaust or scavenging stroke. The hot exhaust gases from the burning of air and fuel begins to escape through another valve in the closed end of the cylinder. The piston moves up again, clearing the gases from the chamber, thereby preparing it for the next cycle.

**(SEE FIGURE B-2)**

You should note here that, with the four-cycle engine, there are two revolutions of the crankshaft per cycle and for each cycle there is only one power stroke. Therefore, one of the principal features is that, for every two revolutions of the crankshaft, there is one power stroke.

In a condensed form, basically what you have to remember about the four-cycle engine is that there are actually four strokes. These are intake, compression, power, and exhaust.

## Two-Cycle Engine

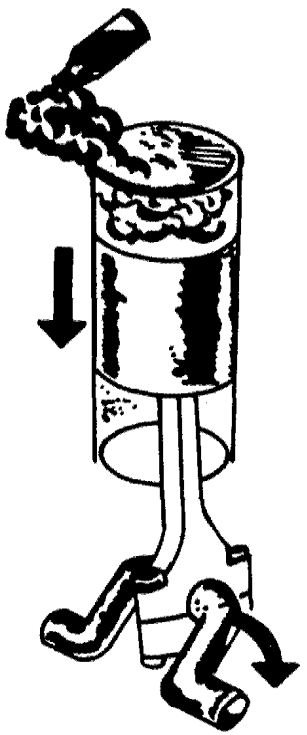
Another important type of engine is the two-cycle engine. Once again, it is more accurately called a two-stroke cycle engine. In this type, the cylinder is ignited once every two strokes or revolution of the crankshaft. There is only a compression stroke and a power stroke and included in these motions are the processes for intake and exhaust.

Some people consider it to be an improvement on the four-cycle engine because it supplies the same power with only two strokes. Many two-cycle gasoline engines have been built; however, in general, their commercial use has been limited to small sizes and special purposes. On the other hand, the two-cycle diesel is the most commonly used engine in the tractor-trailer fleet. Therefore, we will limit any further reference to two-cycle engines to the diesel type.

# *Four-Cycle Engine Operation*

## Figure B-2

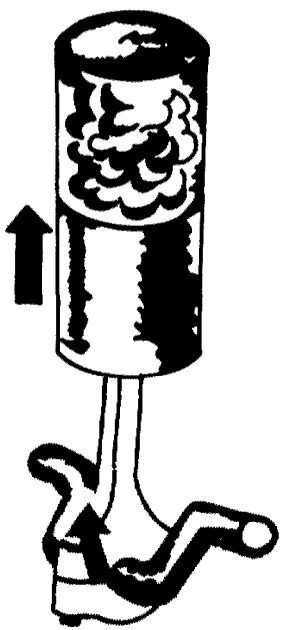
Stroke 1



**Intake**

Intake Valve Open
Exhaust Valve Closed
Piston Moves Down

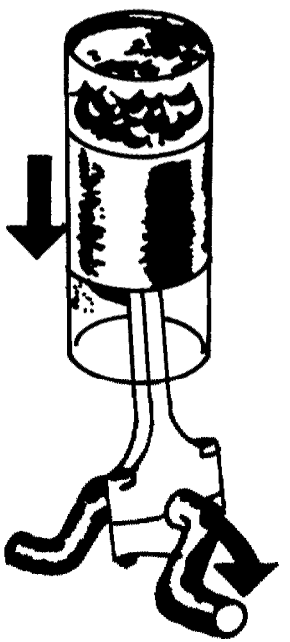
Stroke 2



**Compression**

Both Valves Closed
Piston Moves Up

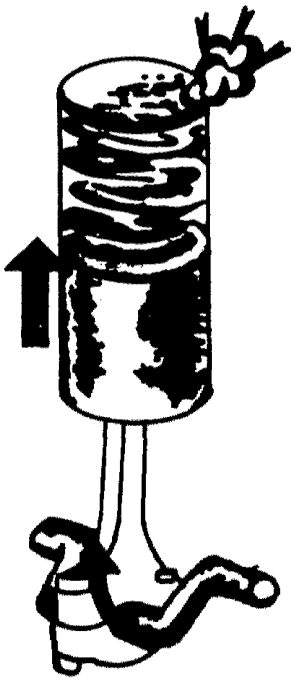
Stroke 3



**Power**

Both Valves Closed
Piston Being Pushed
Down By Expanding
Gases

Stroke 4



**Exhaust**

Intake Valve Closed
Exhaust Valve Open
Piston Moves Up

The two-cycle engine is very similar to the four-cycle. However, in order to compensate for two fewer steps, a couple of changes must be made. The two valves in the top are both converted to be exhaust valves. Additionally, to take care of the intake, a row of holes, or ports, is added around the middle of the cylinder. These are closed off by the piston until it approaches the bottom of its stroke, and then the air is able to enter. Without the extra strokes for the piston to act as an air pump, the blower is needed, and this fits around the outside of the air ports. So, when the piston is at the bottom of the first stroke, the blower pushes air in through the ports which consequently pushes the exhaust gases left from the previous cycle out through the valves.

**(SEE FIGURE B-3)**

Just as it reaches the top, a piston-like device or injector shoots a spray of fuel into the chamber full of the hot fresh air. Ignition of the following expansion takes place as in the four-cycle engine. A little past the halfway point, the burned gases begin to excape through the exhaust valves which have just opened. As the piston proceeds, the ports are uncovered, fresh air fills the chamber, and a cycle is completed in one turn of the crankshaft.

**(SEE FIGURE B-4)**

Thus, by having one power stroke per revolution of the crankshaft, the two-cycle engine is able to produce twice the amount of power that a four-cycle engine of the same size and almost the same weight can.

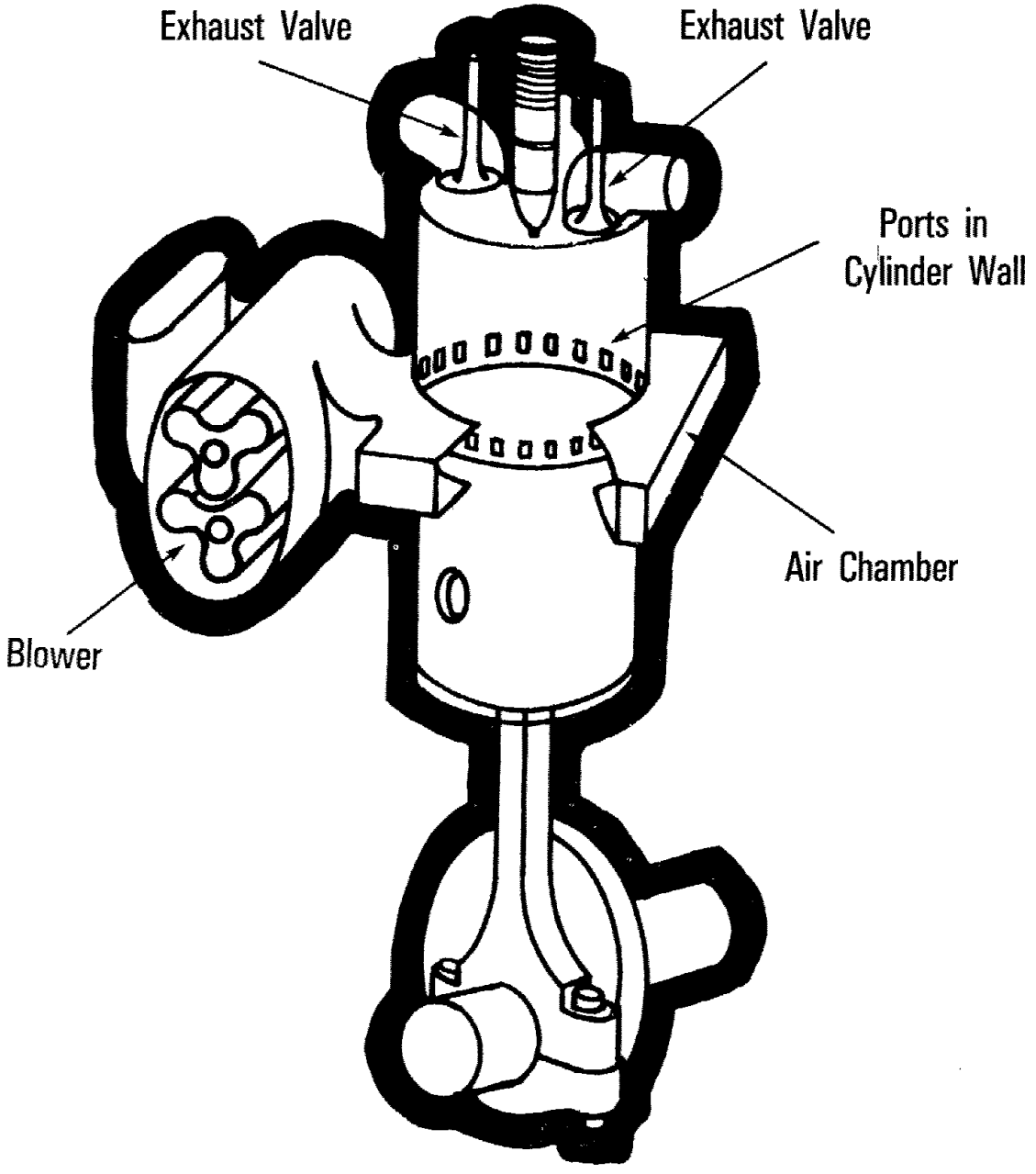
## The Gasoline Engine

The gasoline engine is the most common type of internal combustion engine; there are more than 120 million of them in this country. The total horsepower represented by these engines is much more than the combined horsepower of all other forms of power such as locomotives, manufacturing plants, electrical central stations.

If we take a look at one of these engines, we find that it is much less complicated than it may first appear. Only a few additions are made to our previously studied basiccomponents. The gasoline engine, which is a carburetor type engine, has as one of its integral components a carburetor. The carburetor maintains the proper proportions of air to gasoline which has been broken up into little droplets. The mixture is sent over to the cylinder through the intake manifold. This is a pipe which leads from the carburetor to the combustion chamber of the cylinder. The intake valve regulates the flow of the mixture at

# *A Two Cycle Cylinder*

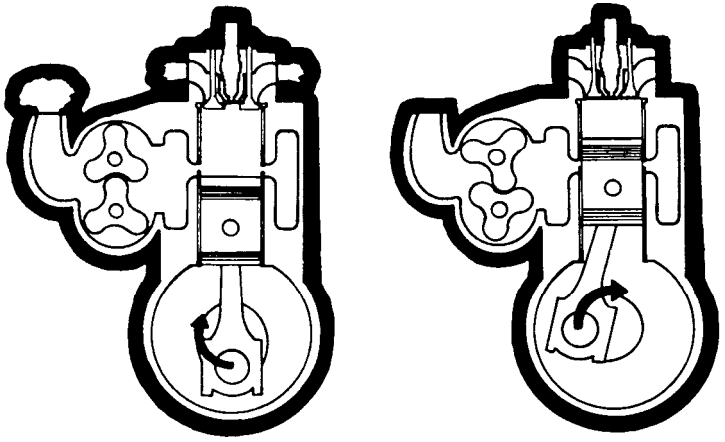
Figure B-3



# *A Two Cycle Engine Operation*

## Figure B-4

### Stroke 1
### Intake and Compression

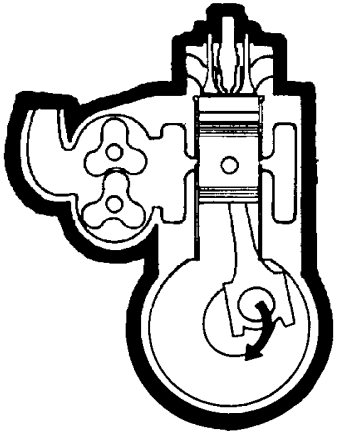


- Exhaust Valves Open
- Air Intake Holes Open
- Piston Moving Up The Cyclinder

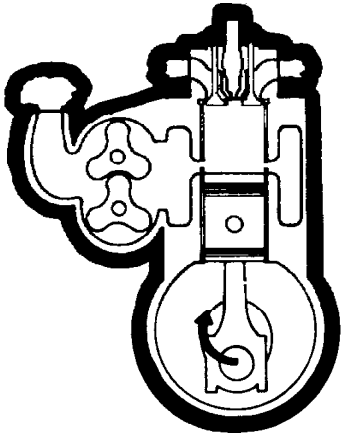


- As Piston Moves Up Toward Top
- Exhaust Valves Close
- Air Intake Holes Close
- Piston Compresses the Air Taken in

### Stroke 2
### Power and Exhaust



- Exhaust Valves Closed
- Air Intake Holes Closed
- Injectors Put Fuel Into the Hot, Compressed Air
- Combustion Occurs
- Piston is Forced Down



- As Piston Goes Down
- Exhaust Valves Open
- Air Intake Holes Open

the cylinder end of the manifold. A spark plug is added to the closed end of the cylinder for ignition. And another valve, the exhaust valve, is also located here.

**(SEE FIGURE B-5)**

This completes the essentials of a gasoline engine which, as you can see from the above description, is a four-cycle engine. Starting in its uppermost position, the piston moves down through its intake stroke, creating a vacuum in the cylinder. This pulls the mixture of air and gasoline in through the open intake valve. After the piston reaches its bottom position, it starts up again, compressing the mixture into the closed end of the cylinder to a pressure of perhaps 200 pounds per square inch. At this point, the spark occurs, and the pressure increases almost instantaneously to 600 or 700 psi. On a piston of 3-1/2" in diameter, a force of about three tons is created which depresses the piston. This, of course, makes the crankshaft turn and transmits power to whatever is connected to the shaft. The exhaust valve opens and, as the piston moves up, the exhaust gases are pushed out. When the piston reaches the top, the exhaust valve closes, the intake valve opens again, and the next cycle is ready to begin.

**(SEE FIGURE B-6)**

## Diesel Engine

The diesel engine is not very different from the gasoline engine. It, too, is an internal combustion engine, and again, it is just a question of obtaining the air and fuel and having it ignited.

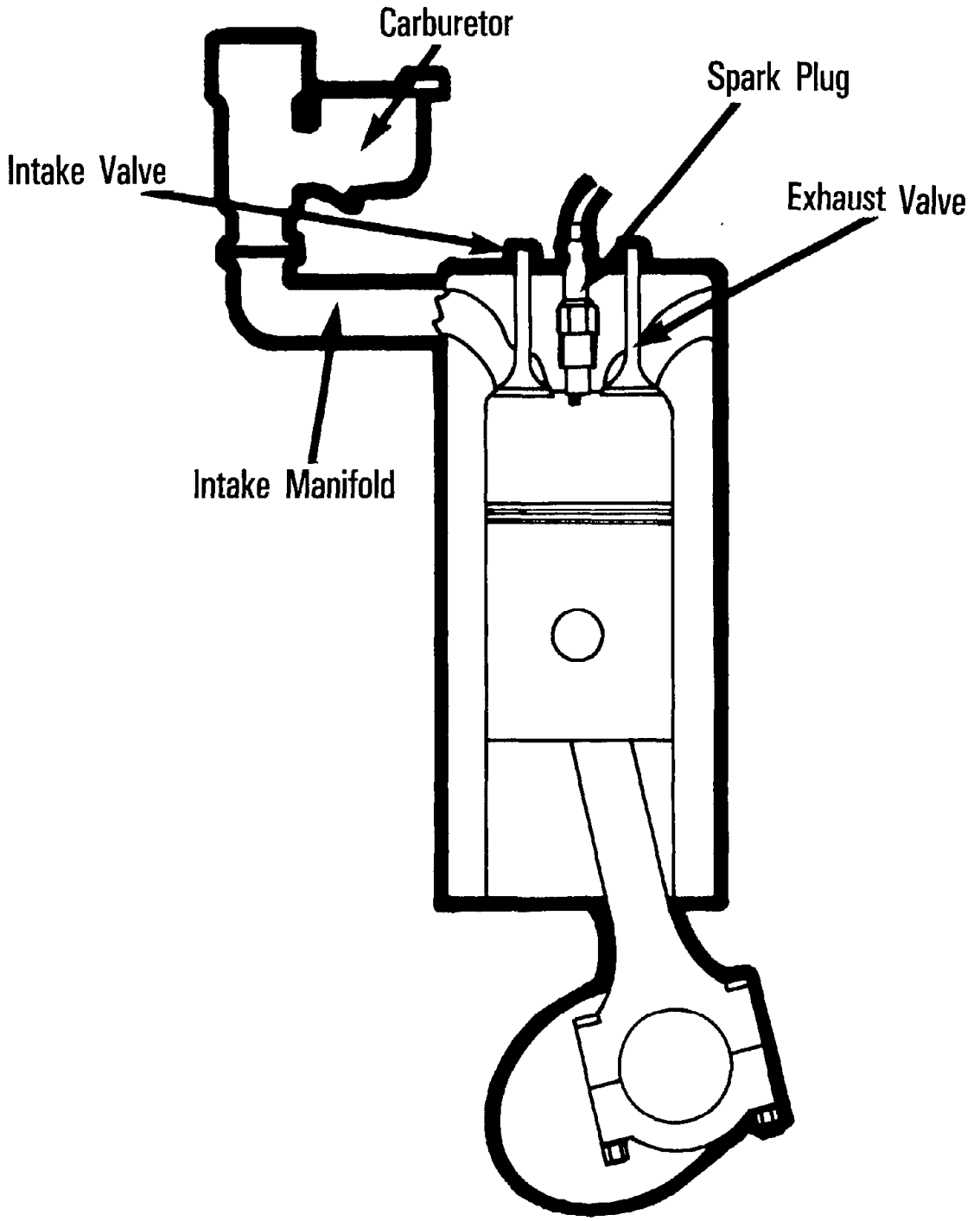
In the case of a diesel engine, it consists of the basic cylinder unit, intake and exhaust valves and, instead of a carburetor, there is an injector which is located where the spark plug was.

The cycle of the diesel engine begins with the intake valve open and the piston going down drawing in pure air, not air-fuel mixture. Then, the valve closes and the piston compresses the air into the small space at the top of the cylinder which makes it increasingly hotter. The air in the diesel engine is squeezed into such a small space that its temperature rises to 1,000 degrees or more. At about the same time, the injector squirts a drop of oil into this hot air, and the temperature is more than enough for it to ignite. Once ignited, the burning mixture expands like in the carburetor engine, but even more because it was compressed more compactly. The piston is pushed down, turning the crankshaft in what is, of course, the power stroke, Finally, the exhaust valve opens, the piston proceeds upwards, and the engine is ready for another cycle to begin,

**(SEE FIGURE B-7)**

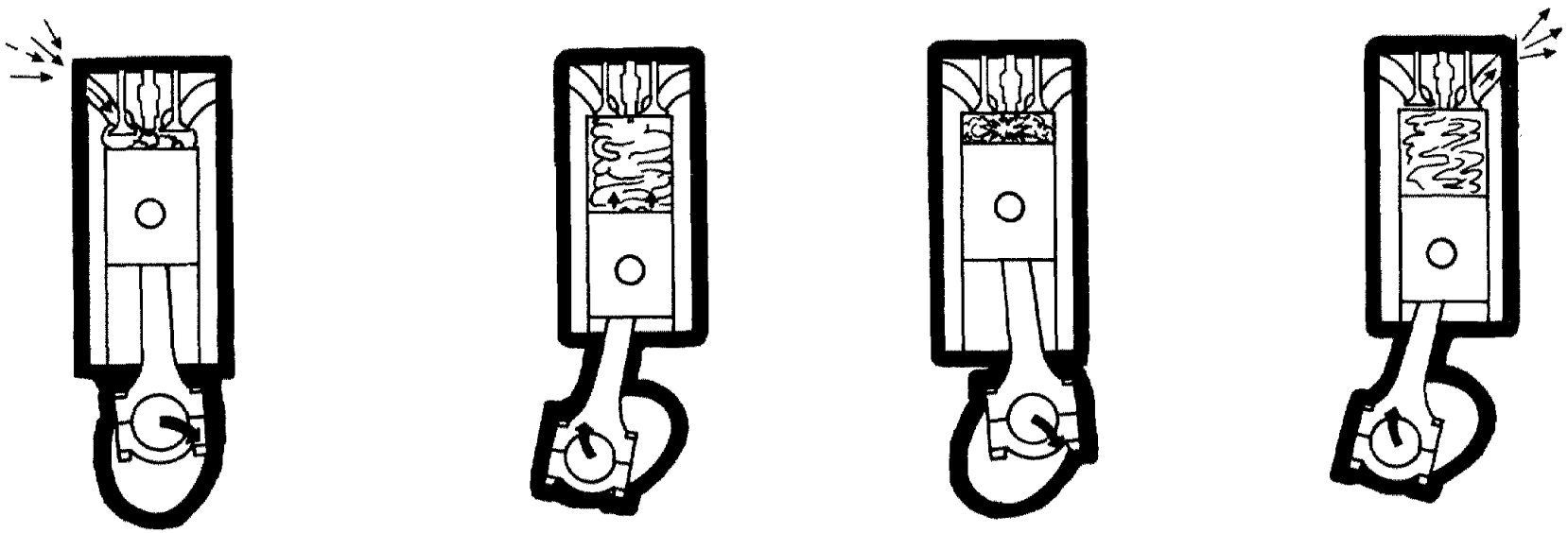
# *A Gasoline Engine Cylinder*

## Figure B-5



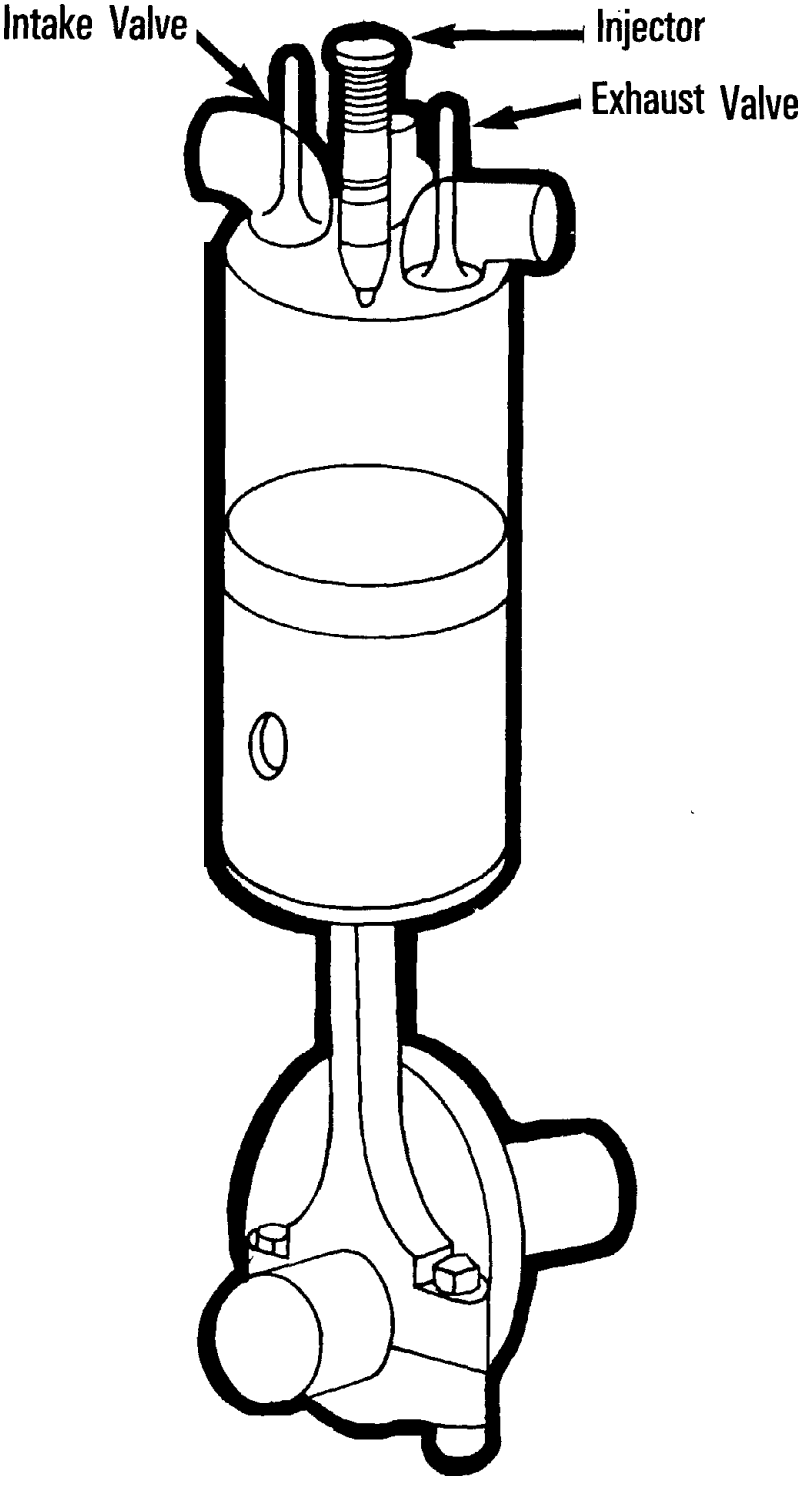
# *Four Cycle Gasoline Engine*

## Figure B-6



# *Diesel Engine Cylinder*

## Figure B-7



The differences between the diesel engine and the gasoline engine are clear, The gasoline engine has a carburetor and a spark plug; the diesel engine has an injector. Consequently, in the gasoline engine, the fuel and air are mixed before compression; in the diesel, afterwards. The compression pressure is much higher in the diesel engine, and there is not an electric ignition, but a compression ignition.

Hereafter, because most of the tractor engines are diesel, we are simply going to focus on diesel engines. You will begin to see, though, the importance of understanding the basic elements of all internal combustion engines.

## FUEL SYSTEM

The principal job of the fuel system of a diesel engine is to regulate the amount of fuel that is injected into the cylinder and precisely when it should be. The basic components are the injector, a tank containing fuel oil, and a pump which is driven by the engine to get the fuel to the injectors from the tank through the filtering system. Usually, the pump delivers more fuel than necessary; however, there is a return pipe to carry back the excess fuel. Shortly before the oil reaches the injector, a filter cleans it, and, because the oil can never be clean enough and dirt can be so destructive, thereisoften another filter between the tank and the pump.

**(SEE FIGURE C-1)**

### Injectors

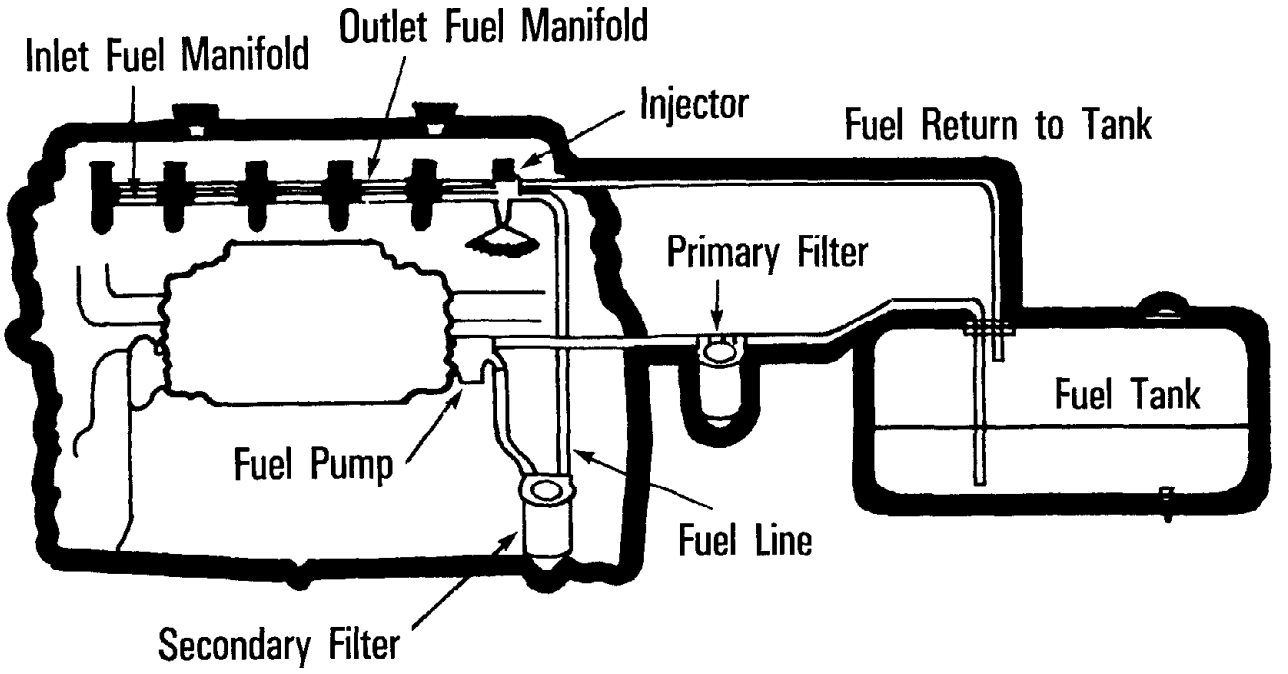
The most important part of the fuel system is the injector. Its functions are very similar to those of a carburetor. It must calculate the right amount of fuel, inject it into the cylinder under high pressure, atomize it, and break it up into a fine spray.

It accomplishes this in a piston-like manner, forcing a little oil under high pressure into the cylinder. The fuel enters this injector cylinder through a port in the side wall when the piston is at the top. The piston moves downward, compressing the fuel, and injecting it into the cylinder of the engine.

This, however, is not as simple as it seems. The amount of fuel to be delivered is not always the same because the engine itself delivers differing amounts of power. Additionally, in a truck's diesel engine, the greatest amount of fuel that is ever injected would be a drop about the size of the head of a kitchen match. The components governing this tiny volume of fuel, therefore, must be exceedingly accurate and well-fitted to each other. It is therefore absolutely critical

# *A Diesel Fuel System*

## Figure C-1



that diesel fuel be kept absolutely free of dirt or other contaminants. Even a small speck of dirt can ruin an injector. As you can guess, the injector is one of the more expensive components of the system.

(SEE FIGURE C-2)

## Fuel Tank

The fuel tank is a vented container in which the fuel is held. Often, on large trucks there are two "strapped" to the truck frame, one to a side; they are called "saddle" tanks. A single fuel tank can be secured at the rear between the frame on straight trucks. If additional fuel tanks are used, the outlets of the tanks are brought together with "Y" or "T" type connections. Roth valves should be open for the installations.

A constant pressure should be maintained in and around the tanks in order that no pressure or vacuum builds up in the tank. For this purpose, a vent hole is often situated in the filler pipe cap and, occasionally, at the very top of the tank.

It is important that you make sure the fuel cap area is kept clean at a17 times. As a precautionary measure, before you remove the fuel filter cap you should clear it and the neck of all dirt. Frequently, the fuel tank is located under the chassis and in a direct spray of dirt. If the area around the cap is not cleaned, much dirt can get into the fuel system and seriously hinder engine operation and/or cause severe damage.

## Fuel Filters

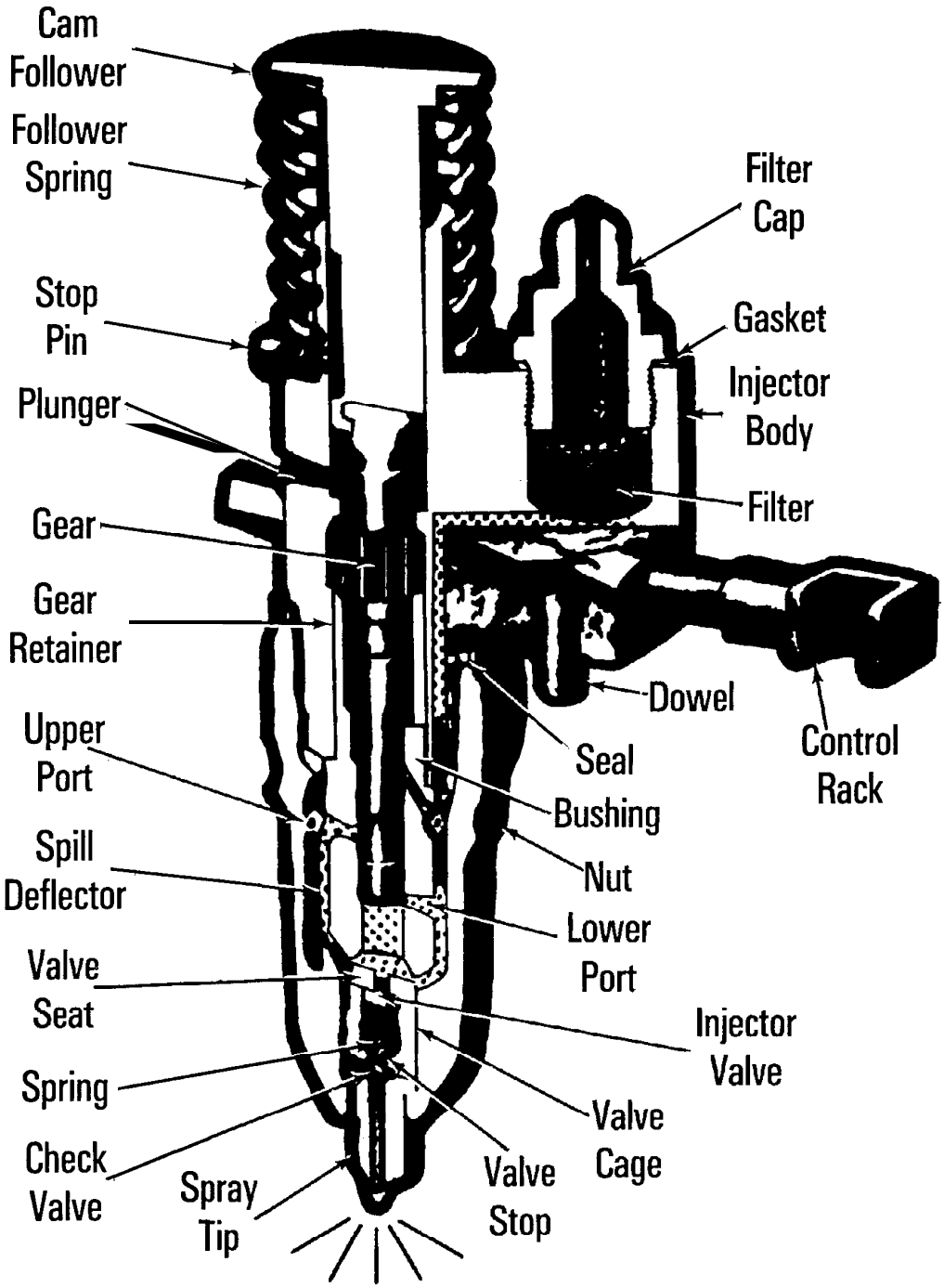
There are ordinarily two categories of fuel filters--the primary or auxiliary filter which is between the fuel tank and the transfer pump, and the secondary filter which is between the transfer pump and the injectors. Occasionally, there is a third or final stage filter which is placed between the secondary filter and the injectors.

The primary filter offers little restriction to the fuel flow, necessitated by the fact that it is situated on the suction side of the pump where the suction pressure is usually only five to six psi. This filter serves to protect the transfer pumps and reduces the load of the secondary filter, thereby lengthening its lifespan. It is very effective in removing waxes, gums, and resins without getting clogged itself,

The secondary filter, an the other hand, is relied upon to remove the fine particles of contaminant in the fluid, Since it is often the final filter before the injectors, it must provide full protection. However, since minimal amounts of contaminants reach the filter, seldom does it have to be changed.

# *Typical Fuel Injector*

## Figure C-2



## Fuel Filter/Water Separator

Another type of filter in the fuel system is the fuel filter/water separator. There are two stages in its operation. In the first stage or coalescer, solid particles are filtered out as the tiny droplets of water in the fuel are brought together, coalesced, to form large drops. The water separator, in the second stage, removes these drops from the fuel.

This process is absolutely necessary because water can seriously harm the fuel system. It can lead to rust and corrosion which damages the engine parts and get into the system from anything from climactic conditions to poor storage facilities and a faulty system design. The tiny droplets of water bring together contaminant particles to form a sticky film that can clog screens and nozzles, The filter assures that the carburetor and injectors are provided with clean dry fuel.

## Fuel Heaters

If you are driving your truck in cold weather zones, you should have your fuelsystem equipped with heaters. Many kinds are available: in-tank units heat the fuel in the tank; in-line units heat the fuel when it is going from the tank to the injector system; filter heaters heat the filters themselves which in turn heat the fuel as it passes through to the injection system. Under some circumstances, you may need all three for satisfactory results.

## Accelerator

The accelerator is a device located in the cab that you control to regulate the flow of fuel and hence the speed of your vehicle,

## Diesel Fuel

A definite advantage that diesel fuel has over gasoline from a safety standpoint is its low rate of giving off vapor. Thus, it does not normally create an explosive air-fuel mixture when accidently spilled or leaked. This can be very important, especially where the fire hazard is above the ordinary.

As in gasoline, there are many variations in diesel fuels, and you can get one to fit the specifications to avoid hard starting, imcomplete combustion, knocking, and other similar troubles.

fuel oils are classified from 1D to 4D, 1D being a high grade fuel with the lowest boiling point and fewest impurities. Kerosene is a common example of a high-grade 1D, fuel. It contributes minimally to the creating of harmful engine corrosion because of the fewer impurities. However, because of the lowerboilingtemperature, it does develop slightly less power than an equal amount of a 'low grade fuel. This is compensated for in maintenance costs.

The octane number is another method of discerning the quality of the fuel. It represents the amount of time the fuel takes to ignite the hot air in the combustion chamber of the cylinder after it has been injected. The faster ignition takes place, the higher the number is; the numbers generally range between 30 and 60. If the octane number is too low, difficult starting, engine knock, and puffs of white smoke from the exhaust may result. This is very often apparent during warm-up and light load operation. And if this is to continue, harmful deposits can gather in the combustion chamber. In cold weather, fuel with a high octane rating is often used so that it will ignite more dependably and more quickly.

### Waxing

An important responsibility in cold weather when using diesel fuel is taking care that wax crystals do not form. They make it difficult, and if the situation his progressed too far, impossible, to start and run a diesel powered unit. The higher the grade, the fewer crystals that will form, but even with 1D, the highest grade of fuel, it is not always the only protection you need.

The only way to eliminate wax crystals is to heat the fuel until they melt. If they are in the tank or in a filter, the tank or the filter has to be warmed, respectively. A filter heater, an in-line heater, an in-tank heater, or any combination of these, may be used depending on the severity of the weather conditions. Cold weather should never hinder your progress with a little care and forethought concerning the condition of your fuel.

## AIR INTAKE AND EXHAUST SYSTEMS

The air intake and exhaust system is another vital element of the diesel engine. The volume of air needed is immense, and it is mandatory that fresh air be readily accessible and disposable through the passages of the air system.

### Operation of System

The air intake system processes and delivers fresh air to the cylinders. Fresh air enters through the bonnet which is a cover protecting against the rain and debris that would enter the snorkel, an extension pipe for the air cleaner. The air cleaner removes dirt, dust and water from the fresh air, assuring as pure air as possible for the combustion chambers. There are two types of air cleaners: oil bath (wet type) and disposable cartridge (dry type). If the engine is to operate efficiently, it is essential that you keep these air cleaners clean. Extra care should be taken if it is extremely dusty or rainy, and it should be examined daily. Otherwise, it should just be checked fairly often.

After the air is cleaned it proceeds to the air intake distributing manifold. Here, it is distributed to the cylinders in small quantities for injection. The air then goes through the air intake ports which are connecting passages to the intake valves. These regulate the amount of air that enters the combustion chambers of the cylinder just before the piston begins its compression stroke.

**(SEE FIGURE D-1)**

After combustion has taken place, the exhaust system activates. The exhaust valves open in the exhaust stroke of the piston and the burned gases are discharged. The gases then go through the exhaust ports or connecting passages to the exhaust manifold where the gases are collected. They then proceed to the exhaust pipe and subsequently to the muffler which mutes the noise produced by the exhaust. The gases are finally discharged through a stack or tail pipe. The stack is vertically mounted and the tail pipe is horizontally mounted. On vertical exhaust types, the end is covered with a rain cap which opens when the engine is giving off exhaust and closes when the engine stops in order to prevent rain from getting in.

**(SEE FIGURE D-2)**

## Turbochargers

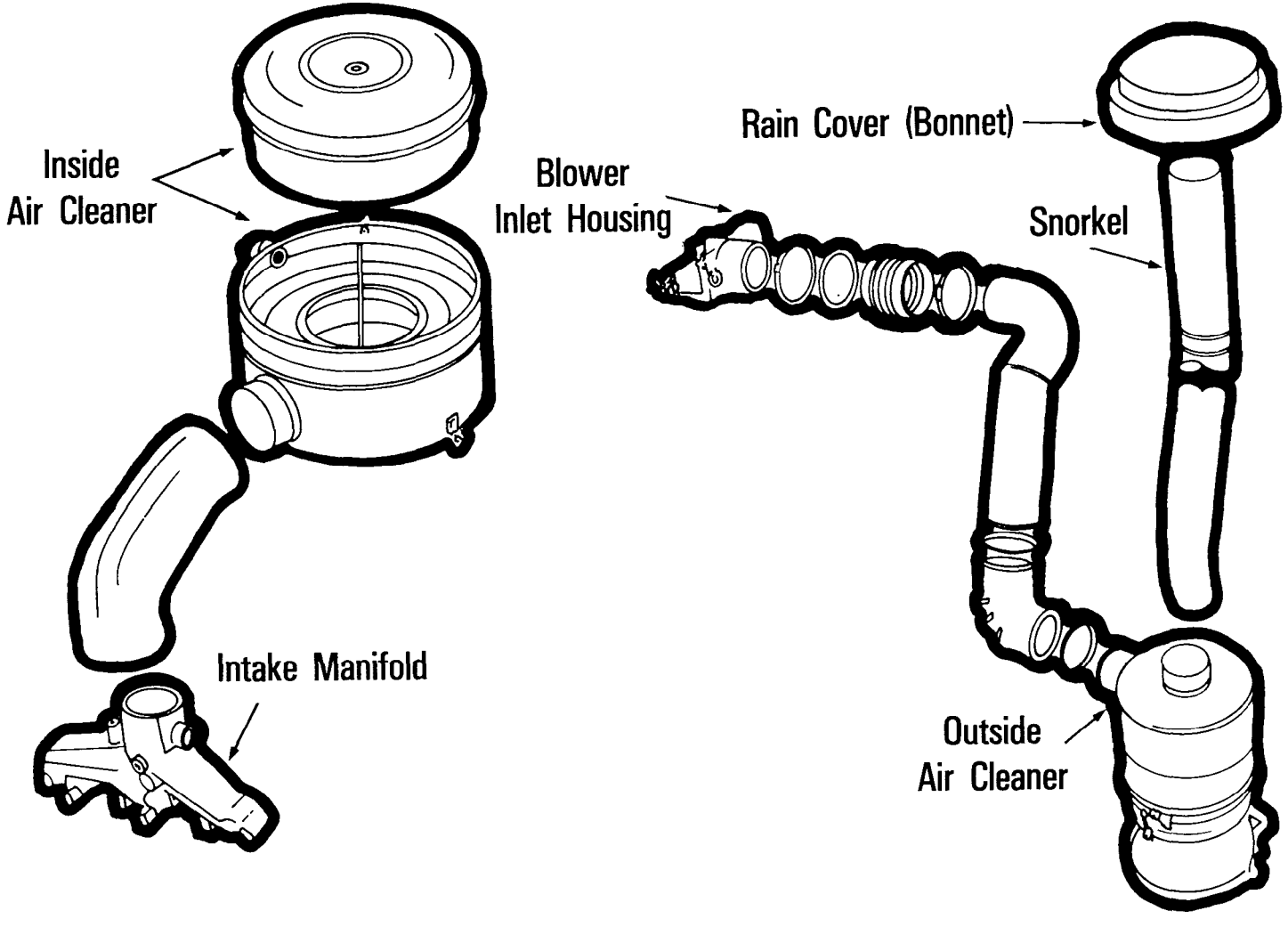
The turbocharger converts the power it gets from the exhaust gases into power that can be used by the engine. The heat of the gases drives the turbine of the turbocharger, rotating its blades. When this happens, the wheel and shaft of the turbine start turning, thereby turning the impeller which is a fan-like component of the turbocharger Air is drawn into the impeller side of the turbocharger and then squeezed from the turbine side of the turbocharger into the intake manifold and the cylinders of the engine.

The additional air flow contributes greatly to the power from the combustion chamber. With the increase of air, a larger fuel charge can be burned without changing the capacity of the engine. More power is created from simply employing the exhaust gases that were going to be discarded otherwise.

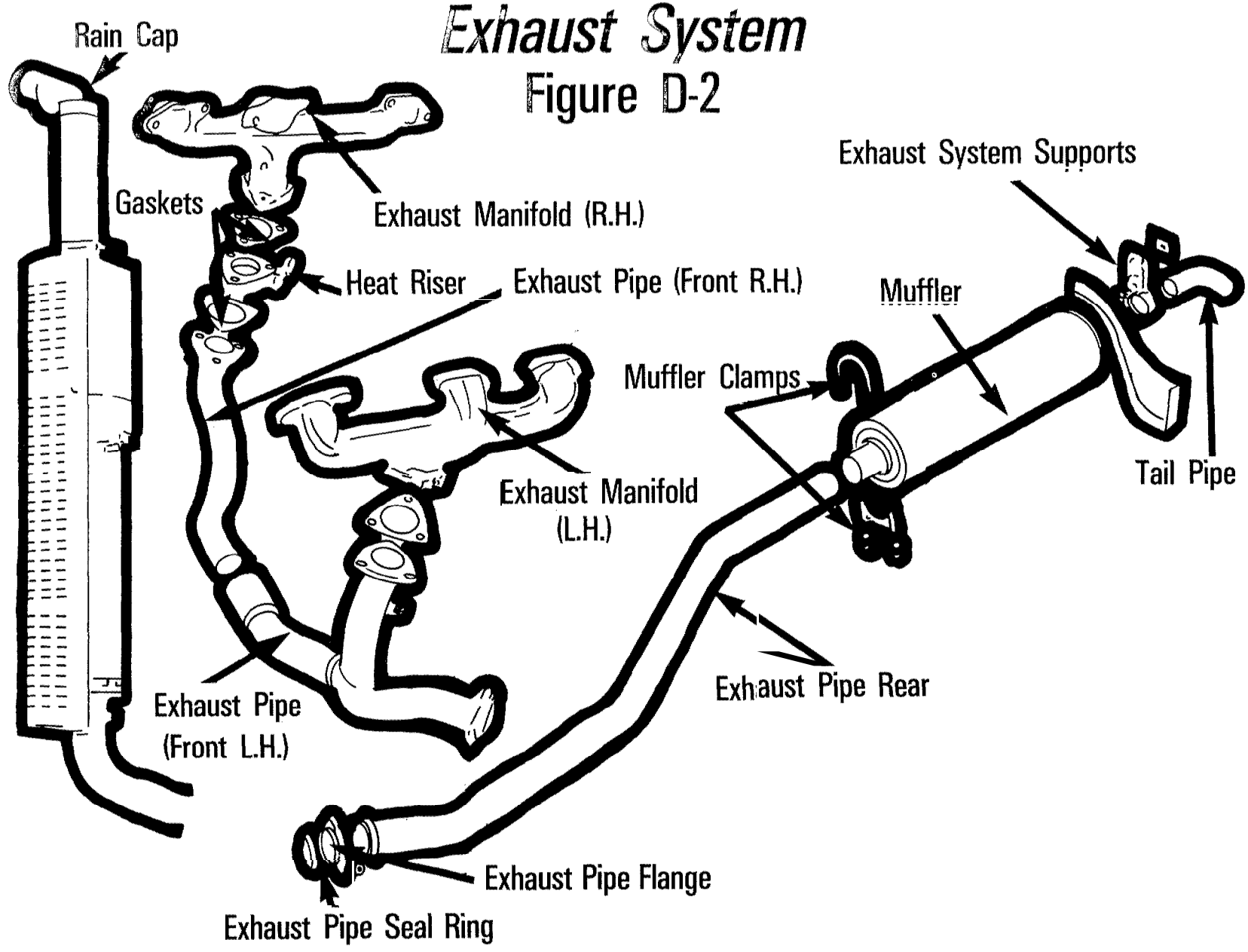
A supercharger is similar to a turbocharger in that it creates an increased air flow into the combustion chamber. However, it is run with the power of the gear train, not the exhaust gases. Superchargers are seldom seen on today's diesels.

# *Air Intake System*

## Figure D-1



# *Exhaust System*
## Figure D-2



## Aftercoolers

You may hear an aftercooler referred to as an intercooler or a thermal cooler, but they all accomplish the same task: cool the intake air from the turbocharger. The engine radiator cools the engine air in the same manner, only it is much larger than the one used as an aftercooler.

The intake air that is drawn into the turbocharger is heated to very high temperatures by the exhaust gases. In order to reduce the danger, the air is sent through this small radiator surrounded by tubes of engine water. This cooling system dissipates the heat of the intake air and returns it to a safe temperature level.

## Pyrometer

The pyrometer is an instrument that measures the temperature of the exhaust gases. This is to assure that it never gets too high. Dangerous temperatures, though, vary from vehicle to vehicle. It can be from 600" - 1,100°F, and you must know your own truck's normal operating temperature. The temperature is registered on the pyrometer gauge on the instrument panel.

Special care must be taken that the temperature does not rise to a dangerous level, especially when you are on mountain roads or long sloping grades. If the temperature of the exhaust gases gets too high, the turbo is likely to overheat. The temperature registered on the pyrometer gauge can be affected by many factors within the engine, for example, where it is placed and the length of the wire that is connected from the sensor to the gauge on the panel.

# LUBRICATION SYSTEM

The lubrication system has been developed to reduce the friction in the workings of the engine. This is important for many reasons as you will see directly.

## Functions of the Lubrication System

The first and foremost purpose of the lubrication system is to distribute oil in order to eliminate friction and wear between the surfaces moving together. This guarantees a greater efficiency and less deterioration in the working parts.

Oil, in its proper state, forms a film between the moving parts, so that instead of having them in direct contact, they ride on the oil. Thus, from the moving back and forth, heat is created and rather than warming up the components, it is absorbed into the oil.

And this leads us to the second function of oil. Since the oil is perpetually circulating throughout the engine, it is able to aid in cooling it, After it goes through the engine, it is cooled off and the heat dissipates. Therefore, when it starts through the engine again, it can absorb more heat, thereby keeping the components a relatively constant temperature.

Another purpose of oil is to aid in cleaning the engine. As the oil proceeds through the engine, it collects bits of carbon, dirt, and metal and carries them through to an oil pan where the larger pieces settle out and the smaller ones filtered.

Sealing parts of the engine with oil is essential. Between the piston and cylinder wall, the oil assures there will not be a loss of pressure in the combustion chamber. The combustion gases must be kept from escaping and causing loss of power.

The oil also protects the parts from corrosion, excessive wear, and rust. It helps to minimize the corrosion from chemicals that can destroy bearing surfaces. Oil can also coat surfaces that are not even moving to protect them from rust that can accummulate.

Finally, ail in the engine absorbs shocks, It forms a cushion between surfaces that are vulnerable to shocks. For example, each time ignition of the air in the combustion chember takes place, a sudden force hits the piston which, in turn, transmits it through the connecting rod to the crank pin, It absorbs the shock as well as reducing noise and wear,

## Operation of Lubrication System

Underneath the crankshaft of the engine there is a pan that is called the oil pan, from there oil is pumped to all of the crucial pressure and friction points of the engine. Some particularly important points are the crankshaft bearings, or main bearings as they are often called. These are the inserts between the crankshaft and the crankcase. Another important point that has crankshaft bearings is where the connecting rod is connected to the crankshaft.

From the main bearings the oil goes through passages in the crankshaft to the connecting rod bearings. Occasionally, in the connecting rod, there is a full length passage in which the oil, still under pressure, feeds upwards to the piston pin. The oil is, in a fen engines, scooped from the oil pan to the connecting rod bearings.

Oil is not pumped directly to some other parts of the engine because they can receive it by the "splash" method. Between the cylinder wall and the piston is an example. The bearings and many of the moving parts of the engine throw off oil, and with the constant motion a fine mist fills the air. All of the parts that are not along the path of the pressure system are able to get their oil in this manner.

In addition to the oil pan many fleets use oil make-up reservoir systems on their vehicles. The system allows the oil to be added to the crankcase when the oil level is low. The oil is transferred from the make-up reservoir to the crankcase automatically.

This system has many benefits:

- Engine is never operating when oil level is low.
- The oil never has to be added under unsanitary conditions.
- Oil does not have to be purchased en route by the quart at truck stop prices (spare oil is carried with you).
- Fleets using custom blended oils do not have to worry about contamination from "non-spec" oils.

## Oil

Many consideration should be taken as to which oil is used for lubrication. There are many different types and you should understand which is best for your engine. First, all oil, like fuel, is graded. The higher the number of the grade the more resistant to flow or the heavier the oil is.

Another factor of the oil to be borne in mind is its additives. Additives have been developed in order to prevent or retard corrosion of the bearings and formation of sludge and deposits on the engine. They are called detergents; a fixed amount of dirt and foreign matter becomes suspended in the oil and then it must be cleaned out and new oil put in. You must make sure the oil is changed because, otherwise, it will not be effective, and this can be extremely detrimental to the engine wear.

Additionally, you should never mix types or brands of oil containing additives. Therefore, when you do change the oil it is very important that you make sure the engine is well drained. Especially when you are changing from a straight mineral oil or an oil without additives to a heavy duty detergent oil should you pay attention to the draining, flushing, and cleaning of the old oil. The oil manufacturers can provide you with the proper instructions for these procedures.

Also you cannot determine the quality or the condition of the oil by feeling it in your fingers or judging its color. You must simply rely upon the manufacturer's recommendations for mileage, and this should be followed closely.

## Oil Filter Systems

Aside from using oil with additives, a method of prolonging the life of the oil and therefore the life of the engine is with oil filters. They remove contaminants as the oil passes through the system.

### Full Flow Systems

In the full flow oil filtration system all of the oil that leaves the oil pump heading for the main bearings and other points of lubrication passes through the oil filter. These low-restriction filters operate under the single-pass method. This means that all of the contaminants, dirt and floating bodies must be filtered out in one trip through a filter. It must be pointed out, though, that since this one filter is responsible for all of the floating material, it is very 'likely to become clogged. This restriction of oil could be very damaging to the engine, so a valve is provided that opens under these conditions. Although the contaminants could also be damaging to the engine, it is believed they are better than burning out the bearings by oil deprivation.

## Bypass System

The bypass or part-flow oil filtration system filters a minimal amount (about 10 percent) of the oil flow. It is usually used in addition to the full flow system. It filters the excess oil that is normally returned to the oil pan without going through the bearings. The flow of oil in the bypass filter is regulated through an opening.

### Combination Bypass/Full Flow System

This is the most preferred system of filtration. The combination provides the thoroughness of the full flow system plus the added protection of the bypass system. This assures a longer life for the oil and the individual filters, thereby reducing operating costs and risk of contamination. The procedures for the two systems together are the same as when they are apart. The oil of the full flow filter goes to the bearings, and that of the bypass filter returns to the oil pan.

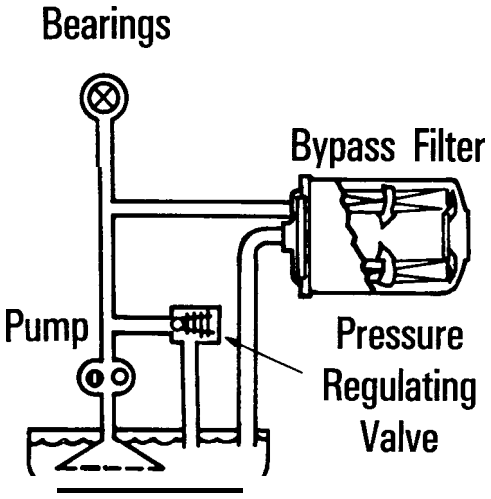
**(SEE FIGURE E-1)**

## COOLING SYSTEMS

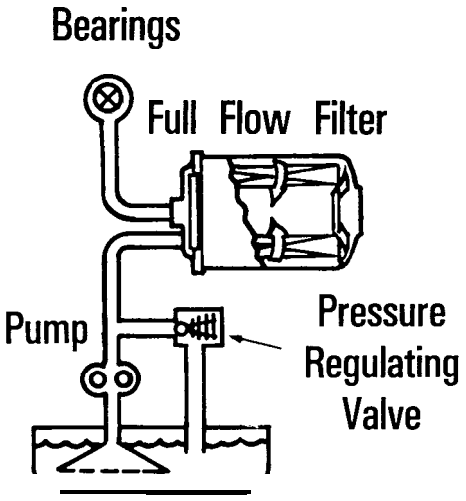
As heat is the basis of the internal combustion engine and the intense heat of the diesel engine can melt the iron components, you must have something to control it. Therefore, a cooling system was developed that dissipates heat fast enough so that it does not damage the engine.

# *Oil Filter Systems*

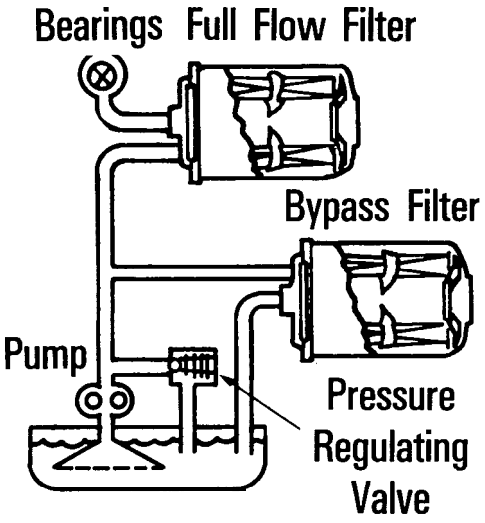
## Figure E-1




Full Flow Lube Oil System




Bypass Lube Oil System




Combination
Lube Oil System

## The Basic Procedure

The engine is cooled by the water right in the block and cylinder head. Passages surround the piston in the walls of the cylinder and other places that get very hot. The water jacket is the collection of passages around the cylinder. Water passes through the water jacket, accumulating more heat as it goes, to the radiator. Here, it flows down through small tubes that are surrounded by air pulled through from the outside by a fan and the motion of the truck. The water cools down and then proceeds back to the pump and through the engine again.

(SEE FIGURE F-1)

## Fluid Recommendations

One thing you should be careful about, though, is the water you use. The cooling system can become damaged if the water has too high a pH or harmful metallic, organic and inorganic contents.

You should have an antifreeze or a year-round coolant. Effective anifreeze comes in many different forms. Some of the optional solutions are methanol (methy-alcohol), ethanol (ethyl-alcohol), and etylene-glycol. You should be careful, though, in the selection of your coolant or antifreeze-- not all of them can be used with a cooling system filter.

Most fleets do operate with a year-round antifreeze or water coolant mixture. How much antifreeze you should put in the radiator depends, though, on the amount of water in the system and the temperature of the outside air. This can be determined specifically for your vehicle by a mechanic.

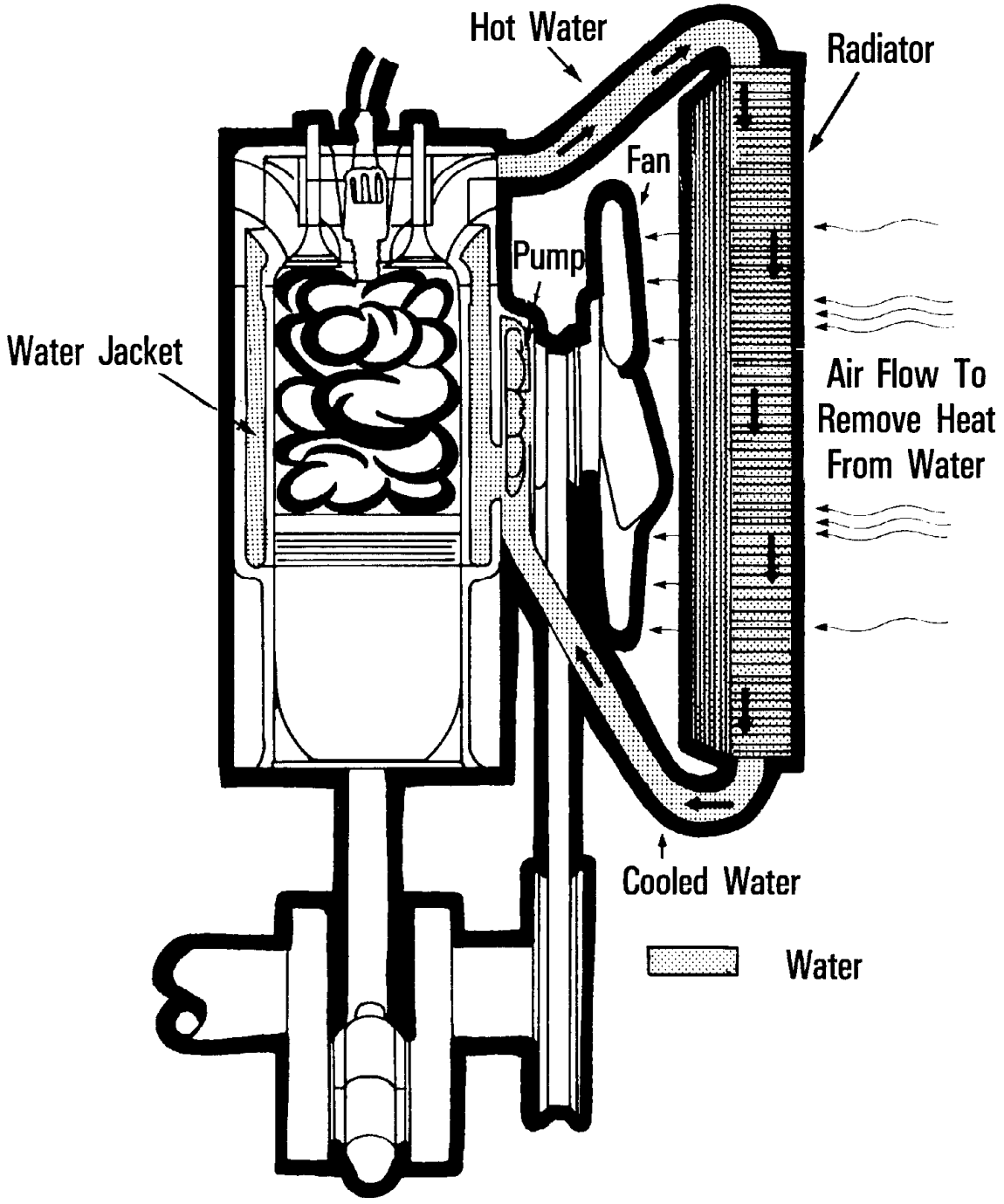
In view of the fact that the cooling system is a closed system, it is absolutely necessary that you keep it full and that you promptly repair all leaks.

## Cooling System Filters, Conditioners and Inhibitors

There are two basic types of cooling system filters: filters with and filters without chemicals. Chemicals are needed in addition to the filtration in order to stabilize or neutralize the system. If chemicals are included with the filter then they release automatically, preventing deterioration in the components. Otherwise, for it to be effective, you should add a liquid treatment yourself.

# *Flow of Coolant*

## Figure F-1



## Components

### Radiator

As you have seen, the purpose of the radiator is to cool the hot water from the engine. It is designed to be able to hold much water in tubes or other passages while exposing as much as possible to the atmosphere. The passages are spread through the radiator, connected at the top to a receiving tank and at the bottom to a dispensing tank.

The water is pumped from the engine to the receiving tank. There it goes through the tubes in the radiator into the dispensing tank and back to the engine.

It is mandatory that you have a cap on your radiator. This is to ensure that the water is free of foreign meter and at the correct pressure. The higher the pressure of the water, the higher the temperature to which the radiator can be raised without boiling. One pound of pressure raises the boiling point 3 degrees. From this you can see there would be fewer overheating problems in mountain operations with highly pressurized water.

### Water Pump

The water pump circulates the water from the radiator through the water jackets and back to the radiator. Most water pumps used in trucks are the centrifugal type. They are rotating fans or impeller. The positive displacement type which uses gears or plungers is seldom used anymore.

### Cooling Fan

The fan is constructed to pull cooling air through the radiator, around the tubes of water. This is of greatest importance at slow speeds or when the engine is idling because the truck is not moving fast enough to provide adequate circulation.

For your protection and for further concentration of the force of the fan, shrouding is often provided. This covers the circumference of the fan, directing the air in.

### Thermostats

In order to maintain the most efficiently operated engine, it is best that the temperature remain fairly constant. For that purpose, a thermostat is placed in the cooling system. The thermostat regulates the flow of water from the engine to the optimal radiator, so the engine can reach the operating temperature. When the water is cold in the engine, the thermostat shuts off a valve, stopping the flow of water to the radiator; then, as the water heats up, the coil expands, opening the valve to permit the water to enter the radiator. In this manner, the thermostatically controlled valve maintains a nearly constant temperature.

# ELECTRICAL SYSTEM

The electrical system is definitely the most comprehensive and complex system in a truck, for it covers everything from the batteries to the lights. There are five basic systems within a truck's electrical system. They are the charging circuit, the cranking circuit, the ignition circuit, and lighting and accessory systems (which include the lighting, instruments, horn and windshield wiper circuits).

## Charging System

The charging system generates electricity to recharge the battery and run the other electrical circuits. The components of the charging system include the battery, alternator (generator), voltage regulator, ammeter, wiring and the truck frame.

## (SEE FIGURE G-1)

### Battery

The battery (also known as a storage battery) collects the electrical energy and converts it checmical energy, thus in effect storing it for use as needed. Usually this is when you are starting or when the generator is not running at a chargeable speed. Also, if you are using many accessories and there is an overload, the battery will assist temporarily with additional electrical energy.

The battery has two posts, a positive post and a negative post, through which the electrical impulses flow. One post and each piece of electrical equipment is attached to the frame of the truck. The impulse goes from the positive post through the electrical equipment, to the frame, and back through the negative post of the battery.

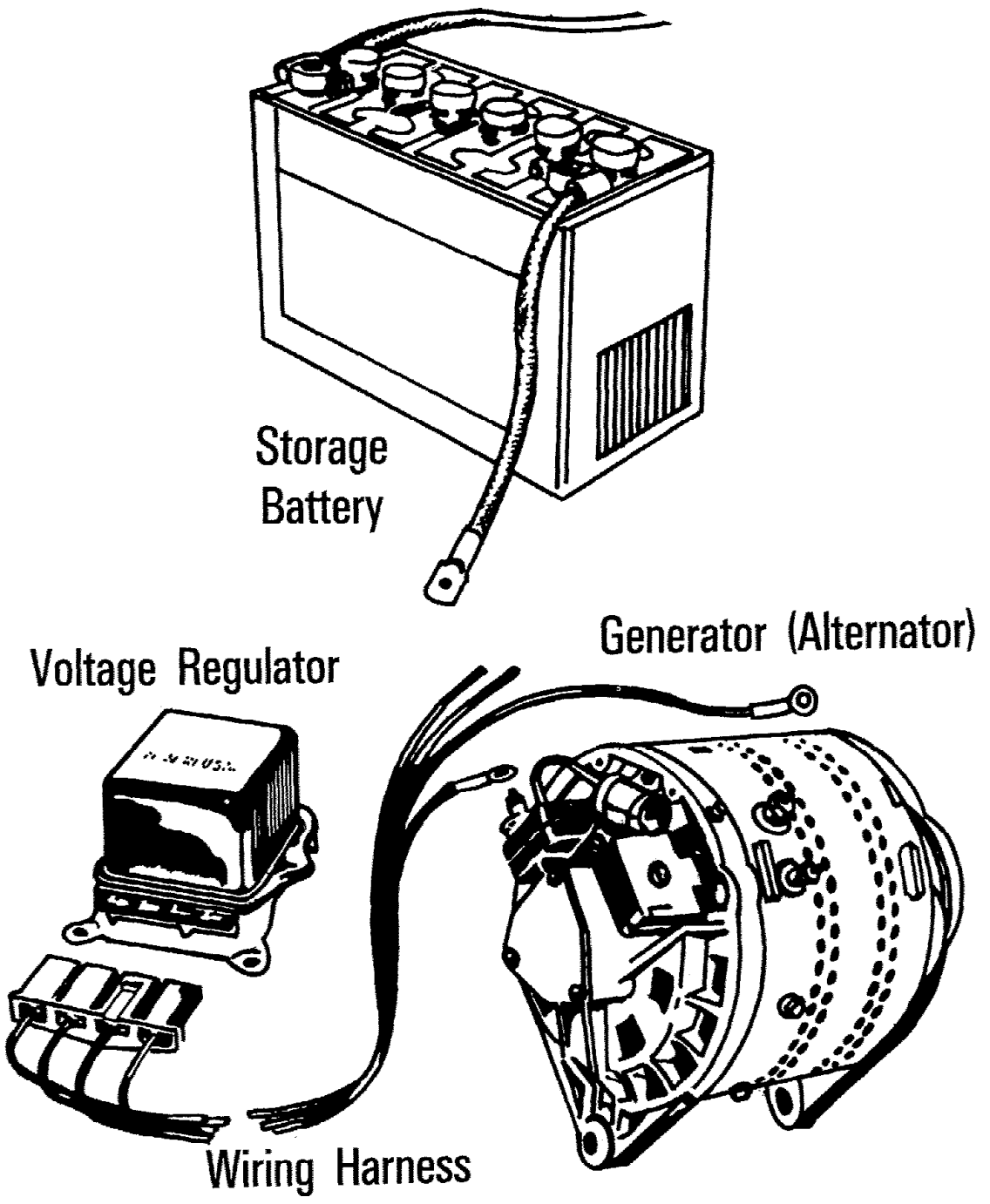
### Generators and Alternators

The battery can be charged by either an alternator, ot a generator. A generator of electricity in a truck converts the mechanical energy from the operating engine into electrical energy to be stored in the battery. Additionally, it supplies electrical power to the ignition system and accessory equipment.

The battery has two posts, a positive post and a negative post, through which the electrical impulses flow. One post and each piece of electrical equipment is attached to the frame of the truck. The impulse goes from the positive post through the electrical equipment, to the frame, and back through the negative post of the battery.

# *Charging System*

## Figure G-1



Generators and Alternators

The generators produce an alternating current (AC) which must then be converted to a direct current (DC). This is necessary in order to provide the correct current for use by the battery and the various electrical systems and acessories that use direct current. In an alternating current generator, otherwise known as an alternator, rectifiers (the converting components) are made which restrict the flow of the current to one direction. This results in the direct current that can be of use in the electrical system.

The generators produce an alternating current (AC) which must then be converted to a direct current (DC). This is necessary in order to provide the correct current for use by the battery and the various electrical systems and acessories that use direct current. In an alternating current generator, otherwise known as an alternator, rectifiers (the converting components) are made which restrict the flow of the current to one direction. This results in the direct current that can be of use in the electrical system.

Voltage Regulators

The voltage regulators control the rate of charge. As the batteries are charged to their maximum capacities, the regulator decreases the charging rate, so the battery is not overcharged and the water is not boiled off.

Instruments

There are two instruments which monitor the operation of the electrical system, the ammeter and the voltmeter. The ammeter is a device that registers the current output of the alternator. The ammeter gauge indicates whether the alternator is charging the battery or not. The voltmeter is a device that registers the voltage at which the electrical system is operating.

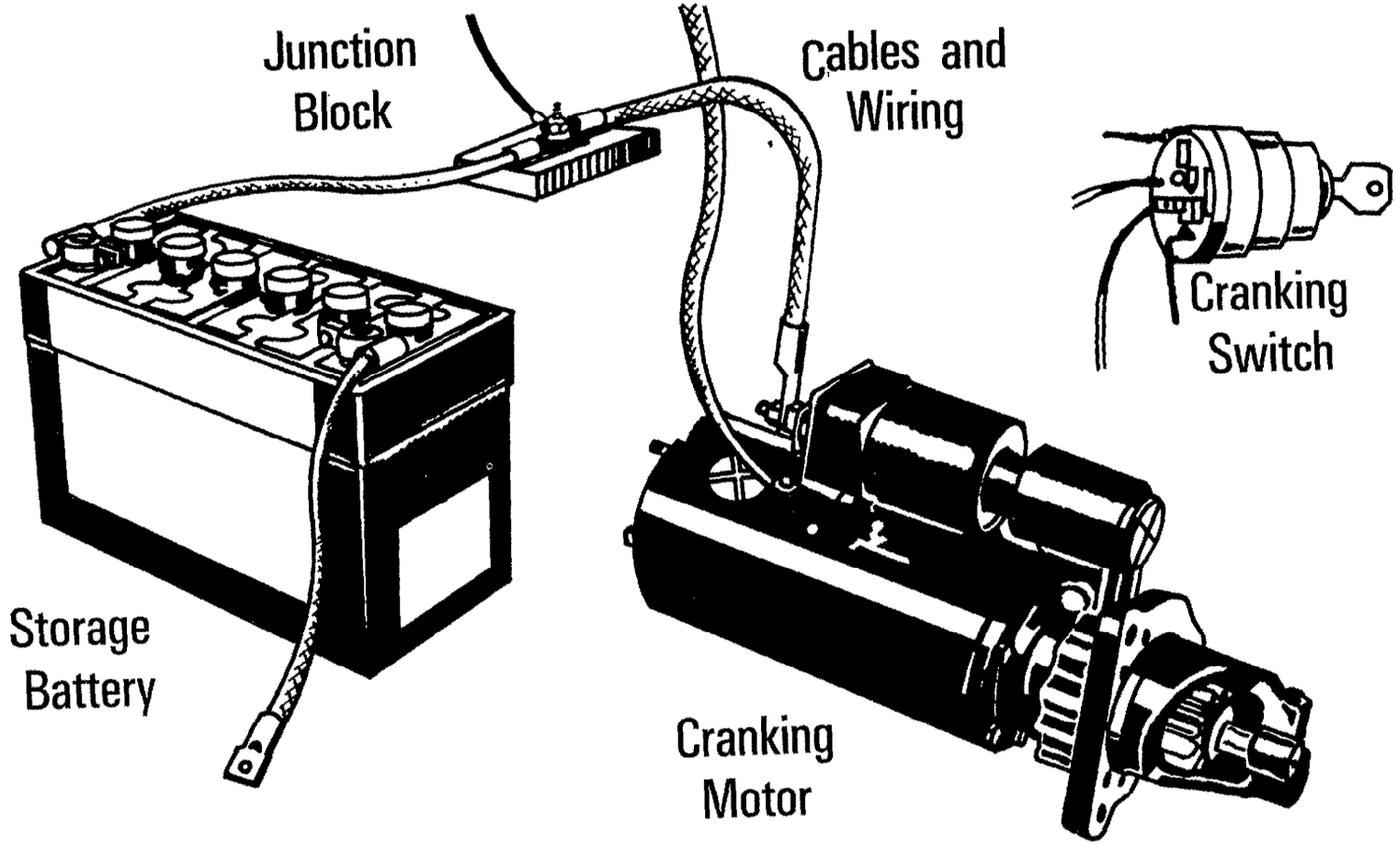
## Cranking System

The cranking system is made up of the parts that are necessary to start the engine. The battery delivers energy to the cranking motor which must, in turn, crank the engine. The current is directed through the starter solenoid and then to the starter from the battery by the ignition switch. On the way, the starter solenoid increases the magnitude of the voltage. On the starter, a system has been developed that engages it with the engine flywheel. When there has been a sufficient amount of energy generated for the engine to run on its own, it is disengaged.

**(SEE FIGURE G-2)**

# *Cranking System*

## Figure G-2



## Ignition System

The ignition system is the electrical circuit in a gasoline engine that ignites the fuel mixtures in the combustion chambers of the cylinders at various times. The electricity originates in the battery, and the ignition switch either breaks or opens up the current in the circuit to stop or start the engine.

When the circuit is opened up, a 12-volt current travels to the coil which is a very dense coil of tightly bound wire. Here the voltage is changed to about 20,000 volts, and the current flows to the ignition distributor. This serves, as its name indicates, to distribute the voltage to the numerous spark plugs of the engine. The cam lode, a timing device within the distributor, controls when the braker points and condenser operate to send a flow of electricity to the spark plugs. The braker points actually initiate the flow; however, the condenser is reserve system that regulates the amount that does go. Thus, with a combined effort of all the ignition systems components, the fuel in the combustion chamber of each cylinder is ignited by a spark just when the piston reaches the top of its compression stroke.

This system, however, applies only to gasoline engines, for in a diesel engine a spark is not needed to ignite its fuel air mixture. The mixture is ignited by the high heat of the compressed air in the cylinders combined with the small droplet of fuel from the injector.

**(SEE FIGURE** G-3)

## The Lighting and Accessory System

The lighting and accessory systems include all of the lighting, horn, instrument and windshield wiper circuits which deliver electricity to their various components. The lighting system includes the following: headlamps, turn signal lamps, marker lamps, tail and stop lamps, turn signal switch, clearance lamp, and dimmer switch. The instrument circuit is responsible for all of the lighting of the gauges and dash instruments. The horn and the windshield wiper circuits provide the electricity for the operation of the horn and the windshield wipers and washer, respectively.

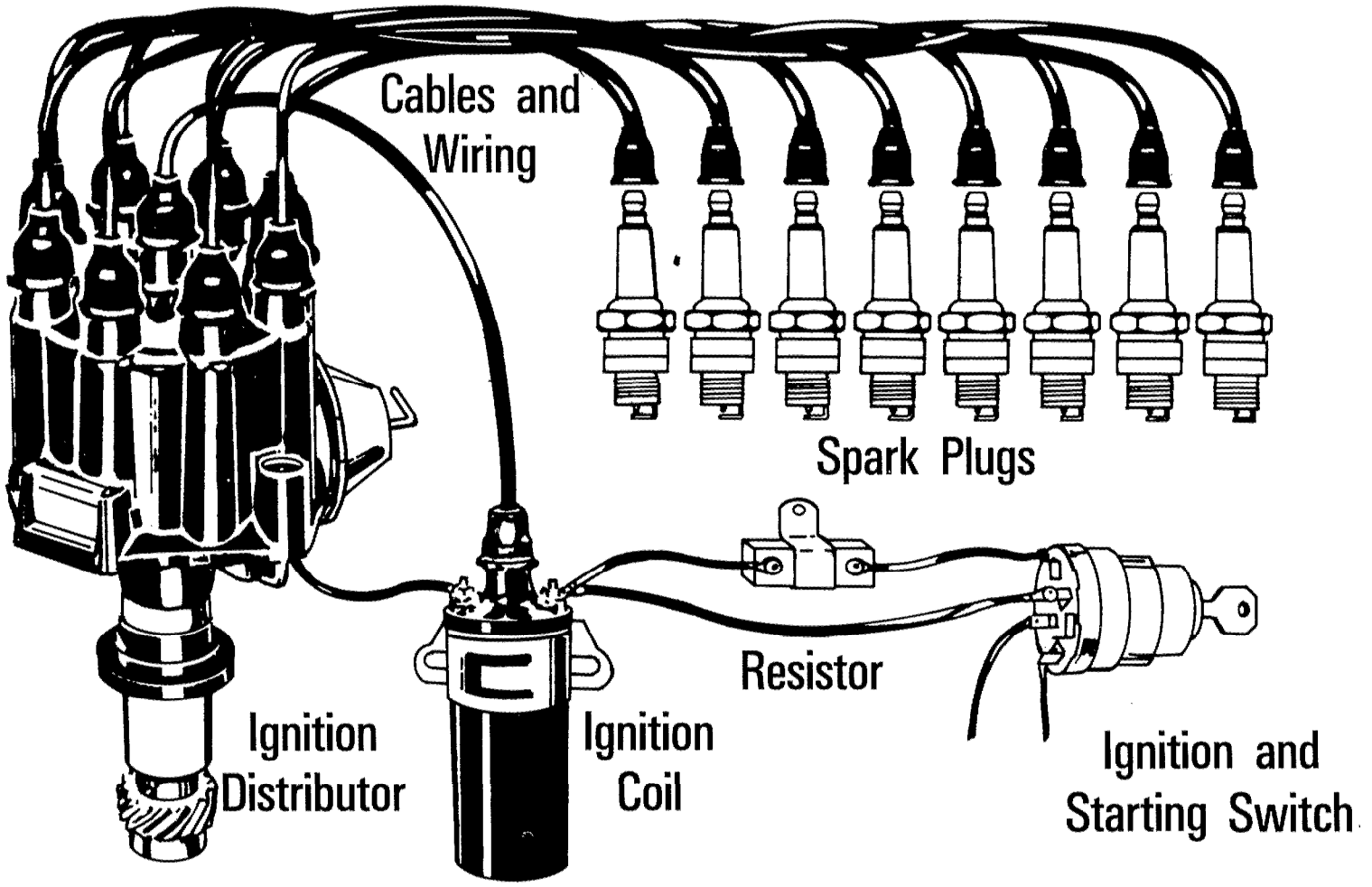
(SEE FIGURE G-4)

## DRIVE TRAIN

A power drive train system is made up of five essential parts. These parts, from the engine to the drive wheels, are the clutch, transmission, drive shaft, universal joints and rear axle differential.

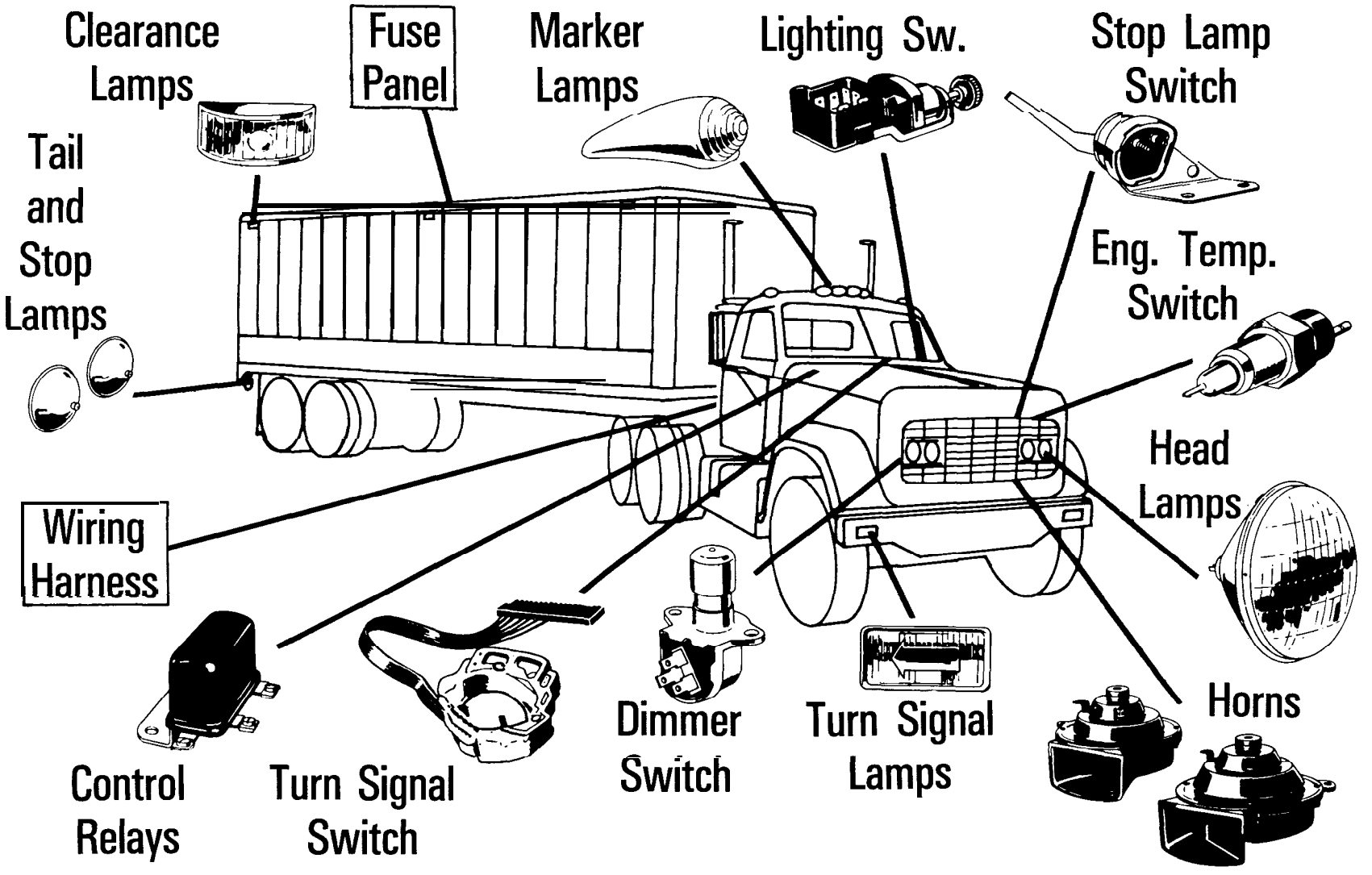
# (Gasoline) Ignition System

## Figure G-3



# *Lighting and Auxiliary Systems*

## Figure G-4



These parts must do three basic things:

- o Transmit power developed by the engine to the rear axle and drive wheels.
- o This power in the form of torque or twist must then be faced in the proper direction.
- o Finally the power generated by the engine must be varied between torque and speed for the vehicle to run efficiently.

The functions of the drive train will be covered in more detail as we discuss the drive train components.

**(SEE FIGURE H-1)**

## Clutch

Starting from the engine the first thing we come to is the clutch. Its job is to disconnect the engine from the power transmission system when the driver so desires. In most trucks the clutch consists of one plate squeezed tightly betyween two other plates. The one in the middle is the driven member (clutch disk); it is connected to the shaft leading back into the transmission. The other two are the driving members; they are connected directly to the engine. A strong spring, or springs, force(s) the two driving members together. This tightens their grip on the middle plate until they all turn together as one unit,

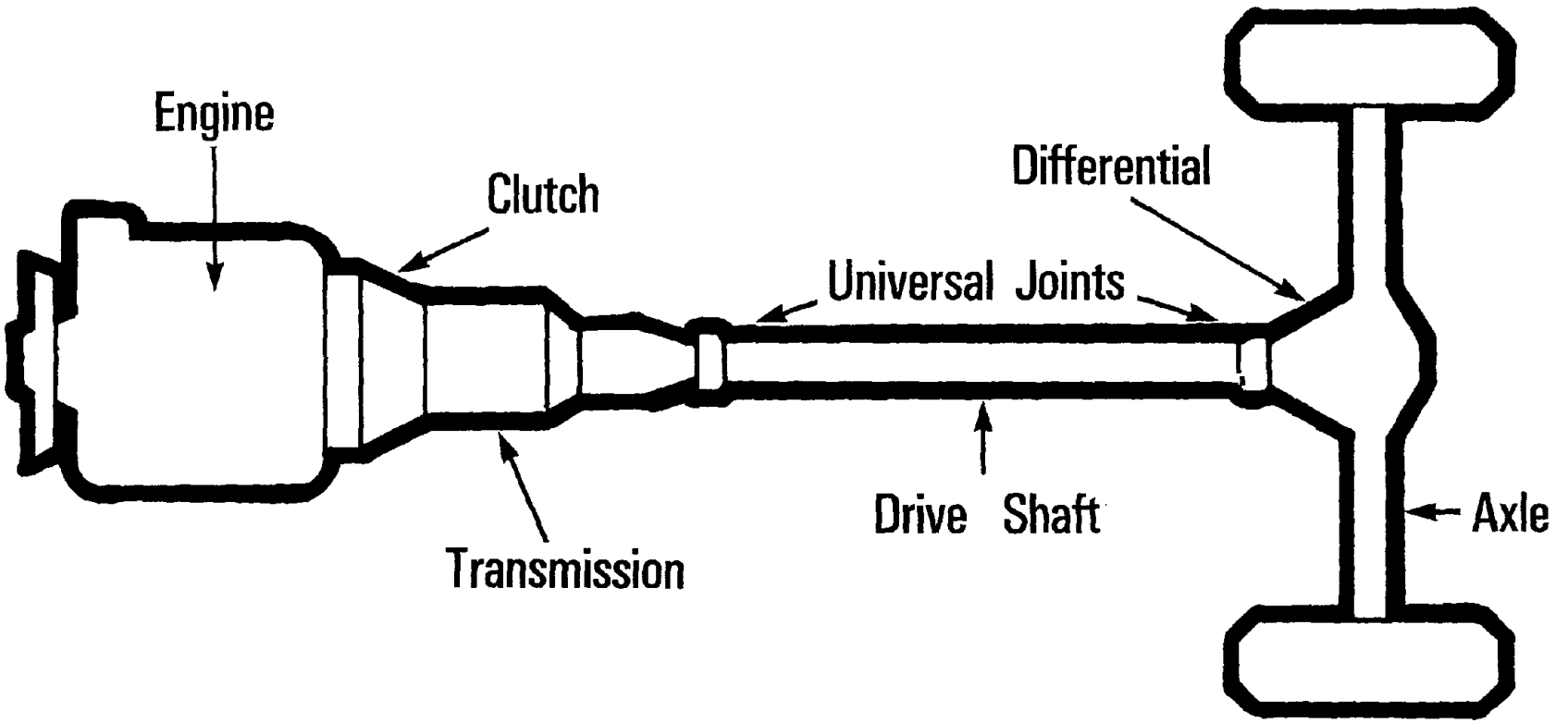
The engine flywheel is used for the first driving member. Its surface is made very smooth where the driven plate pushes up against it,

The other driving member is called the pressure plate. It is a fairly heavy ring of cast iron, smooth on one side. It is fastened to the cover, which is bolted to the flywheel, so they a71 turn together, It is fastened in such a way that it can slide back and forth.

The driven plate is a flat disk of steel with friction facing on each side. The plate is fastened by splines to a shaft going to the transmission. This means it fits into groovesson the shaft so that they must turn together, but the plate can slide forward and backward on the shaft. The driven disk is softer than the other plates. It can be destroyed (sacrificed) to prevent damage to the other parts of the drive train. Clutches, therefore, have an access hole so that they can be adjusted to compensate for wear and tear.

# *Location of Components*

## Figure H-1



A series of coil springs, or sometimes one large flat spring, acts between the clutch cover and the pressure plate. They push the pressure plate toward the flywheel, squeezing the driven plate betwen the two. The springs are always trying to engage the clutch, and they are strong enough to keep it from slipping under any ordinary conditions. To disengage the clutch, the driver pushes on the pedal. This works through levers to pull or push back the pressure plate against the force of the springs. This loosens the driven plate and disconnects the transmission shaft from the engine crankshaft.

## Transmission

The transmission is a case of gears located behind the clutch. The case is usually fastened to the clutch housing, so the entire apparatus looks like an extension of the engine.

### Function of Transmission

The function of the transmission is to proportion the power of an engine between speed and torque (twist). As its name implies, it transmits this power from its source, the engine, to the drive or powered axle(s) in order to propel the vehicle.

The gears of the transmission control the speed of the vehicle. Although the engine moves only at one speed, with different gears you can go slower or faster than that one steady speed.

Another property of the transmission is torque, Torque is what makes something rotate. In other words, it is a twist.

The torque or twisting movement of the gears in a transmission is related to the amount of power that a vehicle exhibits. The gears let the driver vary the speed and the force, or torque, that the engine delivers to the wheels. The two fundamental rules to remember are that the more torque, the less speed there is, and the more speed, the 'less torque there is. This is to say, that the torque is increased by gears in just about the same proportion that speed is reduced,

This means that the driver, by manipulating the gears in the transmission, can change the ratio between the engine and the rear wheels to produce more speed or more torque, whichever is needed, The lower the gear, the more torque that is generated and, conversely, the higher the gear, the more speed.

In addition to the main transmission in heavy trucks that are meant to carry great weights up hills, there is an auxiliary transmission. Using the two together, it is possible to rech a low gear combination with a ratio of 30 to 1, meaning that the torque at the rear wheels is 30 times that of the engine.

On-highway trucks do not have transmission with such dramatic low gear ratios- they are usually about 12-to-1 in a transmission with 15 gears. And in cases of gear boxes with 5-to-10 forward gears, the ratio is as low as 8-to-1 or 6-to-l.

In truck transmissions one set of gears corresponds exactly to the size of the engines. Its ratio is l-to-l. The transmission does not change the amount of power coming from the engine into it. This l-to-l ratio gear combination, direct drive, is very often the highest gear in the transmission.

Another characterizing feature of the transmission of diesel trucks and tractors is the shape of the teeth on its gears. In your car the gears are made so that, with the aid of a synchronizer, the gears will interlock with any reasonable difference between gear speeds. However, truck gears, made of the finest steel and alloys, are cut in such a way that absolutely precise components are needed along with a synchronizer to make sure that both gears are going at just the same speed so they can mesh properly.

## Manual Transmission

The manual transmission can be broken down into three different types.

Multi-Speed Transmission--The multi-speed transmission has from 6 to 20 forward speeds. It occupies less room than the combination transmission because, unlike the others, all of its gears are contained in a single housing. Another distinguishing characteristic of the multi-speed is that, instead of being operated with two separate shift levers ("sticks"), the shifting is done with one lever on which a selector-switch is mounted.

Combination of Main and Auxiliary Transmissions--In adding an auxiliary transmission to the main transmission you can multiply the number of shifting speeds to be used. In explanation, if the main transmission has 5 speeds and the auxiliary transmission has 3 speeds then, with the total number of possible combinations, you have 15 speeds.

The auxiliary transmission is fixed just between the main transmission of the drive axles. This setup requires that there be two separate "sticks" for shifting. There is a certain order and progression in which the levers must be moved, and it is one of the most difficult things for new drivers to learn,

However, there is another easier method that is often preferred in the combination of main and auxiliary transmissions. The main transmission lever has a switch on top of it that controls the operation of the auxiliary transmission. This is made especially easy to operate if the auxiliary transmission is power-operated (with an electrically-operated, air assist), With this type of arrangement, it is possible to get up to 24 speeds if the auxiliary transmission switch has 4 positions and the main transmission has 6.

Combination of Main Transmission and Variable-Speed Rear End--You do not always need a multi-speed or auxiliary transmission in order to have enough speeds for the operation of your vehicle. Another possible way to multiply the numer of speeds is with a variable-speed rear end. This means that there are two gears to use in the rear axle housing; and this, along with a five-speed main transmission will give you ten speeds.

However, if you have a two- or three-speed rear end, it is not the most efficient or practical method to operate the system manually. The distance between the rear axle housing and the driver, and also the vertical motion of the rear end, is a hindrance. Therefore, this part of the combination is power shifted, using an electrically-operated, air assist making just the main transmission the manual part.

## Semiautomatic Transmission

The semiautomatic transmission usually frees the driver from using a clutch (some require clutches for speeds under 3 mph). The driver controls the gear changers by using a gear selection box, He must coordinate using the gear selection lever to change the gears with the speed of the engine which is registered (in rpm) on the instrument panel,

## The Automatic Transmission

The automatic transmission is, of course, the transmission that can be operated with the least amount of difficulty. It is also beneficial with respect to safety in that the driver can concentrate more on the road and his surroundings rather than the changing of gears. However, there are disadvantages which should be considered; the transmission costs more to begin with; more fuel is consumed; it weighs more; and the horsepower of the engine is used less efficiently. This inefficiency may not always be of greatest importance but, if your truck is pulling an extra heavy load up a hill, for example, the added power may be crucial.

A common alternative to the strictly automatic transmission is having the option of shifting manually or automatically. This can be especially useful when you need maximum torque from the engine.

## Drive Shaft and Universal Joints

In back of the transmission is the propeller shaft which runs to the rear of the vehicle. This carries a hollow or a solid steel shaft, sometimes enclosed in an outer tube, sometimes left open. At the front and rear of the shaft are universal joints. These usually are made up of two U-shaped pieces at right angles to each other and fastened together by a cross having arms of equal length.

The propeller shaft transfers the twisting motion of the engine to the rear axle. The universal joints connect the shaft to the transmission and the rear axle.

The U-shaped yokes pivot on the arms of the cross. Since there are two of these pivots, the two shafts can be at an angle to one another and can still turn around and transmit power. They do not have to be in a straight line. This is very important, because even if we could design a vehicle to have them in a straight line to begin with, every time we went over a bump they would get out of line. The rear axle moves with the wheels, up and down with every bump, while the transmission does not move so much, being fastened to the frame. So the universal joints let the propeller shaft keep on turning even though its two ends are moving around in relation to one another.

## Rear Axle, Differential

At the rear end of the propeller shaft is fastened a short shaft carrying a gear on the end. This gear is called the pinion. It meshes with the ring gear which is mounted on the rear axle. The job of the pinion and ring gear combination is to take the torque provided by the propeller shaft, increase it (twisting force increased, speed decreased) and turn it at right angles so it can twist the wheels and drive the vehicle.

Since the pinion is much smaller than the ring, speed is reduced and torque or twisting force is increased.

### Differential Gears

The ring gear is fastened directly to the rear axle which runs from one wheel to the other. This would be fine except that, in some circumstances, as in rounding a corner, the wheels on the axle rotate at different speeds; the outside wheel has to go farther than the inside wheel. This difference of speeds is taken care of by the differential. It sends an equal force of torque to both wheels even when they are not traveling at the same speed, thereby increasing the flexibility of the axle system.

It is fairly simple to see what is happening as the differential is operating when it is right in front of you; however, it is very difficult to describe' And, since you will never have to repair one, it is not really necessary to describe it. All that is important to know is what happens,

What happens is that when the truck goes around the corner, the outside wheels will tend to turn faster because they have to go further in the same time. As the wheel turns, the differential gears in essence take the additional speed of the outer wheels and subtract it from the inner wheels. The result is the faster the outer wheels go the slower the inner wheels go, Therefore, the truck turns the corner without spinning or dragging a wheel.

## Inter-Axle Differential

What is advantageous in turning a corner can be very troublesome on slippery pavement. As one wheel begins to spin ever so slightly, the differential subtracts power from the wheel that has better traction. Almost immediately, one wheel is spinning while the other'remains stationary. Having the wheel that is on firm ground remain stationary while the other one is spinning is a good way to get stuck.

Whenever poor traction is anticipated, the inter-axle differential should be placed in the "lock" position. This assures that equal power will be delivered to both wheels and both axles of a tandem* You should do this before wheels have lost traction and started to spin, As soon as you have regained traction, the inter-axle differential should be placed back in the "unlock" position. It is important to let up on the accelerator in order to provide an interruption in torque to the wheels when searching between the "lock" and the "unlock" positions.

One factor of the inter-axle differential that you should be aware of is that it is not recommended for travel on hard ground when it is in "lock" position. You should switch immediately to "unlock" after you have passed the adverse surface area.

## Rear Axles

Rear axles can be divided into two types: "live" axles and "dead" axles, A live axle actually propels the vehicle along, receiving power from the engine; it is a driving axle, A dead axle is simply there to support the vehicle when another driving axle is unnecessary. They can also be called "tag axles" or "pusher axles,"

On most tractors the front axles can be termed dead although they do function in response to the steering of the vehicle. And if there is only one rear axle, it is, of course, going to be a live axle because it must move the tractor.

**(SEE FIGURE H-2)**

The Advantages of Tandem Axles

The standard tandem on a tractor is made up of two rear axles, and one or both of them can be live. This arrangement is called a tandem rear end and is for carrying maximum loads. If the front axle of the two is dead then the rear axle is called a pusher. If the rear one is dead, it is called a tag axle. If both axles are live, then the combination is called a twin screw.

On tractors that have a set of tandem rear axles, two of the three axles must, by law, have braking systems on them. To have the brakes on the two tandem axles prevents the vehicle from skidding, and it also gives the vehicle better steering control.

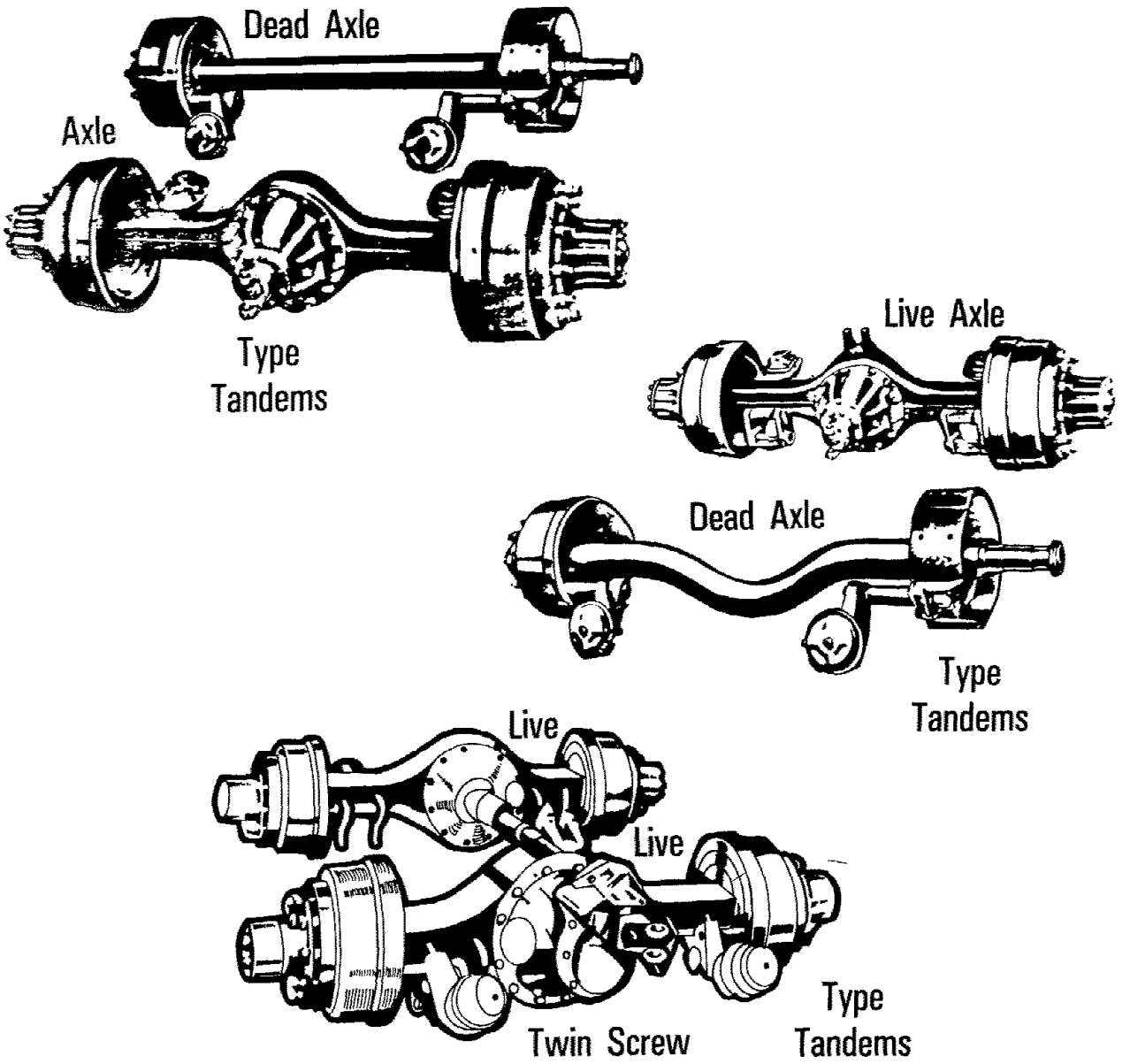
The advantages of having tandem axles are numerous. They provide a more equal or balanced load over the axles, tires and frame, in addition to protecting the load from a significant amount of road shock. With these considerations in mind, vehicles with tandem axles have been legally permitted to carry a greater load than the same vehicles without.

Tandem Axles and Increased Traction--It is often said that tandem axles increase the traction of the vehicle. However. unless both axles are live, the setup can actually detract from the traction. Instead of having a good deal of the weight of the vehicle on one axle, it is on two, so the live axle is not able to grip the road as effectively.

The twin screw, though, does greatly increase a vehicle's traction, and, often, you will see that if a truck is to do much off-the-road construction work it will have many live rear axles in order to conquer the adverse terrain.

Tandems and Tire Wear--The tandem tires, obviously, because of their characteristic of not takinq as much weiqht on each axle, will not wear down so fast as those on-single axles: However, because of the increased number of wheels, there are more to buy when they do finally wear out. You should keep in mind that although the tandem setup does save you money in the long run, it will be quite expensive whenthe wheels have to be replaced.

# *Rear Axles*
## Figure H-2



# BRAKE SYSTEM

The brake system is one of the most important systems on the vehicle.

## Importance of the Braking System

The importance of the braking system cannot be overly emphasized. While it is necessary to have a smoothly operating engine in order to start the vehicle, it is absolutely vital to have a perfectly operating braking system because it could be so dangerous. If the brakes are not in good working order, it could endanger your life plus the lives of others.

A truck's braking system consists of two different parts: the service or foundation brakes, and the parking and emergency brakes. The service brake system is used to slow or stop the vehicle. The parking and emergency brake systems are used for parking or to slow or stop the vehicle whenever the service brake system becomes inoperative.

## Service Brakes

There are two basic types of service brakes, drum and disc.

### Drum Brakes

A drum is a cylindrical metal device that looks like the top of a drum and is turned sideways and fitted on the end of each axle. The drum rotates with the turning wheels and tires of the vehicle. Stopping a vehicle requires the forcing of the brake shoe linings against the machined inside surface of the brake drums. This creates friction. If enough friction is created it is possible to stop the wheels from turning.

There are two types of drum actuating devices, the cam and the wedge. The cam is a rotating piece, usually S-shaped, that is connected to the end of a shaft. When the cam shaft is rotated, the ends of the S-shaped cam press out against rollers which in turn force the brake shoes against the brake drum. The wedge is a sliding wedge- shaped piece molded on the end of a push rod. When the wedge is forced out it comes in contact with the brake shoe rollers. This forces the brake shoes against the brake drum.

## (SEE FIGURE I-1)

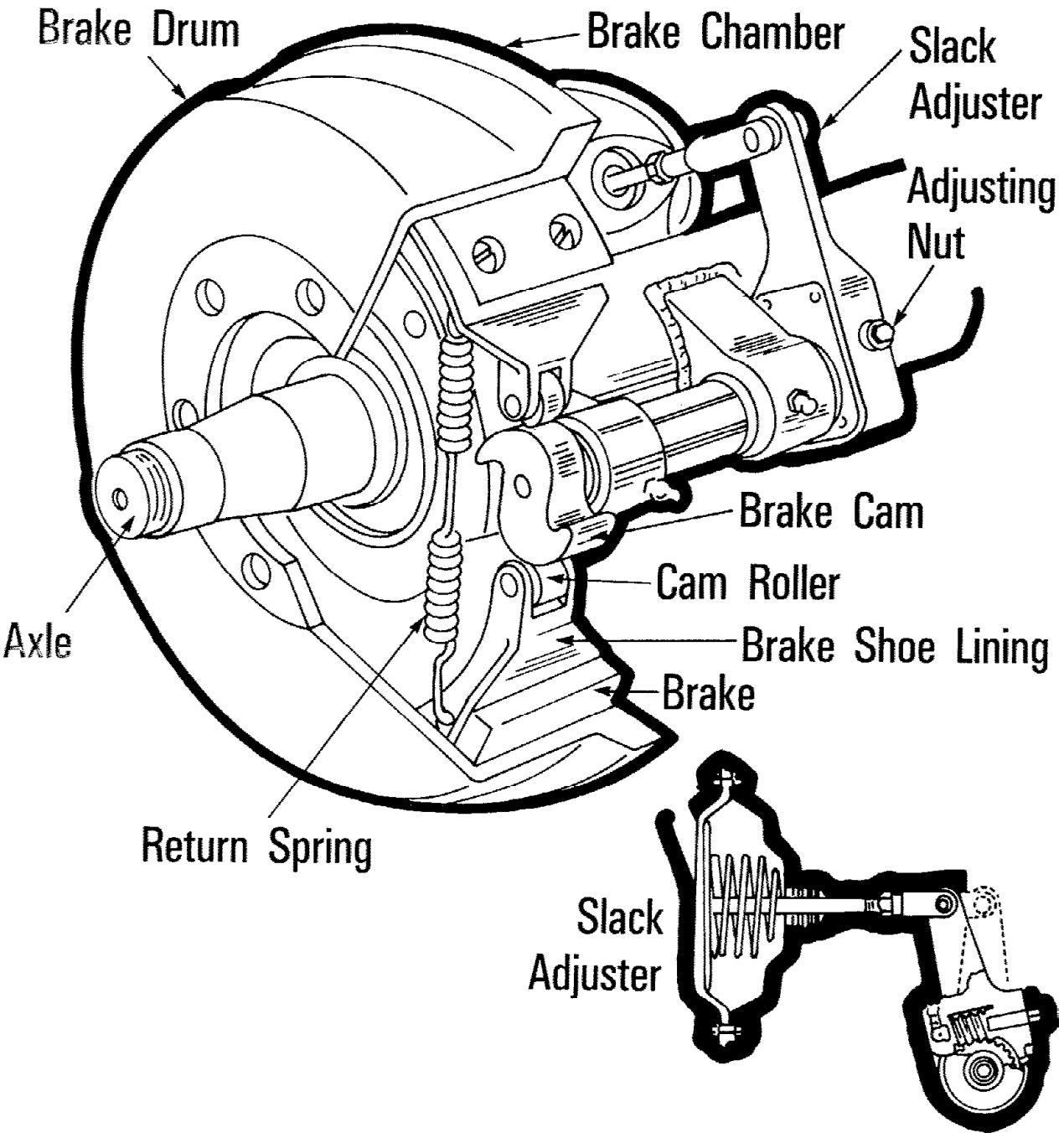
### Disk Brakes

A modern disc brake system will usually consist of a fixed disc attached to the end of the axle. In order to stop a vehicle the brake linings must be forced against the surface of the disc or rotor. This creates friction. Again, if enough friction is produced it is possible to stop the wheels from turning.

# *Drum Brake*

## *Key Components*

## Figure I-1



The heart of this system consists of a power screw shaft and piston, housed in a "caliper." The power screw works like a C-clamp. When the screw is turned it forces the piston to advance thus forcing the inside brake lining to make contact with the disk. When this happens the caliper slides thus pulling the outside brake lining against the disk. This results in equal force being applied to both sides of the brake disk by the lining pads.

**(SEE FIGURE I-2)**

## Spring Brake Systems

You can install spring brakes on any air-brake-equipped vehicle for a dependable parking or emergency brake system. You can release and apply the brakes by means of a control valve within the cab. During normal operation the air, governed by the brake control valve, is delivered through the service airline connection, and maintains the released position of the brakes. Low air pressure applies the brakes.

Therefore you can see that by opening the control valve and admitting main reservoir air pressure to ther spring bake units, the brakes can be released. And by closing the control valve and shutting off the air reservoir flow the pressure is minimized, thereby applying the brakes. This means, though, that, unless there is an auxiliary reservoir, the spring brakes will automatically actuate if the air supply becomes depleted.

**(SEE FIGURE I-3)**

Spring brakes can also be installed on trailer or converter dolly axles. In the trailer brake assembly, the brakes are held in release position by the air pressure from the trailer reservoir.

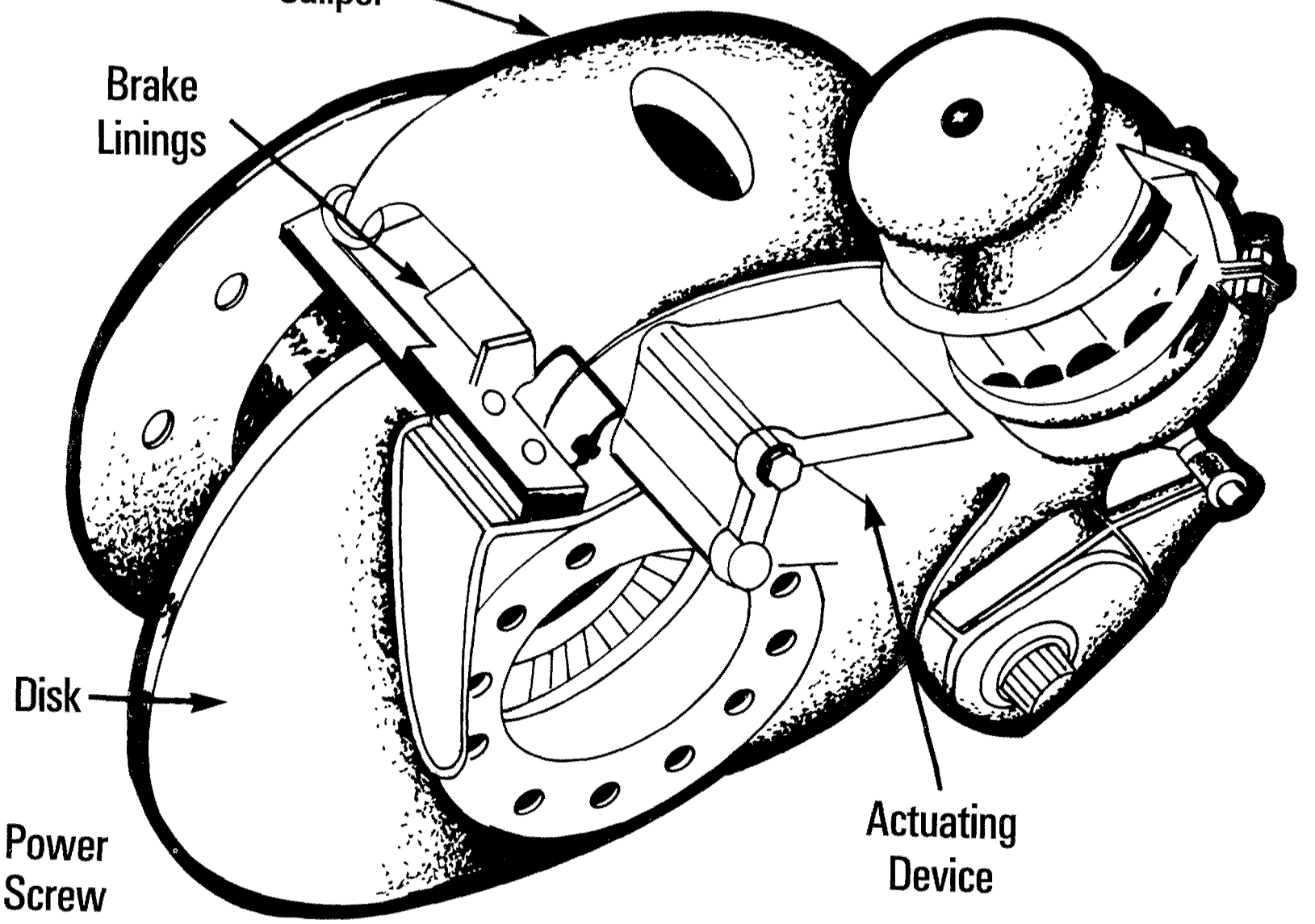
## Air Brake System

Air is compressible; that is, a given amount (volume) of air can be compressed into a smaller space than it normally occupies. The smaller the space it is forced into, the greater the resistance to being squeezed (pressure) it will have. You can feel how powerful air is in the tautness of an inflated tire.

In an air brake system, this pressure is used to gain a mechanical advantage. The air can be a force multiplier and effectively slow the vehicle.

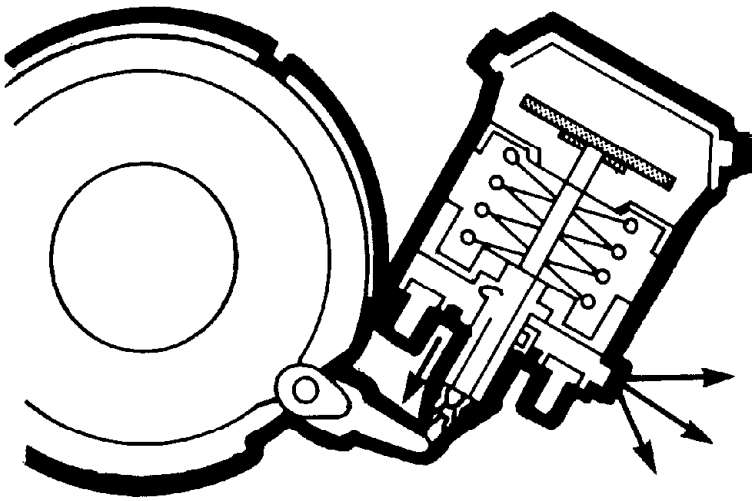
An air brake system is composed of many significant components which work in conjunction with one another to stop a vehicle.

# Disk Brakes
Figure I-2



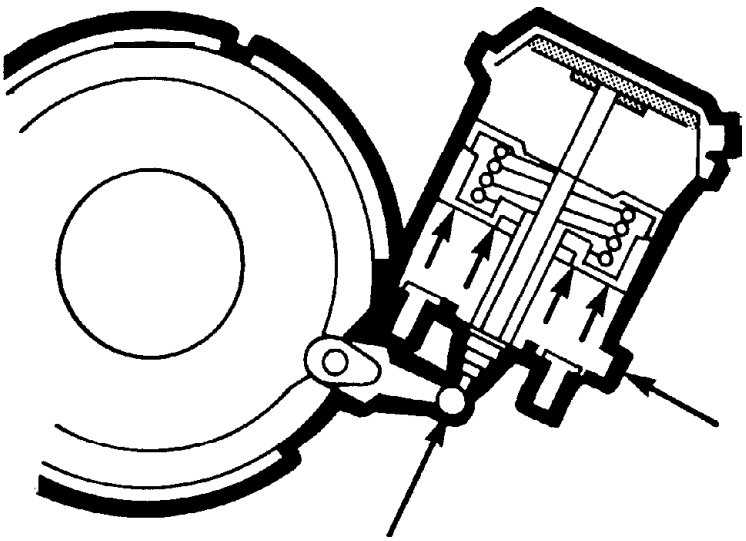
# *Spring Brakes*

## Figure I-3



### Brake Application–Spring Force

Exhausting the Air From the Chamber Releases the Piston, Allowing the Spring to Force It and the Push Rod Forward, Applying the Brakes.



### Normal–Brakes Released

Air Pressure From Service System Acting on the Piston Compresses the Spring, Releasing the Brakes.

## The Compressor

The force created by compressed air is the basic principle behind the air brake system, and this pressurizing takes place in the compressor* The compressor pumps air into a cylinder very similar to that of an engine, operating as the engine does in the intake and compression strokes.

To refresh your memory, in the intake stroke air is drawn into the cylinder through an open valve as the piston moves downwards. In the compression stroke, the valve closes as the piston moves upwards compressing the original volume of air into a much smaller volume. Finally, in the air brake system, when the air reaches a certain pressure, it escapes through the discharge valve.

The compressor is operated in different ways, but always by the engine. It runs when the engine runs. It may use either belts and pulleys or shafts and gears, and these are lubricated by the lubrication system of the engine.

Although the compressor is running all the time the engine is, it is not always pumping. The desired pressure of the air in the cylinder is between 80 and 105 psi, (Some systems can operate as high as 125 psi). When the air pressure reaches 1-5 psi the air is released to an auxiliary cylinder. This is called the unloading stage, and the air is allowed to cool. As the pressure decreases to about 85 psi, the air starts being pumped again, and the cycle is repeated.

It should be emphasized that the cylinder must be kept free of dirt, for it can render irreparable damage to the workings of the cylinder'

## Governor

The governor regulates the air flow in order to maintain the desired pressure. As the pressure approaches 105 psi, the inlet valves are held open for release. And when the pressure drops below 85 psi, the governor closes the inlet valves,

## Air Reservoirs

The air reservoirs are constructed to hold a supply of compressed air. There are usually three tanks in the system: the wet tank, the dry tank, and the trailer reservoir. With this capacity, the system has a larger volume of main reservoir air. The wet tank removes most of the moisture and delivers the air to the dry tank. The trailer reservoir holds compressed air close to the trailer brake chambers for use in normal and emergency situations. The sizes of these tanks can vary depending on how many of them there are and the size of the brake chambers.

## One-Way Check Valve

The one-way check valve is specially designed to prevent the air from flowing back from the reservoirs to the compressor.

## Safety Valves

A safety valve is positioned in the reservoir tanks just in case the pressure is raised to a dangerous level. The safety valve opens usually when the pressure reaches 150 psi and releases the air into the atmosphere, thereby decreasing the pressure in the system.

If the safety valve has to be employed, that indicates that the governor should be serviced. This should only be done by a qualified mechanic. It is very important that you never adjust the safety valve yourself.

## Drain Cocks

Drain cocks are installed within the reservoirs to let off any moisture that accumulates. Since the air is heated to such high temperatures when it is pressurized in the compression chamber, it condenses as it cools in the reservoir, creating moisture that mixes with oil that has leaked past the piston rings. This mixture could damage the braking system if it drained off, especially in the winter time when it might freeze.

In order to prevent water damage, you should drain the moisture daily. This is to be done with the vehicle blocked and on a level surface. All of the air pressure should be allowed to escape because only then will the moisture drain. If you simply open the cock a little bit, the moisture will not be released, only air.

## Reservoir Pressure Gauge and Low-Pressure Warning Signal

The pressure gauge on the instrument panel indicates the amount of air pressure there is in the system in pounds per square inch (psi). If the pressure drops to below 60 psi, the low pressure warning signal activates, either lighting a red warning light or sounding a buzzer or both. Another type of indicator is a "Wig-Wag" that drops into your line of sight and will not be secured in its original position until the necessary pressure returns. If one of these signals should activate, you must stop immediately; 60 psi is still enough air pressure to apply the brakes. You must determine right away what is causing the air to escape.

## The Air Application Pressure Gauge

The air application pressure gauge is also located on the instrument panel and it shows the amount of air pressure that is being applied to the brakes. Logically, therefore, when the brakes are not being used the gauge will read 0 pounds pressure. The unit that relays the measurement is located on the air line connecting the double check valve and the tractor protection valve.

## Treadle Valve

The treadle valve (foot brake) controls the air for the operation of the brakes. The further down the treadle is pressed the more air the system will receive, However, the pressure in the reservoir will still not exceed its safe limit. Releasing the treadle releases the brakes, by exhausting the air from the brakes.

## Independent Trailer Brake

For appplying the brakes to just the trailer unit, a hand valve commonly called a "trolley" valve is installed. The hand valve regulates the amount of air to be used in the operation of the trailer brakes. It is generally located in the right side of the steering column.

## Tractor Protection System

The tractor protection system assures that if the trailer were to break away from the tractor, that not all of the tractor's air pressure would be lost due to the separating or rupturing of the air 'lines. This system is made up of two valves, the tractor protection valve and the emergency valve. The tractor protection valve is opened by the driver to supply air to the trailer after hooking the tractor to a trailer and connecting the air lines together.

## Glad Hands

The term "glad hands" refers to the device used to connect the service and emergency lines of the trailer to the tractor. The connections are secured when the glad hands snap-lock. Unintentional air loss and entrance of foreign matter are prevented by an "O" ring that seals the coupling. However, since it is very important that there be no abrasion, you should also check for dirt and sand before making the connection. When the air lines are unhooked, they should be sealed with protection plates, or "dead-end" couplers, to prevent any dirt from entering. If you do not have dead-end couplers on your vehicle, you should hook the air line up to the glad hand of the emergency line. The risk of brake failure will be highly reduced if you do your best to keep all air lines clean.

## Quick-Release Valve

The quick-release valve, located near the brake chambers, allows a clean, sharp release of the brakes. When you remove your foot from the foot valve, the pressurized air in the chambers escapes quickly into the atmosphere. This way a quick release of the brake shoes is assured, no matter what the distance is between the brake chamber and the foot valve.

However, if the brake chamber is a larger size, often the foot valve is not able to deliver enough air quickly enough. This can create a larger brake lag time.

When the brakes are being applied, the distance does come into consideration. The larger the distance between the foot valve and the brake chambers, the longer it is going to take for the brakes to apply. Therefore, it is going to take longer for the rear trailer brakes to apply than the tractor brakes.

## Relay Valve

The relay valve is designed to overcome this brake lag on a long wheel base vehicle. The relay valve is attached near the rear brake chambers. Between the relay valve and the main reservoir a larger diameter pipe is connected. The original air line from the foot valve to the relay valve is now called the "control line." With this setup, when the brake pedal controlling the foot valve is depressed, the air is sent along the control line until it dead ends at the relay valve. Here it is "relayed" to the pipe which directs the air to the main reservoir, and the air has remained at a constant pressure.

When the brake pedal is released, the air supply is cut off, and the rear chambers do not receive any more air. With this type of system, a quick release valve is unnecessary because the relay valve can release the air pressure through its exhausting port.

## Emergency Relay Valve

The emergency relay valve is installed either on the trailer reservoir or on the trailer frame close to the brake chambers. Just as the relay valve did, the air coming along the control line from the relay valve is relayed by the emergency relay valve to the brake chambers.

The emergency portion of the valve, however, serves to immediately send the air in the trailer reservoir to the brake chambers if there is a rupture or separation in the lines between the tractor and the trailer. This applying of the brakes in an emergency, or dynamiting, occurs automatically. You can also activate the trailer brakes in an emergency with the cab-mounted emergency valve.

The emergency relay valve can also release the trailer brakes quickly.

## Brake Chamber

The brake chambers are chambers of air that are installed close to each wheel. They are attached to the brakes themselves by either a pushrod and a slack adjuster (on a cam brake), or simply a pushrod (on a wedge brake). Air enters the chamber from the brake lines, but from there to the brake shoe and drum, the force is applied mechanically.

How the Basic System Works

The pressurized air is pumped by the compressor to the wet tank where most of the moisture is removed. It then passes through the one-way check valve to the dry reservoir. When the driver depresses the foot valve, the air flows through the foot valve into the service air lines to the tractor brake chambers, front and rear.

At the same time, the air flows in the service brake lines through the highway valve to the tractor protection valve at the back of the tractor. From the tractor protection valve the air is transferred to the trailer through the glad hand connections to the trailer brake chambers.

When the brake pedal is released, the air is exhausted out of the foot valve or relay valve in the tractor and the quick release valve in the trailer.

(SEE FIGURE I-4)

## "121" Brakes

In January of 1975, the National Highway Traffic Safety Administration's new rules regarding the braking systems of truck and buses went into effect. It was called the Federal Motor Vehicle Safety Standard 121 from which "121" brakes get their name, Since you will operate vehicles equipped with them, it is most important to know about them.

The FMVSS-121 originally mandated air brake application and release times, stopping distance requirements, and an anti-skid system.

Stopping Distance Requirements

Initially, a truck was required to be able to stop within 257 feet on dry pavement while traveling 60 mph. The standard also requires the vehicle to do this while staying within a 12-foot-wide lane. The stopping distance was later increased to 293 feet.

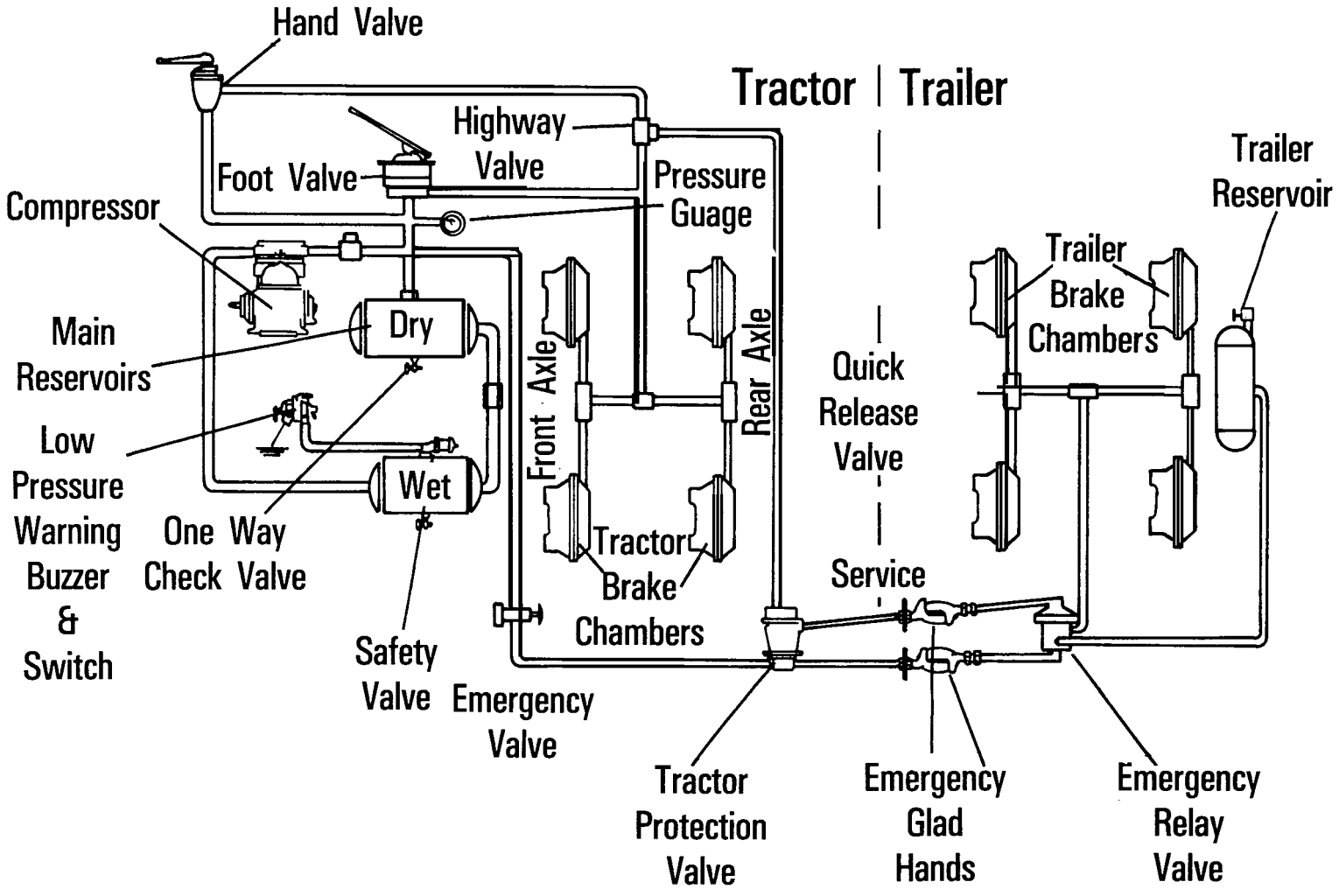
AntiLock or Skid System

The change most talked about in the new "121" regulations is the anti-lock, sometimes referred to as the anti-skid, system. The need for the anti-lock system is due to the stopping distance requirements and the degree of vehicle control needed to maintain the twelve-foot lane during a stop.

The purpose of the anti-lock system is to control wheel lock-up. This is accomplished by an electronic system which senses the speed of each wheel. When the wheel speed sensor detects an imminent lock-up, a valve is opened ans air in the chamber is released. As the wheel speed increases, the valve is closed and air is reapplied. This occurs automatically if the vehicle is stopping and a lockup is sensed.

# *How the Basic System Works*

## Figure I-4



The anti-lock system activates when the driver applies pressure on the brake pedal sharply enough to lock the wheels. Before the "121" system a driver in a panic stop situation would attempt to keep his wheels and tires from locking by pumping the brakes. The makers of 121 brakes have taken this well-known practice of pumping the brakes and packaged it into a computer-operated air brake system. The main difference is the computer system is capable of pumping the brakes three to five times per second faster than any human possibly could.

The problem that confronts the tractor-trailer driver is the mixing of uncompatible equipment. for example, since trailers often last longer than tractors, many pre-121 (1975) trailers are still in operation today. The brake application times for most of the older trailers are much slower than for the tractors being made today. With new air-operated disc brakes, the problem becomes magnified. The need for the tractor-trailer driver to be aware of the type or types of equipment being operated is acute.

## Auxiliary Brakes or Speed Retarders

The increased speed and weight in today's vehicles has created a demand for more effective, more reliable braking systems so loaded vehicle can slow to a safe, controlled speed when going down long grades.

The retarders slow the vehicle movement without actually using the service braking system. There are four basic types of retarders, engine brakes, exhaust brakes, hydraulic retarders and electric (magnetic) retarders. These retarders are able to slow the vehicle down to a very slow speed but can not stop the vehicle completely.

### Engine Brake Example

In the Jacob's Engine Brake, or "Jake Brake" as it is commonly referred to, the engine becomes an air compressor to brake while the vehicle is descending, and then the brake heat is released to the engine cooling system. The normal fuel injection cycle of the engine is interrupted by automatic driver controls in order to do this, During the compression stroke, exhaust valves are opened about 30 degrees before the top to release the compressed air. Energy, therefore, does not return to the engine piston on the expansion stroke, resulting in a net loss of energy. Because energy is necessary for the rotating of the driving wheels, the effect of the Jake Brake system is to retard the "free wheeling" of the driving wheels, thereby braking the vehicle.

This provides a much smoother controlled braking which is especially important when descending long grades. On the long grades, due to the use of the vehicle cooling system, heat does not build up in the engine, decreasing the risk of lubrication failures and piston seizing. All of these factors result in better fuel economy and longer brake life. Finally, the Jake Brake is a complete and separate braking system independent of the air brakes.

## Exhaust Brake Example

The Williams "Blue Ox" brake is effectively an exhaust brake retarder. The flow of exhaust gases is restricted by means of a valve installed in the exhaust system and the 40 to 50 pounds of air pressure that build up in the manifold create a low pressure air compressor which can slow the vehicle.

It is calculated that this brake is able to keep the descending speed of the vehicle in control up to the speed reached during ascent.

There are many advantages to the Williams "blue ox" brake. It helps keep a constant engine temperature, and because of the effect of exhaust compression, certain reciprocation parts of the engine are cushioned, requiring less maintenance.

## Hydraulic Retarders

These driveline retarders, operate on a hydraulic principal exactly in reverse of a centrifugal pump. The hydrotarder is mounted onto the vehicle's driveline. The retarding effect is accomplished by fixing a plate with vanes to a rotating component (rotor) inside a chamber that has staionary vanes (stator). The rotor turns with the driveline. When the hydrotarder is turned off, the chamber containing the rotor is empty (nothing obstructs the rotation of the rotor). The device is activated by filling the chamber with fluid, which resists the rotor movement, thus slowing the vehicle. As the fluid is churned, heat is generated which is equal to the amount of mechanical energy absorbed by the retarder. The heat is then dissipated as the fluid circulates through the engine cooling system. The cycle is completed when the fluid is again circulated through the hydrotarder. Water can also be used but, if hydraulic fluid is used, a heat exchanger needs to be connected to the engine cooling system for temperature control.

The controls located in the cab to govern the operation of the retarder must be turned up to assure its effectiveness. The faster the retarder turns, the more effective it is. However, it cannot singlehandedly bring the vehicle to a complete stop.

You must make sure the speed of the vehicle's descent is not too great for the energy absorption capacity of the retarder. Otherwise, the radiator system may not be able to cool the engine fast enough and damage could result. If care is taken when operating with this type of retarder, there will be less wear and tear on the friction brakes, and a more constant engine temperature will be maintained.

## Electric Retarders (Electromagnet)

Electric retarders are mounted on the driveline of the tractor (can also be mounted on trailer axles) and controlled by a switch in the

the cab. When the switch is turned on, the retarder, actually an electromagnet, drags the flywheel down. Although this slows the vehicle, it will not completely stop it.

Because you cannot regulate the operation of the electric retarders beyond their being "on" or "off," it has the disadvantage of tending to overheat on long downgrades, Another disadvantage is their heavy weight which subtracts from available payload weight.

## TIRES AND WHEELS

### Types of Tires

There are three fundamental types of tires: radial tires, bias tires, and bias belted tires. In radial tires, the body ply cords run around the tire perpendicular to the tread, Additionally, there are belt plies around the tire, parallel to the tread along the part that makes contact with the road. These serve to hold the body ply cords tight and provide sturdiness for the tread. Bias tires have the body ply cords running diaganally across the tire. There may also be breakers, or narrow plies, that run in the same fashion as the ply cords, under the tread, In bias belted tires, body ply cords run diagonally across the tread and belt plys run circumferentially around the tire under the tread.

**(SEE FIGURE J-1)**

Although radial tires are more expensive initially than the other tires, they have many advantages. The tread of radials lasts 40-100 percent longer. Since more of the surface area of radials comes in contact with the road, they have a greater traction while creating 50 percent less friction and, therefore, less heat. This results in greater fuel mileage and better performance.

### Mixing Radial and Bias Ply Tires

In general, it is best not to mix radial and bias ply tires. Keep tires on your vehicle of a consistent size and construction. The differing properties of traction and turning capabilities can create problems. However, for economical reasons, by following very careful guidelines, a combination can be used on the front, drive and trailer axles of a two-axle tandem, and multiple-axle vehicles.

The recommendation in combining radials and bias ply tires applies to those with a 20 inch or larger rim diameter and 8 inch trailer tires. You **NEVER** put tires of different sizes or construction on the same axle. Never use both radial and bias tires in a tandem-drive axle combination.

## Use of Tubes

You can get over-the-road truck tires with or without tubes. In tube tires, a tube is fitted between the tire and the rim. The air that keeps the tire inflated, thereby supporting the vehicle, is held in the tube. Both radial and bias-ply tires can operate with tubes. You must have a multi-piece wheel, including a side ring, a lock ring, a rim, and a rubber flap which fits around the rim-protecting tube.

Tubeless tires are mounted onto a single-piece wheel. The tire itself actually holds the air to support the vehicle. Stemming from the simplicity of the construction of tubeless tires, there are many advantages they have over tube-type construction. Since the tube, flap, side ring and lock ring are not included, they are much lighter, thereby making them easier and safer to mount. Also, there are fewer parts that might be lost or damaged. Tubeless require less maintenance while traveling because, if a sharp object gets caught in the tire, they are held tight, assuring a minimal amount of air loss before you have a chance to repair it. With less complicated equipment, there are fewer repairs, and many of them you can do yourself, so you save money in that respect. In all, you have a cooler running, simpler, more efficient tire with which to.work.

## Types of Wheels

There are two basic types of wheels, the cast-spoke wheel and the disc wheel.

### Cast-Spoke Wheel

Commonly called as a "Dayton," the cast-spoke wheel saves you cost and weight in comparison with the more conventional steel disc wheel. However, since this wheel has a two-piece construction, there are some disadvantages. It is more difficult to adjust the tires and rims, and to balance the wheels. Also, the lug nuts on the wheel must be checked quite often to make sure they are tight.

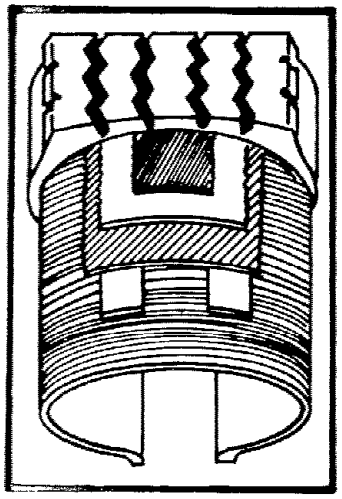
### Disc Wheel

The disc wheel, commonly called a **"Budd,"** comes in aluminum or high-tensile steel; these materials well offset the higher weight of its one-piece construction. Since a pair of Budds can be fastened directly together by six to ten wheel studs, the alignment is simpler. In addition, contrasting with the lug nuts of **Daytons,** these wheel

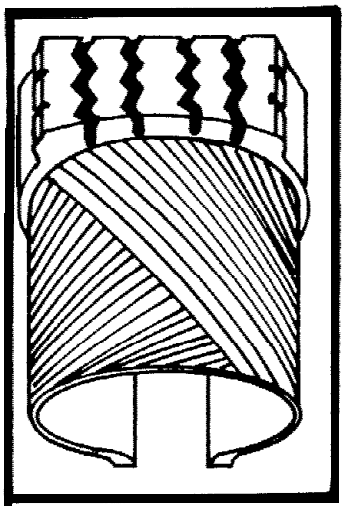
# *Types of Tire Construction*

## Figure J-1

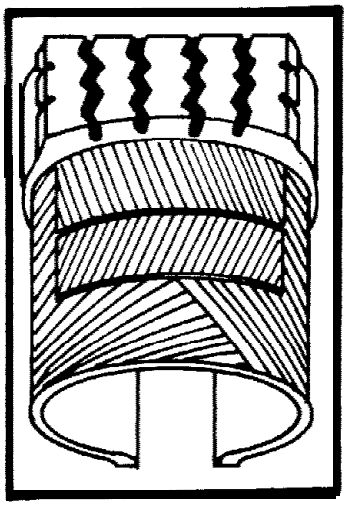
Radial



Bias



Belted Bias



Radial —Body Ply Cords Run Perpendicular Across Tread, Belt Plys Run Circumferentially Around Tire Under Tread.

Bias —Body Ply Cords Run Diagonally Across Tread.

Belted Bias—Body Ply Cords Run Diagonally Across Tread. Belt Plys Run Circumferentially Around Tire Under Tread.

studs are not as likely to loosen up from road vibrations. With respect to proper wheel alignment, therefore, it is easier to change a tire on a Budd than a Dayton.

**(SEE FIGURE J-2)**

## Type of Tread Design and Wheel Position

There are three basic highway truck tire designs: rib, lug, and special service mud and snow lug.

### Rib-Type Tread

The rib-type tread can be used on tires at any position; these "all-position" tires are only for legal highway speeds. They are recommended to be in the front-wheel positions on tractors and on large, straight trucks in high-speed, long-haul service. You can maintain a high degree of control, avoiding skids and steering fluctuations, with the open groove design of these tires.

### Lug and Rib-Lug-Type Treads

For the drive wheel positions, cross rib or cross lug and rib-lugtype tires are recommended. They generally give you more mileage than rib-type tires. Additionally, in over-the-road high-torque service, they provide maximum protection from wear and greater traction. They can be used in off-the-road operation; however, they do not provide as comprehensive traction as the special service mud and snow lug type.

### Special Service Mud and Snow Luq Type Tread

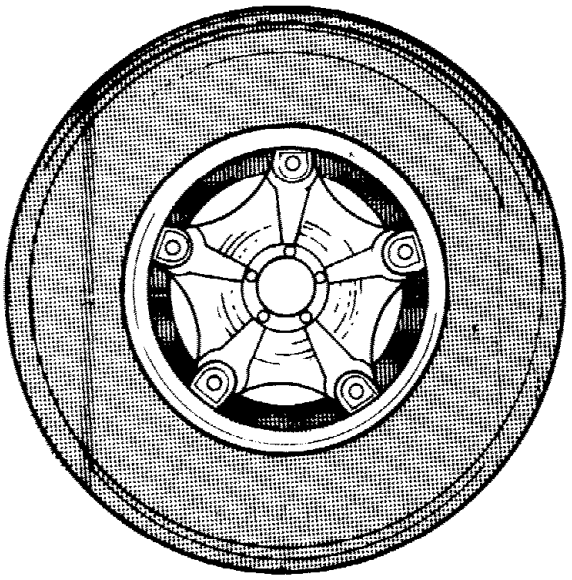
The special service mud and snow lug type tires are made expressly for a high degree of traction. They can be used for on-and-off-the- road service in the drive wheel positions; however, it is recommended that they be used when you are making low-speed hauls over mud or snow or other slippery surfaces or in high speed, long-distance trips in cold weather.

**(SEE FIGURE J-3)**

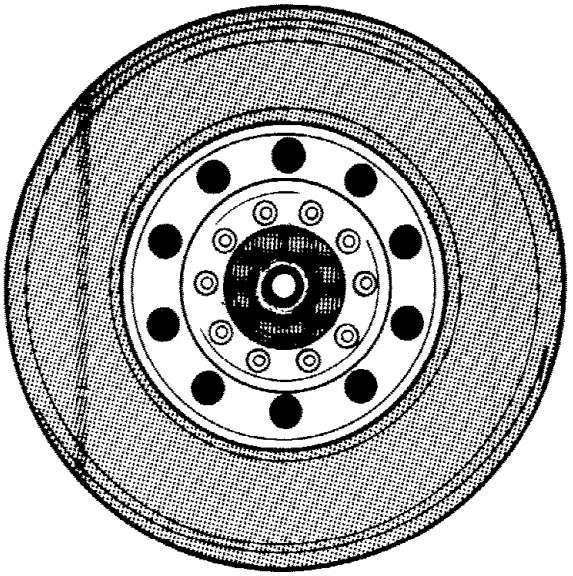
## Proper Inflation

Having your tires inflated to the proper pressure is essential to the effective operation of your vehicle. You should inspect your tires thoroughly and often, and check the pressure with an accurate tire gauge. For correct pressure, refer to the truck owner's manual. Radial tires at their normal pressure can show a bulge on the sides that may appear as if they're underinflated, but this is the way they were designed.

# *Wheel Types*
## Figure J-2

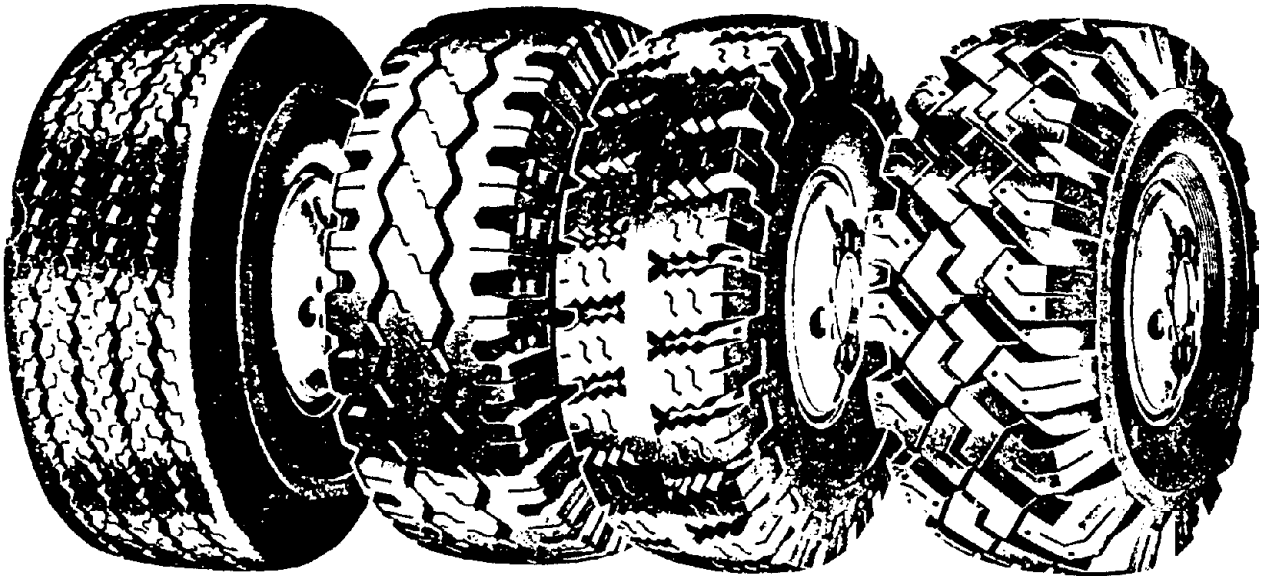


Cast-Spoke Type



Disk Type

# *Types of Tire Treads*
## Figure J-3



Rib Type

Rib and Lug Type

Lug Type

Special Service Mud & Snow Lug Type

## Normal Inflation

For a true reading of the tire pressure, it should be checked and adjusted when the tire is cool. If the tires have just been used and are heated, they will have a higher pressure. You can expect a certain increase after prolonged use. Sizes 9R22.5 tubeless, or 8.25R20 tub-type, and smaller size tires may increase by approximately 10 psi. Sizes 10R22.5 tubeless, or 9.00R20 tube-type, and larger size tires may increase by approximately 15 psi.

If your tires show less than the above increases when they have been heated from use, you should inflate them to their proper pressure. However, if the pressure of the heated tires is more than the recommended pressure, do not release some air. You should wait until the tires cool, check them again, arid then correct the pressure if necessary*

When inflating, keep in mind the maximum pressure for the load that .you will be carrying, making sure not to exceed the rim or wheel rating. You should always replace the valve stem caps in order to maintian a tight air seal and to keep dirt and moisture from entering*

If you have mounted new tires, you should check their pressures after about 24 hours to get an accurate reading.

During the regular operation of yourvehicle, the pressure of the tires is going to increase. You can expect increases of 10 to 15 psi, However, greater increases than that may be indicating under-inflation, overloading, excessive speed, incorrect tire size, or any combination of these possibilities. As soon as you realize one of these factors may be present, creating abnormal heat, you should stop and correct it,

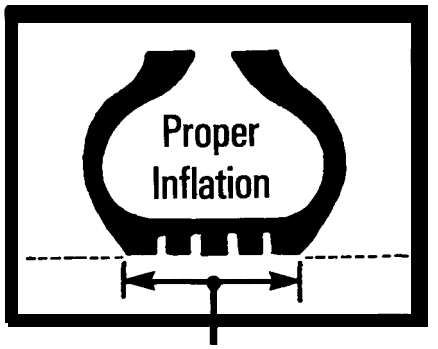
**(SEE FIGURE J-4)**

## Underinflation

Underinflation can be very detrimental to the life of a tire; therefore, you should check the pressure at least once a week with an accurate tire gauge, First, when the tire is underinflated, the tread wears down more quickly. Second, and more serious, the temperature can increase within the tire and result in separation of the tread from the body or belt ply, Another consequence of underinflation is over-deflection. As the soft tire travels over the road it runs over itself, weakening the body cords. If this continues, the body cord construction deteriorates, resulting in a sudden release of air.

If you operate duals in which one is underinflated or flat, the internal and external function acting upon the tire can lead to spontaneous combustion, a sudden burst of flames. Additionally, the other tire, through overwork, could fail, and this would be very dangerous for the driver and other road users.

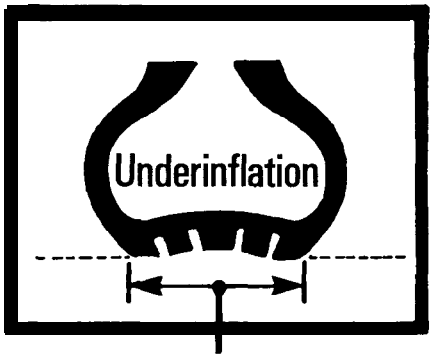
# *Tire Inflation*
## Figure J-4




Tread Contact
With Road

**Proper Inflation**

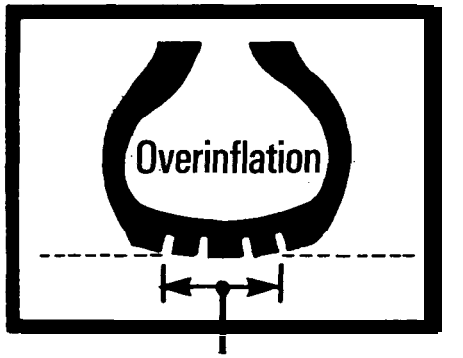
Full Contact
With Road.




Tread Contact
With Road

**Underinflation**

Causes Irregular Wear,
Abnormal Tire
Deflection, Excessive
Heat Build-Up.




Tread Contact
With Road

**Overinflation**

Tires Run Hard,
Causes Irregular Wear.

Radial tires, as have been mentioned previously, may appear soft while actually maintaining their proper pressure. However, you should make sure the pressure does not get too low because there could be serious consequences if excessive heat is generated and the tires fail. Also, you could have trouble controlling your vehicle in emergency situations if the tires are underinflated.

**(SEE FIGURE** J-4)

Overinflation

Overinflation is not good for the tire, either. The rigidity of the tire leaves it more susceptible to being damaged by objects on the road surface; it is easier for it to be cut, snagged, or punctured* Another problem from overinflation is the decreased absorption of shocks. Body breaks can result which overstress the rim, causing rim failure.

It is important that you remember the load capacity cannot be increased over the maximum that is recommended by increasing the pressure to which the tire is inflated.

(SEE **FIGURE** J-4)

Tire **Care**

It is recommended that your tires be rotated at least four times during their normal tread life. In this manner, the wear on the tires can be distributed more evenly, and the mechanic can have a chance to closely examine the tires fairly regularly.

Between rotations, though, you should check your tires daily to make sure they have at least 3/32 of an inch of tread left. If they do not, they either have to be replaced or reconditioned. With regard to reconditioning, there are three courses you can take. You must keep in mind, though, these methods cannot be used on all tires; it is specified whether they can. The tires can be regrooved, which is to say that the remaining tread can be shaved off, and a new tread carved out of the smoothed rubber. They can also have a full recap, or full retread, where the tread is again completely shaved, However, in this case, a new, separate tread is bonded by either a hot or cold bonding process directly onto the old tire. If the cold bonding method is used, the completed tire is called a "cold cap." In the full recap, or full retread, method, the edges of the new tread extend around the sides of the old tire. Finally, there is the top-cap or top-retread method which is the exact same as the full process except that the new tread simply covers the top of the tire. A drawback to this method is that under periods of high stress or heat, the new treads can separate from the tires.

## Tread Life

We would be misleading you to say exactly what the tread life of your tires will be because there are so many varying conditions. It depends on the quality of the original tire, the expertise of the handling of the vehicle, and the attention that is paid to the condition of the tires, whether they are properly inflated and distributed for the load.

We can give you the average tread life, though, taken from those of many tires in differing conditions and circumstances. You can, on your own, greatly increase the life of your treads by taking care to shift smoothly and by being generally responsible. It can also be cut in half if you drive exceedingly fast or brake sharply.

It is recommended that front axle tires be changed every 60,000 miles, even though they generally can last much longer. This is because they are so relied upon for the steering, and if they fail there would be serious consequences. If they are still in good condition, they can, of course, be used on a rear axle where the risk is less.

On twin-screw drive axles, the average tread life is calculated at about 100,000 miles. This figure is noticeably higher than 75,000 miles of the tires on single drive axles and a single drive axle mounted in tandem with a dead axle.

## Proper Matching and Spacing of Duals

If two tires of differing diameters are positioned together, the larger tire will begin to overheat and bulge out at the sides due to taking more of the load on its own. The smaller tire will wear irregularly because of its improper road contact, and tread separation may develop. If the larger tire bulges too far, it will begin to touch, or "kiss," the other tire, increasing the friction and heat between the two which results in a blowout in one or both of the tires.

Between some tires there is an allowable difference in diameters if they each have equal inflation pressures. There can be a 1/4" difference for 8.25 cross section (tubeless 9-22.5) and smaller sizes. There can be a 1/2" difference for 9.00 cross section (tubeless 10-22.5) and larger sizes.

In order to get accurate readings of the diameters of two duals, you should measure the tires 24 hours after they are first inflated with a steel pi tape. If they are to be measured while on the vehicle, it can be done with a string gauge, a straight edge, a tire caliper, or a large square.

To be on the safe side in avoiding abnormal tread wear, you should keep the differences between the diameters to less than 1/4", no matter what the size of the tire is. Also, you should keep the space between the tires at the recommended distance in order to prevent "kissing" and the heat build-up and problems that result.

### How Heat Affects Tire Rubber

As the temperature of the rubber surpasses 250°F, the compounds of the tire rubber weaken, and the rubber softens. This means the tread is more likely to become damaged if the tire is to rotate against a curb, railroad tracks running parallel to the path of the truck, or pit rail guides at terminal dock locations.

A tire can also become exceptionally hot through long-distance operation at highway speeds when it is underinflated or during hot weather. The internal friction heats the tire until it reaches the combustion point and the tire bursts into flames, This usually happens in a dual assembly where one of the tires is underinflated and therefore the other tire is taking an excessive amount of the load. Often, just after the vehicle stops, one or the other blows up, and such fires are extremely difficult to extinguish.

You can see through these instances that it is extremely important to maintain the proper pressure in your tires.

## STEERING SYSTEMS

A well synchronized steering system is integral to the control of the vehicle. There are many factors involved, and a17 of these must be kept in check to assure smooth operation.

### Components of the Steering System

The steering wheel controls the direction of the vehicle. It is connected to and turns the steering shaft.

The steering shaft connects the steering wheel to the gear box.

The gear box multiplies the torque created by the steering wheel and then transfers the torque to the Pitman arm.

The Pitman arm is connected to the drag link which transfers the turning motion to the wheels.

The tie rods connect the wheels together and adjust their operating angle.

The spindle on which the front wheels are mounted is connected to a movable knuckle.

The steering knuckle connects the wheel to the frame. The knuckles turn in yokes at each end of the front axle. These yokes are attached to the front axle by means of steering knuckle pins called "kingpins."

The steering arms, one on each side of the front axle, attach the tie rod to the wheels. The arm on the left is also attached to the drag link.

Correct alignment of these components is necessary for effective steering of the vehicle. If they are not properly aligned, it can lead to increased difficulty in the steering which could be dangerous and expensive for the operator. The position of the components so the steering system is running smoothly is known as correct steering geometry.

**(SEE FIGURE K-1)**

## Types of Steering Systems

### Center Point Design

In the center point design, the kingpin is perpendicular to the ground, making it so that it does not have to support the load of the vehicle. With the components of the vehicle simply pivotinq around the kingpin, the knuckle pin bushings and the other linkage parts wear less quickly. This design makes the steering easier without having to have power steerins. Also, the roadshock is reduced because it is transferred indirectly to the axle beam where it is absorbed.

### Inclined Kingpin

Each time you turn the whee1 with the inclined kingpin design, the front axle load must essentially be lifted. Because the parts of the inclined kingpin design are not working perpendicular to the ground, they are exposed to many pressures the center point design overcomes. There are, though, some advantages the inclined design has over the center point. Because of the pressure of the load, the steering column returns to its original position more easily and readily. Also, the turning circle is smaller because of the track of the axle with respect to the kingpin.

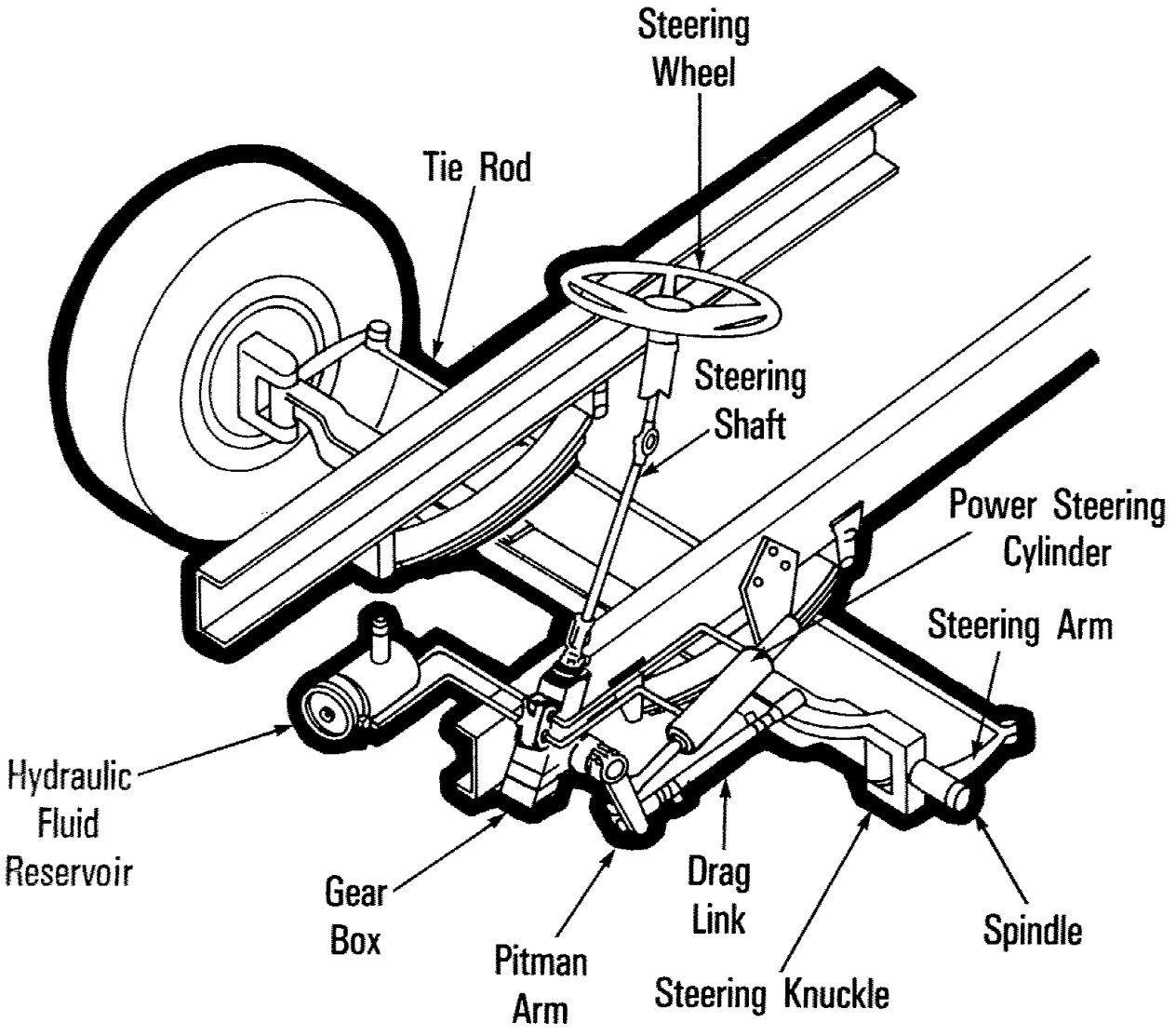
## Wheel Alignment

Certain characteristics pertaining to the front end are built into the axle by the manufacturer. These characteristics may be changed by the individual if it is necessary to suit particular conditions.

### Caster

The "caster" of the axle is the amount of tilt it has. Caster is measure in degrees. It is recommended that the axle have a positive caster, that it tilts forward. In this manner the vehicle will naturally want to go straight, and it will "recover" from turns more readily. Positive caster greatly simplifies the steering for the driver.

# *Steering System Components*
## Figure K-1



Camber

The "camber" of the wheels is the degree of tilt they have with respect to the road. It is preferred in trucks that the wheels have a positive camber so they can support the load. This is to say that the distance across the top of the wheels is greater than the distance across the bottom, and when a heavy load is put on the truck, it serves to straighten the tires out with respect to the ground.

Other characteristics of alignment are the result of wear and damage. The most notable of these is toe in/out.

Toe-In--In toe-in, the distance between the front of the wheels on one axle is less than the distance in the rear. If this becomes too pronounced, the tire will begin to wear excessively on the inside edge of the tread design.

Toe-Out--Toe-out is just the opposite of toe-in; the wheels on the same axle are closer in the back than in the front. In this case, the tires wear prematurely on the outside edge of the tread design.

## Power Steering

Power steering has resulted in a greater control and increased safety in trucks. If it was not originally installed in your vehicle, it is readily accessible in kits tht you can adapt to your present manual system.

Hydraulic Systems

In the hydraulic systems of power steering, there is an engine-operated high pressure pump, a control valve, a hydraulic fluid accumulator or reservoir tank, and a double-acting hydraulic cylinder. In most kits these units are installed separately, but they can be fitted directly into the steering gear, including a power cylinder and control valve.

If you are going to use a kit, the control valve is incorporated into the drag link and is controlled hydraulically by the turning of the steering wheel. Then the hydraulic control valve sets the double-acting hydraulic power cylinder in motion. This cylinder regulates the amount of turn of the axle to which it is attached. This system makes the steering much easier and is very helpful in controlling the vehicle when there are adverse road or load conditions.

### Air Systems

The other type of power steering system is an air-actuated type. In this system, manual steering is coupled with a sensing valve and a power cylinder. In straight driving, steering is manually controlled. Once a rim pull of approximately 10 lbs. is exerted by the driver, a sensing valve allows "metered" air to flow to a power cylinder. The power assists the manual steering in a gradual smooth flow, while maintaining the driver's "feel" of the road, At the same time, road shocks traveling up from the wheels to different steering components are absorbed through the power portions of the system, eliminating a sometimes uncomfortable source of driver tension.

The brake system of the vehicle is protected from loss of needed air to power steering in cases of malfunction. A safety valve isolates the air power system when the vehicle air pressure drops below 70 lb. The steering then reverts to 100% manual until adequate air pressure is restored. Even without an emergency situation, the driver may turn off the power assist if he chooses. With the valve in the "off" position, steering is once again completely manual.

When both of these systems are used, you are assured the greatest control with the least amount of effort. They do not jeopardize the straightening out characteristics of the axle or the steering geometry of the systems. Additionally, you will not have to overcompensate in the steering because there is no lag in the response of the axle to the turning of the steering wheel.

Moreover, there are many advantages to the power steering systems. The driver does not become as tired because it does not take as much effort to turn the wheel. The road shocks are absorbed more effectively, so they do not tire the driver or wear down the components of the system as quickly. The maneuvering of the vehicle is simplified which makes it safer in dense traffic and when backing. It is easier to keep the vehicle traveling straight and on the highway in case of a blowout. Withpowersteering you can put a heavier load over the front axle, so you increase your payloads and, in turn, the traction of the front wheels, assuring a safer ride.

## Trailer Axles that Steer

### Cable Steering

The cable steering system is the first of the three basic types of self-steering axles. It uses cables to attach the trailer axles at the kingpin with a swivel. When the trailer begins turning, the tension becomes greater on the side opposite to the direction the vehicle is turning because the trailer axle and suspension assemblies are mounted on turntables. On the semi-trailers with three or four axles, the front axle is designed to go in the same direction as the turn, while the rear axle goes in the opposite direction.

Castering Axles

Castering axles are very similar to heavy-duty truck steering axles. The kingpins are positioned 5-1/2 inches ahead of the center, and the axle is designed in such a way that it naturally travels straight. However, when the vehicle moves into a turn, the axle follows that direction, returning to its original direction after the turn is completed. This type of axle can be used in straight trucks or tractors as trailing axles.

Mechanically Controlled Axles

The mechanically controlled self-steering axles have two additional steering arms that attach the steering axle to the trailer body. The axle follows the direction of the turn when the tractor goes into a turn. With this system the thrust of the trailer against the tractor is reduced and you can begin to make the turn 30% sooner.

## Turning Doubles

Converter dollies act as the steering axle for the second trailer in a doubles combination. Logically, you can negotiate a turn with a set of 27-foot doubles more easily than with a 45-foot semi-trailer. The greater number of points of articulation permits a narrower swing, so you can be closer to the side of the road and still make the turn. The inflexible 45-foot semi-trailer requires a greater expanse in which to turn.

**(SEE FIGURE K-2)**

## COUPLING SYSTEMS

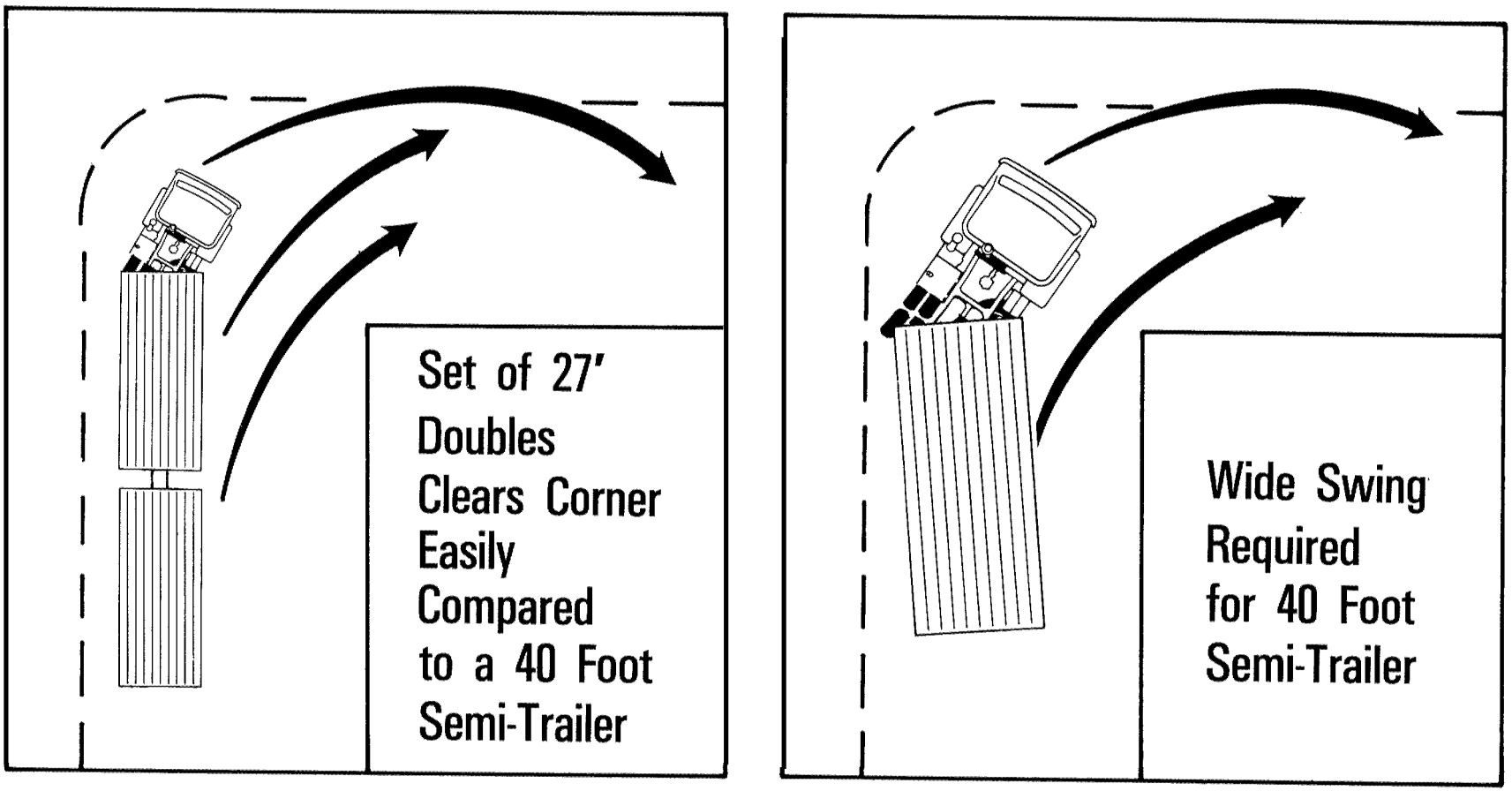
The primary function of the coupling system in a tractor-trailer is to connect the tractor to the trailer, the power to the payload. The two key components in the coupling system are the fifth wheel and the trailer kingpin. Coupling the tractor to the trailer through a single 2" kingpin is one of the most critical areas of tractor/semitrailer operation.

## Fifth Wheel

The fifth wheel is not a true wheel in that it rides on the ground. It is an integral part of the coupling system that holds the kinpin that is attached to the trailer securely. In this fashion, the tractor and the trailer are able to manipulate around corners and other such obstacles smoothly while lending a certain amount of stability to the trailer.

# *Set of Doubles and 40 Foot Semi-Trailer Making Right Turns*

Figure K-2



There are many options on the fifth wheel designed for convenience in coupling and uncoupling. There are approach rails, tapered frames, and highly developed locking mechanisms that can eliminate any excess movement between the kingpin and the fifth wheel; all of these reduce the amount of wear exacted from the components of the coupling system. Additionally, for different types of loads, there are different styles of fifth wheels. Fixed-mount wheels are permanently placed; sliding fifth wheels can be moved back and forth on special tracks; lifting fifth wheels simplify positioning trailers correctly without cranking landing dollies, or raising loaded trailers for dumping; and compensating fifth wheels help improve vehicle stability when carrying heavy liquid loads.

## Fixed-Mount Type

The most popular fifth wheel is the fixed-mount, so called because it is secured in a fixed position behind a cab. It is made up of three units--the top or base plate, the bracket sub-assemblies, and the frame mounting members which are generally structural steel angles that are bolted on the fifth wheel. The top plate includes the locking mechanism and bears much of the stress of coupling. The bracket sub-assemblies hold the top plate in position.

**(SEE FIGURE L-1)**

## Sliding (Adjustable) Type

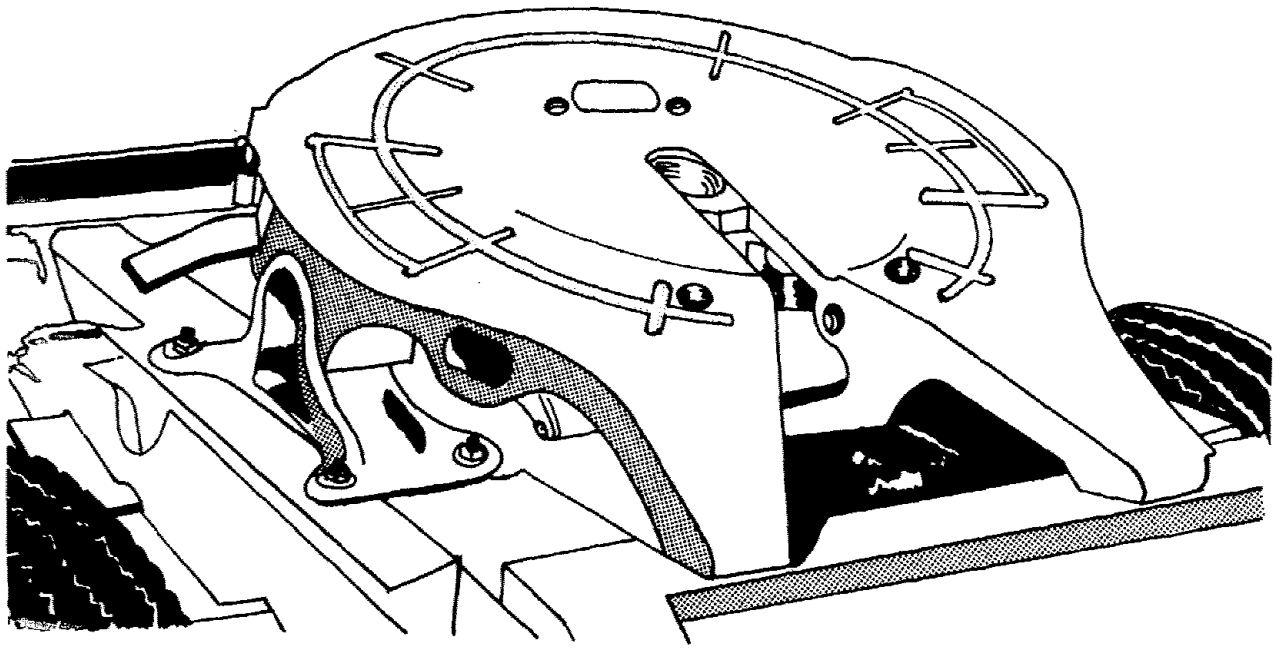
The sliding fifth wheel, or slider, can, as its name indicates, slide backwards and forwards and then be locked into place in order to adapt to different loads. It increases truck flexibility greatly. The slider is especially helpful for small fleets in conforming to state laws concerning lengths of vehicles and weight distribution over axles. This would not be possible with the fifth wheel fixed permanently.

There are two basic types of mechanisms which lock sliding fifth wheels in place. Some have pins that fit into matching holes in the slider track and some use a plunger fitting into a row of slotted holes in the center of the base.

The slider can be adjusted manually or automatically. When it is done manually, the driver moves the pins or plunger himself, then adjusts the fifth wheel by moving it forward or backward. When it is done automatically, an air-actuated control in the cab reacts, the locking device unlocks and driver moves the tractor forward or backward (after setting trailer brakes) until desired fifth wheel position is achieved.

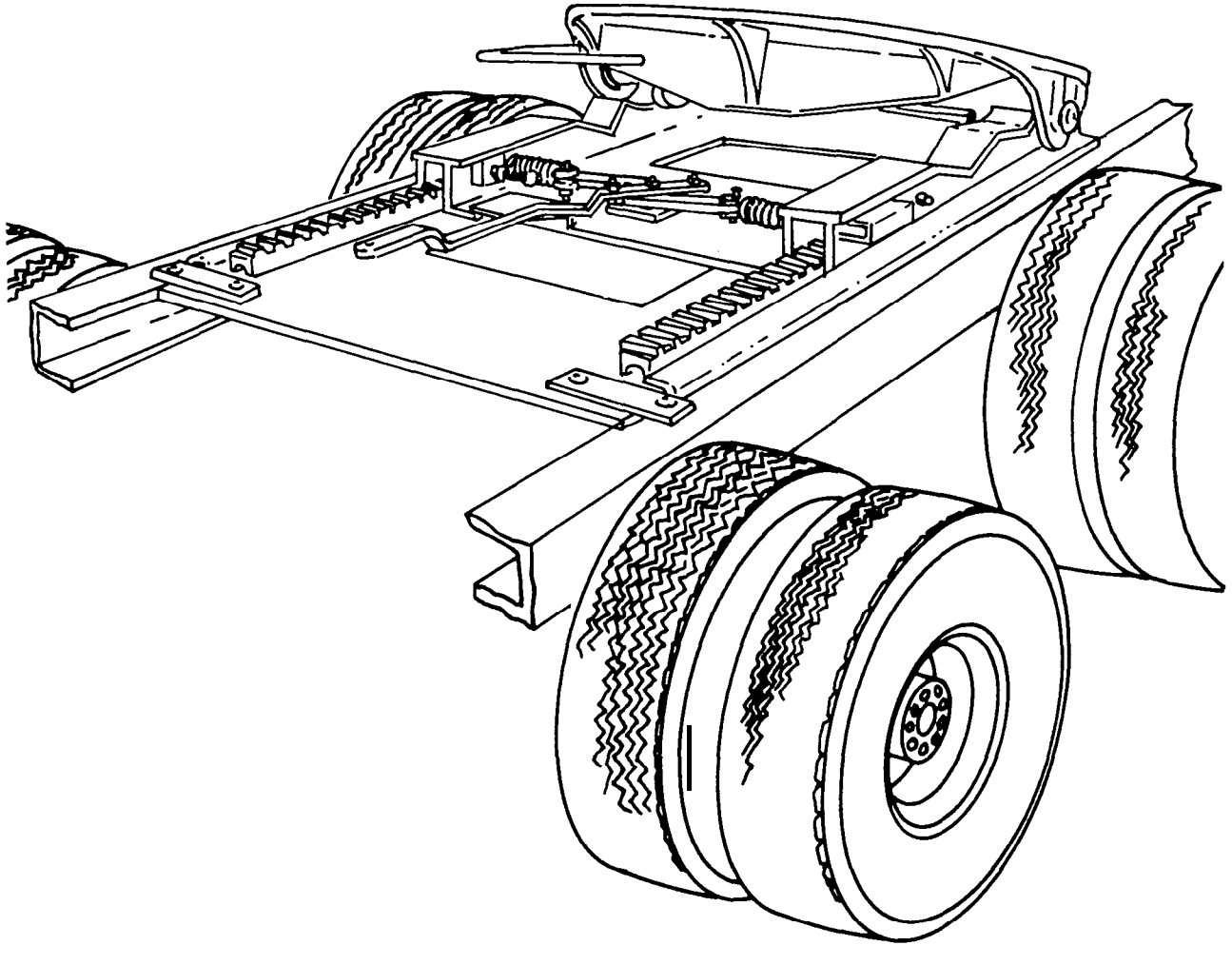
**(SEE FIGURE L-2)**

# *Fixed Fifth Wheel*
## Figure L-1



# *Sliding Fifth Wheel*

## Figure L-2



### Kingpin Locking Mechanisms

In order to prevent an unexpected release and have easy, safe couplings, it is best to have a sturdy, secure locking mechanism. There are two basic types of kingpin locking mechanisms used in a fifth wheel assembly: mechanical and compression. Each one automatically locks in coupling.

Mechanical locks hold the trailer kingpin tightly by means of spring-loaded jaws. Mechanical locks must be manually adjusted to compensate for the day-to-day wear on the jaws, and to assure a snug fit on a new(full-size) kingpin.

Compression locks grasp the kingpin securely with a built-in rubber block that compresses just behind the jaw assembly. Although a compression lock may be more complex than a mechanical lock, it has a greater self-sufficiency and does not need as much maintenance as the mechanical. Additionally, with this system, the road shocks transmitted to the driver are lessened.

### fifth Wheel Slack Adjusters

The slack adjuster of a fifth wheel adjusts the kingpin locking mechanism so it will fit snugly and securely around the kingpin. Slack adjusters are present on most mechanical locking mechanisms.

## Kingpins

Kingpins are attached to the upper fifth wheel plate which is mounted on the front bottom side of the trailer. The kingpin is typically a 2-inch steel pin which is locked into the jaws of the fifth wheel to couple the tractor and trailer. It is made of a high strength steel and will usually last the lifetime of the trailer.

## Other Coupling Devices

### Converter Dolly

There are two types of converter dollies--the conventional dolly and the Jifflox or Universal converter dolly. Generally, the converter dollies are used to convert semi-trailers into full trailers. The dolly would become the front axle of the second trailer. However, in the east, but not in the west, the Jifflox or Universal converter dolly is hooked behind the single axle of the tractor, converting it into a tandem tag axle. The tractor would then be capable of pulling a heavily loaded 45-foot trailer,

Essentially, though, they are both made up of the same components, a fifth wheel, a drawbar and eye, safety chains, an air hose, and electrical cable connections. The drawbar or towbar eye, located on the end of the drawbar is a circular catch made of heavy steel. It is used to secure the converter dolly to the trailer. The eye fits into the pintle hook and is locked in place by the plunger. The safety chains are attached to small hooks on either side of the pintle hook. They keep the converter dolly and the second trailer from breaking away from the first trailer if something happens to the pintle hook and drawbar eye connection.

**(SEE FIGURE L-3)**

The different trailer combinations for which the converter dollies can be used are the western doubles, the turnpike doubles and the western triples.

Western doubles have two semi-trailers, the second of which is converted to a full trailer using a converter dolly. The trailers range in length from 24 to 27 feet with 27 feet being the most common.

Turnpike Doubles are the same as the western doubles except for their trailer size. The length of the trailers is usually 40 feet.

Western Triples have three 27-foot trailers coupled together (the order: tractor, semi-trailer, converter dolly, semi-trailer, converter dolly, semi-trailer).

**(SEE FIGURE L-4)**

### Trailer Landing Gears

The landing gears support the front end load weight of the trailer, when uncoupled. They are usually hand cranked up and down. Most have a single or dual speed crank. Landing gears are equipped with either wheels or skid feet attached to their bottom. They support the trailer load pushing down on them. They are not, however, designed to withstand side or front and rear pressure.

### Pintle Hooks

A pintle hook is a trailer hitch. It secures the trailer to converter dolly. The hitch can either be rigid or swivel. It works with the dolly eye like a hook and eye. Pintle hooks have basically two types of locking mechanisms. The first type is spring loaded and the second is air-activated. Both types operate a plunger which is the part of the hitch which fits over the dolly eye and locks it in place.

# *Converter Dolly*

## Figure L-3

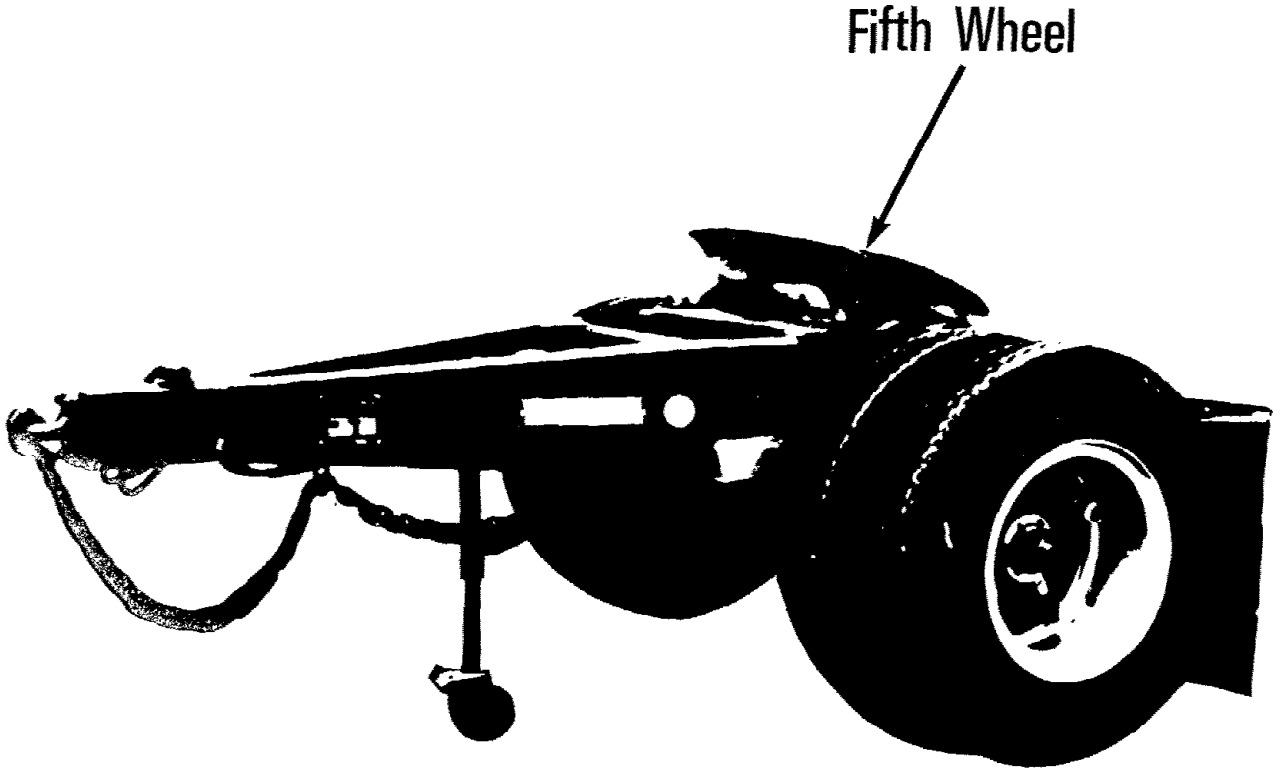
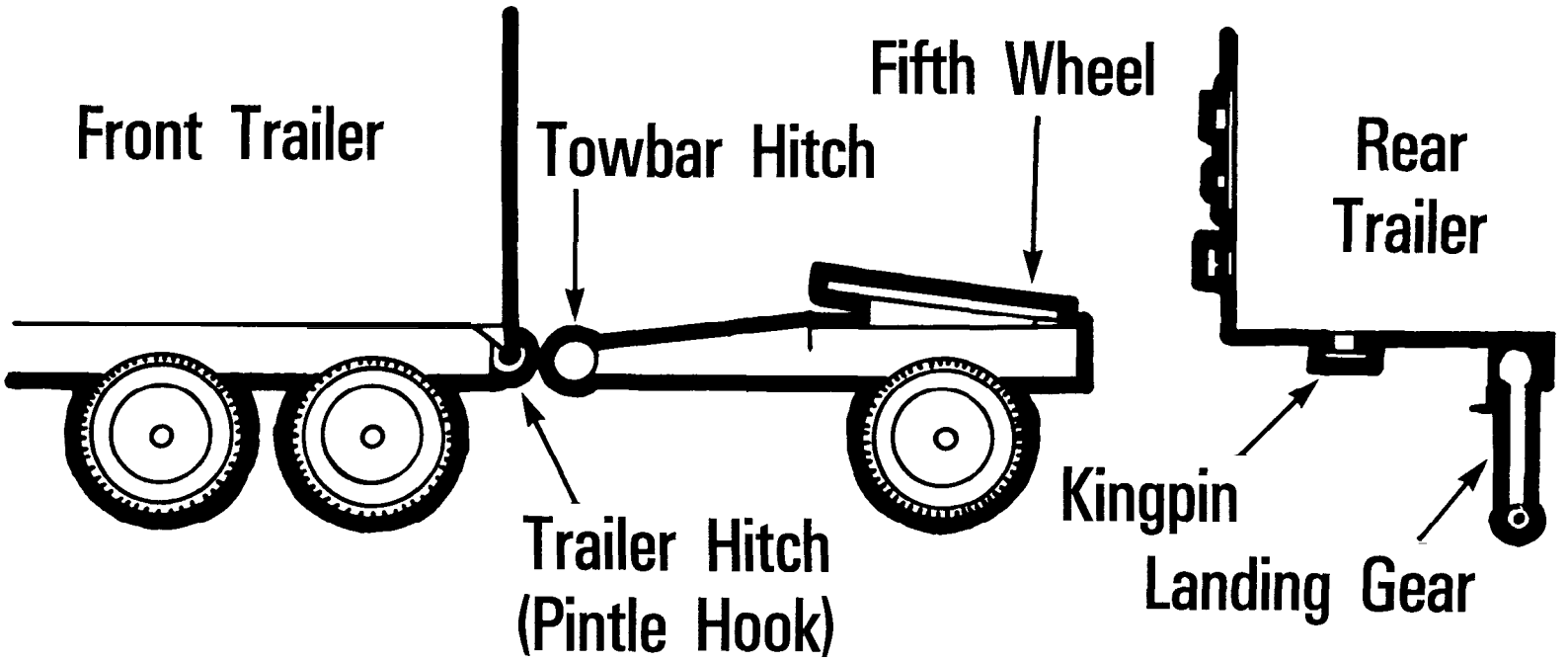


Figure L-4


Front Trailer
Towbar Hitch
Fifth Wheel
Rear Trailer
Trailer Hitch (Pintle Hook)
Kingpin
Landing Gear

Notes

UNIT 4.2
PREVENTIVE
MAINTENANC
AND SERVICIN

# UNIT 4.2 PREVENTIVE MAINTENANCE AND SERVICING

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn how to

- o check and service engine fuel, oil, coolant, battery and filters involved.
- o check tire air pressure.
- o how to change a wheel (with tire mounted) and check for proper tire and wheel mounting.
- o drain moisture from air brake supply reservoirs and fuel systems
- o check and adjust brakes.
- o clean and repair lights.
- o change fuses and reset circuit breakers.

You will learn

- o the importance of periodic inspection and repair to prevention of enroute breakdowns, long life of parts, safety and economy of operation.
- o the applicable requirements of the Federal Motor Carrier Safety Regulations.

## WHAT WILL HAPPEN IN THIS UNIT

This unit consists of one classroom and three lab lessons.

### Outline of Classroom Lesson

Lesson 1 - Nature and Importance of Preventive Maintenance

I. Overview of Maintenance
   A. Fleet-Performed Maintenance
   B. Driver-Performed Maintenance

II. Types of Maintenance
   A. Routine Servicing
   B. Scheduled Preventive Maintenance
   C. Unscheduled Maintenance

III. The Federal Motor Vehicle Inspection and Maintenance Requirements
IV. Importance of Preventive Maintenance
A. Breakdown Costs
B. Maintenance Costs
C. Operating Costs
D. Purpose of Unit

## Description of Lab Lessons

Lesson 2 - Engine Fluids, Filters, Lights, and Filters

In this lesson the instructor will demonstrate procedures for checking and/or changing the fuel tanks, fuel level, fuel filters, oil level and filter, coolant level and filter, battery fluid level, power steering fluid level and air filter. He will also demonstrate procedures for inspecting and changing lights and fuses and for resetting circuit breakers.

Lesson 3 - Changing Tires and Checking Tire Air Pressure

In this lesson the instructor will demonstrate procedures for checking tire inflation pressure and for removing a tire and wheel assembly and replacing it with a spare.

Lesson 4 - Air Reservoir Drainage and Brake Adjustment

In this 'lesson the instructor will demonstrate procedures for draining moisture from air reservoir tanks and for adjusting both drum and disc brakes,

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Checking Fuel Tank, Fuel Level and Changing Fuel Filters Checklist
- Checking Oil Level and Changing Oil Filters Checklist
- Checking Coolant Level and Changing Coolant Filters Checklist
- Checking Battery and Power Steering Fluid Level Checklist
- Changing Air Filter Elements Checklist
- Changing Head Lamp, Fuses and Resetting Circuit Breakers Checklist
- Draining Moisture from Air and Fuel System Checklist
- Adjusting Brakes Checklist
- Checking Tire Air Pressure and Checklist

## UNIT 4.2 - CHECKLIST NUMBER 1

# CHECKING FUEL TANK, FUEL LEVEL AND CHANGING FUEL FILTERS

## Fuel Tanks

1. Open drain cocks on bottom of tanks and drain off any water present
2. Tighten all fuel tank mountings and brackets
3. Check seal in fuel tank cap and check breather hole

## Fuel Level

1. Park vehicle on level ground
2. Open fuel tank cap
3. Visually check fuel level
4. Make sure level corresponds with gauge reading in cab

## Changing Filters

Strainer replacement

1. Turn fuel filter element counter clockwise unit it is free of base
2. Discard filter element
3. Clean seal surface on filter base
4. Wipe up fuel that was spilled during filter removal
5. Coat seal of new filter with clean diesel fuel or engine oil
6. Thread filter onto base until seal contacts base
7. Tighten filter on additional 1/2 turn
8. Start engine and check for leaks

Filter Replacement

1. Turn off fuel supply from fuel tanks
2. Place a suitable container under filter
3. Open drain cock in filter housing base and drain
4. Remove filter body (with element)
5. Discard filter element
6. Clean housing and close drain cock
7. Install new filter in housing
8. Fill housing with clean fuel
9. Install filter housing (containing new filter element) with a new gasket (lubricate with fuel or engine oil) and tighten
10. Open fuel line shut off valve
11. Start engine
12. Check for leaks

Notes:

UNIT 4.2 - CHECKLIST NUMBER 2

## CHECKING ENGINE OIL LEVEL AND CHANGING OIL FILTERS

### Oil Level

1. Park vehicle on level ground, shut engine off (allow a few minutes far oil to drain down before checking)
2. Locate dipstick
3. Pull stick out, wipe clean and replace
4. Pull out again, check oil 'level
5. Level should be maintained between the full and add marks (Do not overfill or operate vehicle when oil level is below add mark)

### Changing Filter

1. Remove drain plug from bottom of filter housing, drain oil
2. Remove filter housing containing filter element (consult manufacturer's owner guides for specific instructions on removal of filter elements)
3. Discard filter
4. Clean housing and cover
5. Replace with new filter element, secure housing
6. Replace drain plug
7. Start engine, check for leaks
8. Shut engine down, wait 10 minutes
9. Check oil level (add sufficient oil to bring it to proper level on dip stick)

## UNIT 4.2 - CHECKLIST NUMBER 3

## CHECKING COOLANT LEVEL AND CHANGING COOLANT FILTERS

### Coolant Level

Preparation

1. Shut engine off (never check when running)
2. Wait until engine has cooled
3. Even then use extreme care when removing radiator cap
4. Protect hands (gloves, thick cloth)

Removing radiator cap

1. Turn cap slowly to the first stop
2. Step back while pressure is released from cooling system
3. When all pressure has been released, press down on the cap and remove it

Checking coolant level

1. Visually check level of coolant, add if necessary (consult operators's manual for specific instruction for your particular vehicle)
2. Some vehicles have sight glasses or see through overflow containers for checking coolant level.

### Changing Coolant Filters

Preparation

1. Shut engine off
2. Wait until engine has cooled
3. Do not handle hot filter with bare hands (gloves, thick cloth)

Removing filter

1. Turn filter element counter clockwise and remove
2. Replace with new filter element and new cover gasket
3. Start engine, check for leaks

## UNIT 4.2 - CHECKLIST NUMBER 4

### CHECKING BATTERY FLUID LEVEL

#### Precautions

1. Caution: Batteries contain acid which will cause severe burns if contacted with skin
2. Batteries give off explosive gases--no smoking
3. Protect eyes with goggles or glasses

#### Checking Fluid Level

1. Open battery caps, check fluid level (not necessary with maintenance free batteries)
2. Fill if needed--bring level to bottom of split ring in cell filler well (Add distilled water if possible, never use acid)

### PROCEDURE FOR CHECKING, POWER STEERING FLUID LEVEL

#### Preparation

With engine running at normal operating temperature, turn steering wheel back and forth several times to stabilize fluid level

#### Checking Fluid Level

1. Stop engine
2. Remove dipstick
3. Fluid should register between bottom of dipstick and full mark
4. Add if necessary, bring level to full mark, do not overfill (Consult manufacturer's specification in owner's manual for correct type of fluid)

## UNIT 4.2 - CHECKLIST NUMBER 5

### CHANGING AIR FILTER ELEMENT

## CHANGING AIR FILTER ELEMENTS--DRY AIR CLEANERS

On air cleaners with a restrictions indicator, change or clean element when indicator shows red

On vehicles equipped with an air filter restriction gauge, replace element when gauge reads 25" for Cummins and Caterpillar engines and 20" for Detroit Diesel engines

### Steps

1. Remove end covering from housing
2. Remove filter element (do not handle with greasy hands)
3. Inspect end cover and gasket surfaces for dents or possible air leaks
4. Check outlet tube (should be clean and undamaged)
5. Check filter element for holes and tears (replace if damaged)
6. If filter is undamaged, it may be cleaned by using compressed air (always blow air in opposite direction of normal air cleaner flow)
7. Wipe out any dirt in the filter housing
8. Install filter element
9. Replace end cover and secure

NOTE: Always handle filter element carefully to prevent dirt from shaking loose onto clean side of system.

## UNIT 4.2 - CHECKLIST NUMBER 6

### CHANGING HEAD LAMP

A supply of smaller lights as well as sealed beam head lamps, fuses and wire should be carried with the vehicle

**Steps**

1. Park vehicle, shut off and secure
2. Remove trim ring from burned out light
3. Unfasten mounting screws
4. Disconnect light from socket and remove
5. Remove any dirt or bugs from socket area
6. Replace with new head lamp (plug it in)
7. Test lamp to see if its working properly
8. Fasten mounting screws
9. Replace trim ring
10. Make sure new light is clean

NOTE: Do not touch head lamp adjusting screws!

### CHANGING FUSES AND RESETTING CIRCUIT BREAKERS

**Fuses**

Always use right size and amp fuse (new fuse should have the same amp rating as the fuse it replaces)

**Steps**

1. Check the fuse and clip holder for cleanliness and burrs
2. If dirty, touch up the contact points with a coarse cloth
3. Gently but firmly snap new fuse into clip holder (make sure there is a good connection between fuse ends and clip holder)

**Circuit Breakers**

1. Remove circuit breaker cover panel
2. Flip the circuit breaker switch back in the opposite direction to reset
3. Replace panel

UNIT 4.2 - **CHECKLIST NUMBER 7**

## DRAINING MOISTURE **FROM** AIR RESERVOIRS

1. Place vehicle on level ground
2. Chock wheels
3. Open drain cocks by twisting valve on bottom of tank
4. Allow all air pressure to escape (0 psi)--this will permit moisture to drain
5. Close valve

## DRAINING **MOISTURE FROM FUEL SYSTEM**

1. Locate filter with water separator
2. Remove drain plug at bottom of filter
3. Allow water to drain
4. Replace drain plug

## UNIT 4.2 - CHECKLIST NUMBER 8

ADJUSTING **BRAKES**

### Drum Brakes (S-cam)

Preparation

1. Chock wheels
2. Clean adjusting area
3. Press down on lock collar
4. Turn adjusting screw until shoes make contact with the drum
5. Visually check to see that contact was made

The adjusting screw is being turned the wrong way if:
The screw turns more than two full turns
The push rod starts to pull out of the chamber

Adjustment

1. Back screw off 1/2 turn
2. Measure push rod travel
   With air pressure
   Have someone apply pressure (100 psi)
   Push rod should travel between 1 and 1-1/2 inches
   With a prybar
   If alone pull out push rod with a prybar
   Pushrod should travel between 1/2 and 3/4 inches

### Disc Brakes (Power Screw)

Preparation

1. Chock wheels
2. Clean adjusting area
3. Turn adjusting nut until brake linings contact disk
4. Check visually to see that contact was made

Adjustment

1. After linings contact disk, back screw off one complete turn

2. Road test (this type adjustment will provide a slightly increased stroke and will necessitate more frequent adjustments)

Note: This is a simplified illustration of brake adjustment procedures. Remember, brake adjustments should be performed only by a trained driver, following maintenance manual procedures and then only to enable the driver to move vehicle to a point where service by a qualified mechanic is available.

Notes:

## UNIT 4.2 - CHECKLIST NUMBER 9

### CHECKING TIRE AIR PRESSURE

1. Remove valve stem cap
2. Place air gauge over valve stem opening
3. Read inflation pressure (inflate if necessary)
4. Replace cap
5. Check operators manual or read correct inflation pressure for tire on its side wall
6. Replace cap

NOTE: Never check air pressure when tires are cold, hot readings are incorrect.

### CHANGING A WHEEL/TIRE ASSEMBLY

Secure **Vehicle**

1. Park vehicle on level ground
2. Chock other wheels fully against vehicle movement
3. Set parking brakes and place transmission in lowest forward gear

Inspect Tire

1. Check for over inflation
2. Compare appearance of tire with that of other tires
3. Check side and lock rings
4. On duals, also check seating of inner tire
5. If inflation or seating does not appear normal, avoid attempting tire change, obtain expert help

**Place Jack**

1. Refer to owners manual to determine proper placement of jack for removing the tire to be changed
2. Place hardwood plank or block under base of jack regardless of surface

## Remove Wheel/Tire Assembly

1. Loosen stud nuts

2. Observe direction of rotation
   Examine thread
   On some wheels, direction indicated on end of stud
   "R" means to right (clockwise)
   "L" means to left (counter-clockwise)

3. Stand to one side of tire. Portions of wheel assembly may fly outward and cause injury when stud bolts are loosened

4. Turn stud nuts by hand until they are flush with the end of the stud

5. Loosen clamp (on cast-type wheels)

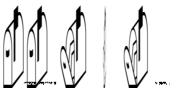
6. Tap with hammer
   Don't remove stud nuts until clamp is free
   Clamp could fly off studs

7. Remove air lines from any wheels with a tire pressure sensing device, and cap the line and actuator

8. Raise vehicle
   Jack up vehicle to allow tire to clear the surface
   Stand clear of vehicle while raising jack
   Vehicle could slip off jack and cause severe injury
   if arms, legs, or head are under the vehicle

9. Remove the wheel assembly
   Remove stud nuts
   Pull off wheel assembly

10. Remove inside wheel of a dual wheel assembly following the same procedure

Notes: 

## Replace Wheels

1. Replace inside duals first

2. Mount wheel
   - Place wheel on hub
   - Install rim clamp (cast-type wheel)
   - Install stud nuts
   - Tighten nuts properly

3. Follow prescribed pattern
   - Consult owners manual for proper pattern
   - If manual not available, use the following tightening sequence:

4. If wheel is free to rotate, move the nut to be tightened to the top position

5. Use proper tightening procedure
   - Tighten with lugwrench

6. Use torque wrench for final tightening
   - Follow torque specifications in owners manual
   - Don't over tighten
     - Can damage rim
     - Can strip treads on stud
   - Don't under tighten
     - Nuts can work loose
     - Wheel could come off

NOTE: Never use oil or grease on studs.

7. If tires equipped with pressure sensing device
   - Remove caps
   - Connect air line to actuator

8. Lower vehicle
   - Lower jack until tire supports the weight of the vehicle
   - Remove the jack

9. Store equipment in proper place
   - Jack and support plank
   - Store damaged tire (where spare came from)
   - Remove wheel chock

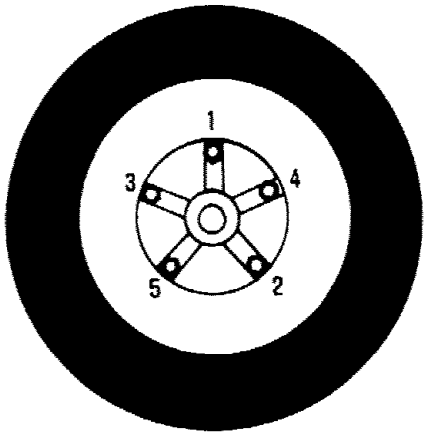
## Recheck Torque

1. Stop after driving a few miles and tighten nuts as necessary using torque wrench
   - Rotation of wheel almost always loosens wheel
   - Nuts can fall off unless tightened

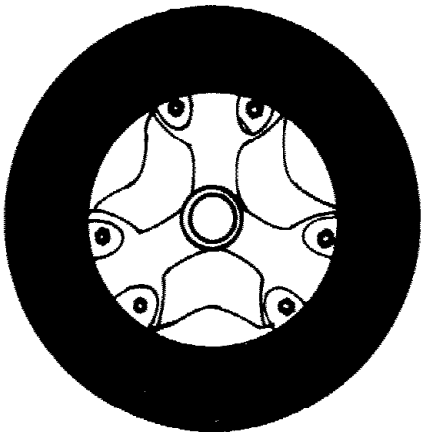
2. Repeat process after 100 miles

# *Wheel Lug Tightening Sequence For Spoke and Disk Type Wheels*

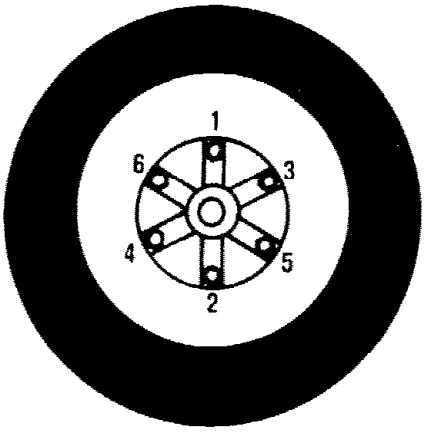
## 5 Spoke Cast Wheel



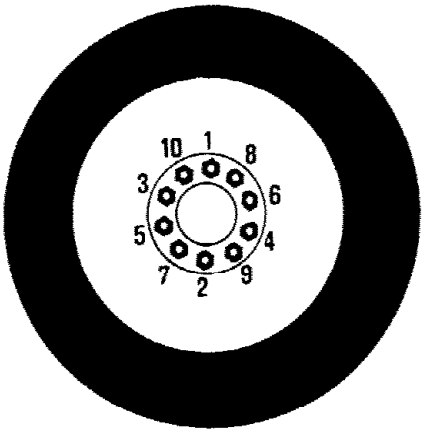

## 3 Spoke Cast Wheel



## 6 Spoke Cast Wheel




## Disk Wheel



# UNIT 4.3
# DIAGNOSING AND REPORTING MALFUNCTIONS

# UNIT 4.3 DIAGNOSING AND REPORTING MALFUNCTIONS

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- 0 identify vehicle systems or components that are functioning properly, in imminent danger of failing or functioning improperly.
- o describe, through sight, sound, feel and smell, the symptoms of improper operation completely and accurately to the people in charge of maintenance.
- o start a vehicle with dead batteries or no air pressure (if equipped with air starters).

You will learn

- o the importance of not attempting vehicle repairs for which you are not qualified.
- o the importance of properly reporting breakdowns that occur enroute.

## WHAT WILL HAPPEN IN THIS UNIT

Most of this unit will take place in the classroom. You will learn the importance of, and techniques for, troubleshooting and reporting malfunctions. The classroom lesson concludes with an exercise in troubleshooting and filling out vehicle condition report forms. In the lab, you will observe how to start a vehicle with dead batteries or no air pressure.

## Outline of Classroom Lesson

Lesson 1 - Diagnosing and Reporting Malfunctions

I. The Importance of Troubleshooting and Reporting
   A. Driver Awareness
   B. Early Detection of Malfunctions
   C. Driver Responsibility
   D. Mechanics Responsibility
   E. Driver and Mechanic Joint Responsibility

II. Troubleshooting
   A. Knowledge of Vehicle
   B. Detection of Symptoms
   C. Troubleshooting Guide

III. Reporting Requirements
   Driver's Job

IV. Problem-Solving Exercise

V. Summary

## Description of Lab Lesson

Lesson 2 - Emergency Starting Procedures

In this lesson the instructor will demonstrate procedures for starting a vehicle that has a dead battery and for starting a vehicle, equipped with an air starter, that has no air pressure.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- o Troubleshooting Guide
- o Procedures for Jump Starting Dead Batteries - Checklist
- o Procedures for Starting Vehicle with Air Starter--No Air Pressure -Checklist

## TROUBLESHOOTING GUIDE

| | IF YOU SEE | SYSTEM AFFECTED | WHAT TO LOOK FOR | WHAT TO DO |
|---|---|---|---|---|
| 1. | Ammeter shows continuous maximum charge | Electrical | Short circuit in wiring | Disconnect battery terminals until short has been repaired |
| | | | Points in in voltage regulator or cutout sticking | Have mechanic repair |
| 2' | Ammeter shows discharge with motor running | Electrical | Loose connection or short in wiring | Tighten connection |
| | | | Battery installed wrong | Reverse battery leads |
| | | | Burned out or improperly adjusted generator or alternator | Have replaced or repaired by mechanic |
| | | | Loose or broken alternator | Replace or tighten belt |
| 3' | High engine temperature | Cooling | Low water level | Shut off engine. Allow to cool to normal. Add water. |
| | | | Frozen radiator - | Cover radiator, run motor slowly, add water as needed. |
| | | | Broken fan belt | Replace fan belt |
| | | | Retarded water or oil circulation | Have checked and repaired by mechanic |
| | | | Defective fan clutch or shutters | Have checked and repair by mechanic |
| 4' | Coolant, oil or fuel dripping | Cooling, Lubricating, or Fuel System | Check for source of leak | Have repaired by mechanic |
| 5' | Gauge reading out of proper range | | Check the system that the gauge refer to | Have mechanic check gauge and appropriate system |

| IF YOU SEE | SYSTEM AFFECTED | WHAT TO LOOK FOR | WHAT TO DO |
|---|---|---|---|
| 6. Excessive exhaust smoke | Exhaust or turbo system | Air cleaner dirty<br>Poor grade fuel<br>Return fuel line blocked, bent or squeezed together<br>Engine over-fueled<br>Fuel pump malfunctioning | Clean filter<br><br>Let mechanic check |
| 7' Black exhaust smoke | Engine, fuel system | Overrich mixture due to<br>- restricted air supply<br>- poor fuel spray distribution<br>- improperly adjusted fuel control racks<br>or<br>- overloading or lugging the engine | Clean or change filters<br>Let mechanic check<br><br><br><br><br><br>Shift to lower gear to keep engine speed up |
| 8. White (sometimes grey) exhaust smoke | Engine, fuel system | Due to incomplete combustion in cold engine. Should clear up when engine warms.<br>If it doesn't, look for misfiring due to<br>- Worn injector spray holes<br>- Low cylinder compression<br>- Faulty cooling system<br>- Low fuel volatility | Have mechanic check |

| IF YOU SEE | SYSTEM AFFECTED | WHAT TO LOOK FOR | WHAT TO DO |
|---|---|---|---|
| 9. Blue exhaust smoke | Engine, fuel system | Due to the burning of large quanitities of lubricating oil as a result of<br>- Worn intake value guides<br>- Poor oil control ring action<br>- Worn blower shaft seals<br>- Overfilled oil bath air cleaner | Have mechanic check |
| 10. Low oil pressure reading | Lubrication system | Oil has become diluted by fuel or coolant leaks | Let mechanic check |
| | | High oil temperature | Let mechanic check |
| | | Worn oil pump | |
| | | Wrong weight oil for type of weather conditions | Change oil |
| | | Dirty filters | Clean or replace |
| | | Worn bearings | Replace |
| | | Oil and filter needs changing | Change oil and filter |
| | | Oil leak | Let mechanic check |
| 11. Metallic click in time with wheel revolutions | Suspension, wheels or tires | Wheel loose on axle | Tighten axle nut |
| | | Loose wheel or tire lugs | Tighten lugs |
| | | Piece of metal in tire | Remove metal or change tire |
| 12. Dull thud in time with with wheel revolutions | Wheels and tires | Flat tire | Change tire |
| | | Loose wheel or tire lugs | Tighten lugs |
| | | Rock between duals | Remove rock |

| IF YOU SEE | SYSTEM AFFECTED | WHAT TO LOOK FOR | WHAT TO DO |
|---|---|---|---|
| 13. Clanking noise in time with wheel revolutions | Tire on drive train system | Lock rim off tire<br>Loose drive shaft | Change tire<br>Have tightened by mechanic |
| 14. Dull thud or loud rap in time with motor | Engine | Burned out main or connecting rod bearing<br>Piston slap | Shut off motor. Contact garage for instructions |
| 15. Air escaping | Tires, air system, braking system | Punctured or damaged<br>Open petcock on air<br>Air lines or fittings leaking<br>Brake application or relay valve sticking<br>Ice on brake valves | Change tire<br>Close petcock<br>Repair lines, tighten or change fittings<br>Apply air to brakes several times<br>Apply heat |
| 16. Snap or click when starting from dead stop | Drive train system | Loose universal joint bolts<br>Excessive wear in universal joint or differential | Tighten bolts<br>Report to mechanic |
| 17. Under floor noises | Drive train | Clutch trouble<br>Bad throw-out bearing<br>Bent drive shaft<br>Broken teeth in transmission | Have mechanic check |
| 18. Whine--harsh with high pitch | Drive train on engine system | Worn accessory drive gears<br>Loose belts | Let mechanic check<br>Tighten belts |

| | IF YOU SEE | SYSTEM AFFECTED | WHAT TO LOOK FOR | WHAT TO DO |
|---|---|---|---|---|
| 19. | Whine--short with high pitch | Engine | Ball bearing spinning in housing | Have mechanic check |
| | | | Generator or alternator malfunctioning | |
| | | | Water pump malfunctioning | If water pump, shut off engine immediately |
| 20. | Clicking sound in engine with loss of power, sluggishness and overheating | Engine | Broken valve spring<br>Worn timing gear | Have mechanic check |
| 21. | Sudden loss of power | Brake, drive train, engine or fuel system | Brakes dragging | Have adjusted by mechanic |
| | | | Clutch slipping | Have adjusted by mechanic |
| | | | Spark plug wire disconnected | Replace wire |
| | | | Overheated engine | Determine cause of overheating and remedy |
| | | | Vapor lock | Let cool |
| 22. | Engine surges | Fuel or engine system | Air in fuel system<br>Worn gear on fuel pump<br>Throttle linkage loose<br>Low fuel supply<br>Buffer screw not properly set | Have mechanic check |
| 23. | Brakes grab | Braking system | Grease on brake lining | Have grease removed by mechanic |
| | | | Improperly adjusted brakes | Have readjusted by mechanic |

| IF YOU SEE | SYSTEM AFFECTED | WHAT TO LOOK FOR | WHAT TO DO |
|---|---|---|---|
| 24, Brakes don't hold | Braking system | Brakes out of adjustment | Have readjusted by mechanic |
| | | Grease on linings | Have removed by mechanic |
| | | Water or ice on linings | Drive short distance with hand brake set |
| | | Low air pressure | Check for air leaks |
| | | Air tanks full of oil or water | Bleed air tanks |
| | | Master cylinder low on fluid | Fill master cylinder |
| | | Worn brake linings | Have replaced by mechanic |
| | | Hydraulic line broken | Repair or install new line |
| | | Broken air line or fitting leaking | Repair or install new air line or fitting |
| 25. Constant pull to right or left on steering | Tires, suspension, braking or steering system | A soft tire | Repair or change it |
| | | A broken spring | Drive carefully until it can or repaired |
| | | One front brake tight | Adjust or have adjusted by a mechanic |
| | | Misadjusted tandem or front axle alignment | |

| IF YOU SEE | SYSTEM AFFECTED | WHAT TO LOOK FOR | WHAT TO DO |
|---|---|---|---|
| 26. Vibration in engine | Engine system | One or more cylinders not firing, caused by defective spark plugs, shorted spark plug wires, or wires off spark plus | Change plugs or make necessary adjustments |
| | | Sticky valve | Have repairs made by mechanic |
| | | Broken valve | |
| | | Blown cylinder head gasket | |
| | | Vibration damper loose or worn | |
| | | Unbalanced or damaged fan | |
| | | Engine mounting loose or worn | |
| | | Engine out of line in frame | |
| | | Clutch out of balance | |
| | | Drive line out of balance or line | |
| | | Bad injectors | |
| 27. Vibration in steering in time with rotation of wheels | Tire, wheel or rim | Wheels out of balance | Have adjustments made by mechanic |
| | | Bubble on side of tire | Change tire |
| | | Broken lock rim on tire | Change tire |
| | | Bent wheels or rims | Change tire |
| | | Uneven tire wear caused by other defects | Have defects remedied by mechanic |
| | | Tire mounted on wheel incorrectly | Loosen tire lugs and tighten evenly |
| | | Loose wheel lugs, broken studs | Tighten lugs, have broken studs replaced |

| IF YOU SEE | SYSTEM AFFECTED | WHAT TO LOOK FOR | WHAT TO DO |
|---|---|---|---|
| 28, Gradual loss of power | Fuel or engine system | Fuel filter dirty or clogged | Clean or replace |
| | | Throttle linkage worn | Let mechanic check |
| | | Air filter clogged | Clean filter |
| | | Fuel pump gear worn | Let mechanic check |
| | | Dirty air filter | Clean or replace |
| | | Cam lobes worn | Clean or replace |
| | | Faulty valve | Let mechanic check |
| 29. Burning rags | Drive train, engine, or brake system | Overheated engine | Remedy cause |
| | | Clutch slipping (engine will race) | Have adjusted by mechanic |
| | | Hot or dragging brakes | Have adjusted by mechanic |
| | | Hand brake not released | Release brake |
| 30. Burning rubber | Braking system, tire or electrical system | Tire on fire | Extinguish immediately and remove from vehicle |
| | | Hot or dragging brakes | Have adjusted by mechanic |
| | | Short circuit in wiring | Disconnect battery terminal |
| | | Belt slipping or frozen pulley bearing | Tighten or replace |
| 31. Diesel fuel oil | Fuel systems | Any leaks in system | Have repaired by mechanic |
| 32. Burning oil (May also smell like burning rags) | Lubrication or engine system | Oil dripping on exhaust manifold or pipe | Find source of oil leak wipe off excess oil |
| | | Overheated engine | Ascertain cause of overheating and repair or have repaired |
| 33. Exhaust odor | | Cracked manifold | Have repaired by mechanic |
| | | Loose connection in exhaust system | Keep cab well ventilated until repairs have been made |
| | | Leaking muffler | |
| | | Improperly located tail pipe | |

# UNIT 4.3 CHECKLIST

## PROCEDURES OR JUMP STARTING DEAD BATTERIES

### Observe Safety Precautions

1. Shield eyes or wear safety goggles
2. Don't smoke
3. Make sure batteries are negatively grounded and carry same voltage (e.g., 12 volt charging 12 volt)
4. Do not get battery acid on skin or clothing
5. Never jump start if battery fluid is frozen

### Prepare Vehicle

1. Align vehicles (do not let vehicles touch each other)
2. Set parking brakes
3. Place transmission in neutral
4. Add water to battery if needed

### Hook-Up Jumper Cables

Steps must be taken in order

1. Clamp jumper cable to positive pole of dead battery.
2. Clamp other end of the same cable to positive pole of booster battery.
3. Connect second cable to negative pole of booster battery. Be careful that the two cables don't touch each other.
4. Attach other end of second cable to truck frame or block of disabled vehicle, as far away from battery as possible.
5. Start engine of booster truck, wait a few minutes to allow current from booster battery to flow to dead battery.
6. Crank engine of disabled vehicle with clutch disengaged to reduce load on cranking motor.
7. When disabled vehicle is started, immediately remove jumper cables carefully in reverse order of how they were put on.

NOTE: Care must be taken to identify negative ground systems before attempting to use these procedures. If this is not done, serious damage to a vehicles alternator could result.

## PROCEDURES FOR STARTING VEHICLE WITH AIR STARTER--NO AIR PRESSURE

### Prepare Vehicle

Align vehicle with a charged air supply.

### Hook-Up

Using a Compressor

1 Hook up an air line from compressor to the gladhand of the disabled vehicles air reservoir

2. Fill reservoir

3 Start disabled tractor

Using Another Tractor

1. Hook up an air line from one reservoir to the other

2 Start the booster tractor

3 Fill empty air reservoir on disabled vehicle

4. Start disabled tractor

# Notes:

Notes:

UNIT 5.1
ANDLIN
CARGO

# UNIT 5.1 HANDLING CARGO

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- load and unload cargo safety and efficiently.
- make sure that the weight and the distribution of the load meet safety standards and legal requirements.
- secure loads properly.
- mount placards when carrying hazardous materials.

You will learn

- the various methods for securing cargo, including how to block, brace, pack, and stack cargo.
- how to use straps, rope, cable, chains and chain binders for safe tiedown to prevent damage and accidents.
- how common cargo handling equipment works, including pallets, jacks, dollies, handtrucks, forklift trucks, nets, slings, rug poles, and Johnson bars.
- the kinds of hazardous materials and when placards and special paperwork are required.
- Federal and State regulations on loading, weight limits, and distribution of cargo.
- why improper loading and unloading, overloading, and improper weight distribution are dangerous.
- the kinds of unstable freight and how to handle unstable freight.
- how to operate common cargo handling equipment safely.
- how to tie knots for securing cargo.
- how to block and brace cargo properly.

## WHAT WILL HAPPEN IN THIS UNIT

This unit consists of two classroom lessons and two lab lessons, the last of which is optional.

### Outline of Classroom Lessons

Lesson I - Basic Cargo Handling Procedures and Requirements

I. The Importance of Proper Cargo Handling
   A. Overview
   B. Consequences of Improperly Secured Cargo
   C. Driver's Responsibilities
   D. Federal, State and local Regulations

II. Principals of Weight Distribution
   A. Overweight Definitions
   B. Weight Distribution
   C. Consequences of Overloads/Poor Distribution
   D. Problem Solving Discussion

III. Principles and Methods of Cargo Securement
   A. Problems Associated with Improperly Secured or Covered Cargo
   B. Driver Responsibility
   C. Loading Procedure
   D. Sealed and Containerized Loads
   E. Examples of Loading and Securing Common Loads
   F. Driving Specialized Cargo
   G. Recap

IV. Handling Hazardous Materials
   A. Basic Types of Hazardous Materials
   B. Handling Hazardous Materials
   C. Inspecting Vehicles Carrying Hazardous Materials

V. Problem-Solving Discussion: Seven Situations

Lesson 2 - Techniques for Loading, Securing and Unloading Cargo

I. Function and Operation of Cargo Handling Equipment
   Types of Equipment to Move Cargo
   Student Problem-Solving Exercises

II. Demonstration of Cargo Securing Equipment

### Outline of Lab Lessons

Lesson 3 - Demonstration of Cargo Securement

In this lesson you will practice tying down and covering cargo on a loaded trailer, You will start with a trailer that is completely loaded except for one or two pieces of cargo. The class will inspect the load and discuss the distribution of weight. Under the instructor's supervision, you will then load the remaining cargo, tie it down and secure the tarpaulin.

Lesson 4 - Observation of Cargo Handling Operation (This is optional lesson)

This lesson consists of a field trip to a local freight terminal or similar operation to give you a first hand look at actual cargo handling operations. Among the things you may observe are, shipping papers and their use, loading and unloading of cargo and the operation of cargo handling equipment. Your instructor may elect to omit this lesson if suitable facilities and sufficient time cannot be found to include it.

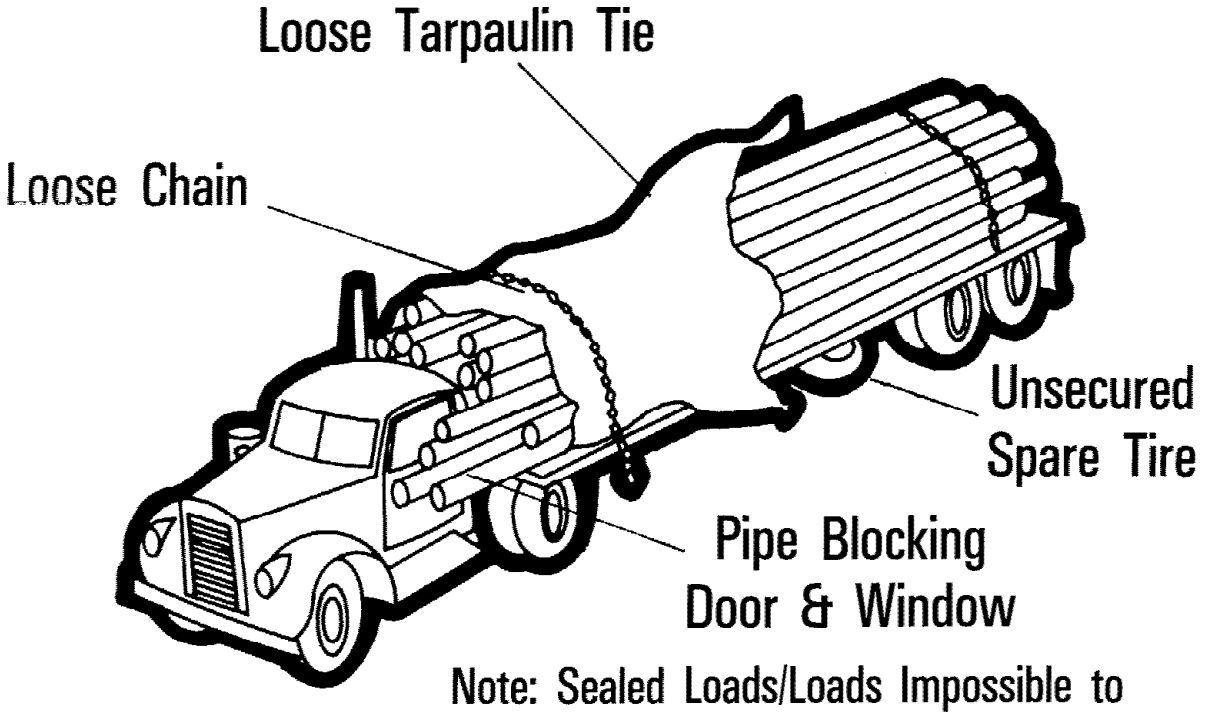
STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Copy of the Federal Motor Carrier Safety Regulations, Parts 390-397.
- Driver responsibilities for checking securement of cargo.
- Cargo Handling responsibilities and safety tips.
- Copy of J.J. Keller and Associates "Drivers Pocket Guide to Hazardous Materials - Compliance with Materials Transportation Bureau and Bureau of Motor Carrier Safety Regulations on Hazardous Materials and Waste" (or similar simplified version of Title 49 - Code of Federal Regulations - Parts 100-177).

# *Driver Responsibilities*

## *For **Checking** Securement of Cargo*




Note: Sealed Loads/Loads Impossible to Examine Needn't Be Checked.

1. Check Load, as Shown, Before Leaving.

2. Stop After 1st 25 Miles, Examine Load & Adjust if Necessary.

3. If Driver:
   a. Changes His Duty Status or
   b. Drives 3 Hours or
   c. Drives 150 Miles He Must Recheck & Readjust Load. (Can Do It More Often If He Needs or Wants to)

## CARGO HANDLING RESPONSIBILTIIES

As a driver you may be called on to load or unload your vehicle. Even if you aren't, you are responsible to see that the vehicle is not overloaded, that the weight of the cargo is properly distributed and that the cargo is properly secured.

There are three key reasons why you have that responsibility.

First--you are responsible for the condition of the cargo. If it isn't loaded and secured properly, it could be damaged or lost enroute.

Second--You have an obligation to public safety. The law says that you can't operate an overloaded vehicle or one on which the weight of the cargo is unsafely distributed. These State laws are meant to protect State roads and bridges and to protect the public. An overloaded vehicle is hard to handle and dangerous to drive. It takes longer to stop in an emergency which could be fatal. And if the cargo is not properly secured on an open van, it could fall onto the road and be a serious danger to other drivers.

Third--You are responsbile for the condition of the vehicle that you drive. Too much cargo weight or poorly distributed weight can damage suspensions, tires, and put a greate strain on the transmission. Proper cargo handling and loading is not only important for the vehicles safe handling, but to the life of its components.

## CARGO HANDLING PRINCIPLES

Cargo handling and freight hauling is a complex business today. Different kinds of cargo require different kinds of trailers and different kinds of loading and securing equipment and techniques. You will have to learn those special techniques from the carrier who hires you. For example, if you are hired to haul tankers, you must be trained on the special techniques for loading, inspecting and driving those tankers.

Even though there are as many loading and securing techniques to learn about as there are types of cargo, there are some basic principals that apply to all types of cargo. These principals are discussed briefly below.

### Basic Principles

There are two basic rules about cargo weight:

- o Don't overload the vehicle
- o Distribute the weight properly on the tractor and trailer.

## Avoid Overloading

The GVW (Gross Vehicle Weight) which is the total weight of the vehicle and the cargo should not exceed the limits set by State law or by the manufacturers rated capacity of the vehicle.

Also, the weight should not exceed the capacity of any component on the vehicle. This includes the manufactuer's rated capacity for tires, suspension and fifth wheel.

Axle weight is the amount of weight transmitted to the gruond by one axle or a tandem on a tractor or trailer. It is rated by the manufacturer and by State laws also. When you drive through a State weight station, the inspectors will check your GVW and the weight per axle to see if you are within the legal limits.

## Distibution of Weight Properly

The distribution of weight on the tractor and trailer has a lot to do with whether or not you exceed the capacities of any of the vehicles axles. The chart on the next page shows examples of proper weight distribution and loading. Besides the chart, there are some keypoints to keep in mind:

- o Divide the load evenly in the back and front of the trailer, putting roughly half of the load up front and half in the back.
- o Spread it evenly on the floor to prevent shifting.
- o Arrange the load to get the weight per axle within the legal limits. With the sliding tandem on the trailer, the rear position puts more weight on the tractor rear axle. If the tandem is shifted forward, more weight is put on the trailer.
- o Keep the center of gravity as low as possible. A high center of gravity makes the vehicle more dangerous to handle especially on curves and hills. Keep it low by avoiding concentration of the load on one point on the trailer, putting the heavy goods on the bottom and distributing partial loads among the axles.
- o Redistribute weight after partially unloading the vehicle. The cargo weight becomes unbalances after a partial unloading and has to be redistributed to prevent shifting and to keep the center of gravity low.

## LOADING FREIGHT ON A TRAILER

It's your responsibility to see that the cargo you deliver is not damaged. Much of that damage can occur when cargo is loaded onto the trailer. Each type of cargo has its own rules for safe handling and loading. You will have to learn those precautions when you handle different loads such as food, crated items, batteries, rugs, steel piping, cattle and so on. For

most of those items, you can usually find a booklet of instructions that will aid you in safe handling and loading, and any concientious carrier will train you on how to handle the kind of cargo he wants you to deliver. While it is impossible to give you all the rules for dealing with all the different kinds of cargo, there are some general rules that you should know. Most of these are a matter of common sense.

## Make Sure the Trailer Is Safe Before You Start

Cargo can be damaged by hazards in the trailer itself. Make sure the inside of the cargo carrying space is clean and free from bolts, nails, or metal edges which could damage cargo. And if there are holes in the floor, roof or walls, the cargo could be damaged by water.

## Make Sure the Cargo Is Packed Correctly

Do not accept wet or leaking cargo or cargo that is improperly packaged. Wet or leaking cargo is already damaged and could damage other cargo. Improperly packaged cargo could damage other cargo or the trailer enroute. Be alert for these conditions or situations:

- o Items that are too heavy for the container, especially when cardboard containers are used.
- o Containers that are not properly sealed and will allow the cargo to break out in transit.
- o Container markings, e.g., "This End Up," "Fragile."
- o Never load heavy freight on top of light freight.
- o Avoid putting containers such as cardboard or plywood on the bottom.
- o Don't mix loads, like engines and glass, unless there are rope or restraints between them.
- o Load commodities in pails, tubs and buckets "Top Up" to prevent leakage. Don't stack them too high and separate each layer with corrugated or solid fibreboard.
- o Avoid using hooks. They can be safely used but more often they damage the cargo.
- o Don't stack freight so high that it will topple over onto other freight.
- o Try to load the freight that will be unloaded first on the back of the trailer.
- o Make every effort to have the destination marking on the freight showing when you load it. But don't do this if it means disregarding "This Side Up" instructions on the freight.

## USING CARGO HANDLING EQUIPMENT

Cargo is handled by hand or with mechanical equipment. The first rule in cargo handling is--do not handle the cargo roughly, You can be out of a job real quick if you get in the habit of carelessly dropping or damaging cargo. It costs your boss a lot of money when cargo is lost or damaged.

Handling cargo means using cargo handling equipment. You have to know what equipment to use and how to use it safely. Again, this often means getting more training before you attempt to use any equipment. We've listed some of the basic equipment below followed by a few tips for handling handtrucks, forklifts and pallet jacks safely.

### Safety Tips for Cargo Handling Equipment

Those tools are put at your disposal to make your job easier and safer, and they will certainly do this if used correctly.

Two-wheel hand truck

Get trucks square with object to be loaded.

Rock object slightly forward and slip lip of trucks under. (DO NOT put lip all the way under for then you cannot get object balanced on trucks.)

Block bottom of trucks by putting foot on wheel or axle, whichever is most comfortable. (DO NOT let wheel roll and twist ankle.)

Grasp top of object with one hand and pull back on handle of truck with the other, at the same time push bottom of trucks away from you with foot. AVOID JERKY MOTIONS.

Balance the load on the wheels and roll truck by pushing--DO NOT PULL.

To unload, hold top of load and straighten wheelers easy, allow load to roll slightly forward, and pull wheelers.

Barrel trucks:

Put the lips against bottom of drum and with wheelers pushed forward put hook securely over lip of drum.

Place foot on the bracket just above the middle of the axle and holding bottom of wheelers pull back slowly until barrel is balanced over the axle.

To unload, set wheelers and barrel up and push against handles of wheelers. This will force lips out from under drum.

Level Dolly (Johnson Bar)

1. Get lip securely under the object. This might have to be done by getting a small bite at first then getting a helper to put a little block under object.

2. Get out at the end of the handle where you can get all the leverage possible.

3. Do not put handle between legs, and if you are not sure you can hold the handle down GET HELP. This handle will have tremendous power if it gets away from you and flies up.

4. This tool is nearly always used by two or more men and generally used in conjunction with pipe rollers or fork lift. It is used on very heavy objects.

Pipe rollers

1. Use same size pipe if possible.

2' Use pipe that is long enough to go across object.

3. Take it easy--do not let object run off pipe--sure hard on toes.

4. Use two or more pipes, and use the balance of the object to get next pipe under object.

Crowbar

Use the same principle here as on the lever dolly.

To make the handling of barrels easy and safe, you have been furnished with barrel wheelers which we have discussed previously, but which we shall discuss again today.

- o Don't ever try to manhandle a barrel, use barrel trucks if possible.
- o Be very careful when loading barrels onto a floor-veyer cart (do not put heavy drums on cart).
- o Move this freight as short a distance as possible, even if you have to move a truck.
- o Don't tilt a barrel over and try to roll it on the rim unless you have handled several thousands barrels this way. It will get away from you and fall on you or someone else, or will burst when it lands on its side.
- o Don't lean across a barrel to break it over, grasp the lips on the near side and pull gently, or you may have it on top of you.

- o If you have a helper, let him break the barrel so that you can get the lip of the two wheeler under it. (Assuming you are someplace where barrel wheelers are not available), then you block the wheels of the two-wheeler and pull and let him push--teamwork really counts here.

- o Occasionally you will get old oil drums cut in half and then loaded with metal ingots; those should be handled with either a fork lift or pipe rollers.

- o Coke drums have tires on them and are consequently supposed .to be laid on the side and rolled. These drums are very heavy and an ordinary man will have much trouble breaking them over. There is a definite art to handling these:

  - Get help if possible.

  - Use a wall for leg leverage, but be careful about twisting motion here or you will hurt your back or leg.

  - You can grasp the lip of the drum nearest you, block the bottom of the drum with your foot, then pull slowly (don't jerk) and when you get started good you can twist it so that it will roll off.

  - When you haul these on a truck laying down, be positive they are blocked securely.

## Using Forklifts or Other Mechanical Equipment

1. Make sure you have the proper training before you use a forklift or any mechanical loading equipment.

2. Drive a forklift carefully. Always look in the direction your are driving. And if the load blocks your view, drive in reverse.

3. Park the forklift safely, with the forks down.

4. Don't allow passengers on a forklift. It's only meant for cargo.

5. Don't run the forks too far under the load as they can come out the other side and damage other freight or the trailer.

6. Check to make sure the trailer is chocked before you drive any mechanical equipment on it. The weight of a forklift on the nose of an unchocked trailer can cause it to roll away.

## 5. SECURING AND COVERING CARGO

Cargo needs to be secured to prevent shifting or damage. Shifting cargo not only gets damaged butm akes your vehicle dangerous to handle. Federal Motor Carrier Service Regulations 393.100 though 106 gives all the requirements for securing cargo against shifting. You will need to refer to those regulations along with taining by your carrier to be able to do a good job. Some of the basic things you should know are listed below.

Blocking--is usually pieces of wood or lumber which are placed or nailed to the front or side of cargo to prevent it from shifting. Wheeled items and heavy machinery must be blocked.

Bracking--is the front and side structures used to keep the entire cargo from shifting.

Dunnage--is material used to protect or support freight. For example, inflatable cargo dunnage made of nylon can be used to fill damage causing space inside a trailer.

### Cargo Tiedown

Besides being properly blocked and braced and protected by dunnage, cargo needs to be properly secured by ropes, straps or chain. This applies to cargo inside closed trailers as well as cargo on open vans. While cargo on open trailers is obviously secured so it won't fall off, cargo inside a van has to be secured to prevent it from shifting around.

#### Ropes

You must know the strength and type of rope before you use it. Never use ordinary rope to tie down a cargo and always inspect rope as it can be affected by moisture and can rot. Rope is used to tie down cotton bales and similar loads and as added tie down for other cargo secured by straps or chains. You have to know how to tie a knot to use rope to secure cargo. A common trucker's know is illustrated later in this material.

#### Straps

Straps are made of synthetic material such as nylon, so they are not subject to rotting. Straps are tightened by tensioning devices such as buckles, winches or ratchets. They can be used on a variety of ways from bracing loads in a closed van to tying down heavy loads on an open trailer. They are subject to chafing and must be inspected. Straps are rated by the amount of the Toad they can hold, from 500 to 10,000 pounds. You must make sure that the strap used to secure a load is rated strong enough to carry the load.

Chains

Chains are the strongest tie down device and are used to tie down heavy loads such as steel machinery, steel piping and lumber. Chains should not be used on loads they will damage, such as cardborad cartons or crates. Like straps, chains are rated by strength. And while very strong, you need to check for broken or bent links when you use chain. Also, chains are subject to corrosion and must be covered when not in use.

Chain Binder Safety Tips

- o Never ever attempt to operate (lock or release a load binder) while standing on the load.
- o When locking (taking slack out of chain) a load binder always position it so that you pull down on the handle not push up--letting gravity give you a hand.
- o Whenever more leverage is needed to lock or relese a chain binder a piece of pipe may be slid over the handle to increase the leverage. However, be careful to slide the pipe all the way down on the handle so that it doesn't accidently slip off during the process.
- o Be careful when using a pipe extension (called a "cheater bar") not to damage the chain binder.
- o Never, place any part of you body in such a position so that it can be struck by handle as it rotates or flips from the locked to the released position or vice versa.
- o Always have feet firmly planted on the ground at all times because of Number 5 above or in case the chains, binder or point of chain attachment should break.

Edge Protectors

A piece of rubber between a strap and the sharp edged cargo it is holding down protects the strap. Similarly, a piece of rubber between a chain and cargo it is holding down protects the cargo from damage by the chain.

## Cargo Covering

There are two reasons to cover cargo on an open trailer--to protect the cargo from the weather and to protect the public from falling cargo. Steel and other metal cargo is highly corrosive and if it is not covered, it will be ruined by wet weather. If you are the driver who makes that mistake, you are the one who takes the heat.

There is a wide variety of lightweight special tarps to prevent different cargos. You need to make sure you use the right kind of tarp. For example, special tarps are used for steel hauling and for covering other machinery that is easily corrected.

There are some basic things you should know about cargo covering and using tarps.

- o First, you are responsible for covering the cargo.
- o Inspect the covering before you use it. A ripped or leaking tarp offers little protection.
- o Put the tarp on securely
  - --Slip the tarp on from front ;to back
  - --Pull it back so the nose fits snugly
  - --Center it so it hangs equally
  - --Tie it securely with rubber ties or hemp rope
- o Protect the tarp by placing padding between the tarp and the sharp edges of machinery or similar cargo.

UNIT 5.2
CARGO
DOCUMENTATION

# UNIT 5.2 CARGO DOCUMENTATION

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn how to

- o check your cargo on both pickup and delivery to see what it is, how much there is, and what condition it is in.
- o check the information on the bill of lading and properly record and report any over, short, or damaged cargo.
- o obtain required signatures on delivery receipts and other required forms.
- o properly prepare a manifest, freight bill, bill of lading, and other required forms.
- o meet the requirements for hazardous materials and waste documentation.

You will learn

- o the driver's responsibilities for making sure paperwork is properly filled out.
- o the problems that can be caused by paperwork that is not properly filled out.

## WHAT WILL HAPPEN IN THIS UNIT

The entire unit will take place in the classroom. Following the presentation of information, you will participate in discussion and problem-solving activities in which you can practice applying what you have learned.

## Outline of Classroom Lessons

Lesson 1 - Cargo Documentation: Basic Forms and Procedures

I. Basic Definitions and Forms
   A. Definitions of Motor Carriers
   B. Who Needs Cargo Documentation
   C. Basic Terms Related to Freight
   D. Definitions of Documents
   E. Transportation Charges and Services

II. Filling Out Basic Shipping Documents
   A. Bills of Lading
   B. Freight Bills
   C. Cargo Manifest
   D. Other Documents Related to Shipping

III. Pickup and Delivery Procedures
   A. Pickup of Freight
   B. Delivery of Freight
   C. Special Pickup and Delivery Situations
   D. Interline Freight

IV. Documentation and Placarding of Hazardous Materials
   A. Basic Responsibilities
   B. Labeling and Placarding Hazardous Materials

V. Review

Lesson 2 - Cargo Documentation Problems

I. Review of Cargo Documentatjon Procedures
   A. Four Situations Involving Cargo Documentation
   B. Problem-Solving Exercise: Preparing a Bill of Lading

II. Consequences of Faulty Cargo Handling Procedures
   A. Main Reasons for Cargo Loss
   B. Main Reasons for Cargo Damage
   C. Consequences of Loss and Damage Affect Driver
   D. Prevention of Cargo Loss and Damage
   E. Student Discussion: What Can the Driver Do?

III. Procedures for Over, Short, and Damaged Cargo

   A. Discrepancies that Occur on Delivery of Freight
   B. What Happens When O, S, and D Occur
   C. General Procedures for Handling All Cargo Discrepancies

IV. Problem-Solving Situations--Class Discussion of Four Cargo Documentatjon Problems

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- The Bill of Lading (a description of the Uniform Straight Bill of Lading, Order Notify Bill of Lading and Shipper's Weight Load and Count)

- Pickup and Devliery of Freight Checklist

- The Handling of Hazardous Materials and Wastes
- Official U.S. DOT Chart (in color) covering Hazardous Warning Labels (side 1) and Warning Placards (side 2)
- Problem Solving Exercise: Preparing a Bill of Lading (for use in class)
- Uniform Order Bill of Lading (for use in class exercise)
- o Handling "Over", "Short" and "Damaged" Freight Checklist

## Uniform Straight Bill of Lading

| Section | Instructions |
|---|---|
| Carrier | The name of the carrier agreeing to the contract |
| Shipper | The carrier fills in this part when he accepts shipment and describes the terms on which the goods were received. "In apparent good condition..." This means the driver needs to check to make sure that those goods are in good condition when he/she picks them up. |
| Date | The pickup date must be entered here because tariffs and other freight charges are based on this date. It is also important in deciding whether the shipment was delayed or delivered within the schedule agreed on. |
| Consignee | Filled out by the shipper, this shows where the goods are going. "Consigned to ABC Company..." The address must be complete and clear. |
| Routing | All the carriers involved in the shipment need to be listed here and the delivery carrier has to be indicated. |
| Collection information | This will be filled by the carrier to indicate how the goods will be paid for by the consignee. If it's "prepaid" the driver has no concern. It it is COD, the driver must know what kind of check his carrier will accept. Normally a certified check is required. However, the consignee might have credit with the carrier. It's up to the driver to collect payment and know what kind of payment is acceptable. |
| Description of article | This is filled by the shipper and verified by the carrier. The articles must be completely described, including the number and amount of each kind of freight listed. The "check" column should be checked off when the shipper matches the actual cargo against the bill of lading on pickup. Any damaged or missing freight must be noted before the contract is signed and initialed by the shipper or the shipper's clerk and the carrier (or driver). |

| | |
|---|---|
| Signature | The contract is not valid until it's signed. The driver signs for the carrier and a shipper's clerk or other agent usually signs for the shipper* Once it's signed, it's a legal contract. Full and legible signatures are required, No initials. |
| Copies | copy 1. Original--sent to consignee<br>copy 2. Shipping order--copy for the carrier<br>copy 3. Memorandum--copy for the shipper |
| Contract information | The detailed, legal contract between the shipper and carrier is printed on the back of Copy 2 of the Bill of Lading. |

## Order Notify Bill of Lading

This is a special bill of lading. It will be stamped "Order Notify Bill of Lading." Copies 1, 2, and 3 serve the same purpose as copies 1, 2, and 3 of the Uniform Straight Bill of Lading, but are different colors. The key difference between the Order Notify Bill of Lading and the Uniform Straight Bill of Lading is that the "order notify" is a negotiable document (like money). The driver must deliver the freight to the holder of Copy 3 (the yellow copy) of the Order Notify Bill of Lading. The back of the yellow copy has to be endorsed. The important thing to remember is that the person accepting the freight must surrender the yellow copy to the person delivering it before the freight can be released. The yellow copy is like payment for the freight. Don't release freight on an Order Notify Bill of Lading until you are "paid" with the yellow copy,

## Shipper's Weight Load and Count

If the shipment is loaded and sealed by the shipper, he will accept the responsibility for the weight and count. The Bill of Lading must be noted "Shippers, Weight, Load and Count." The serial numbers of each seal must be listed on all three copies of the Bill of Lading. While the driver does not have to inspect and count the freight, he/she must make sure the above conditions are met before accepting the shipment,

Notes:

NOTES

## PICKUP AND DELIVERY OF FREIGHT CHECKLIST

### STEPS IN PICKUP OF FREIGHT

- o Count and inspect freight.
- o Make sure freight is properly marked to aid in checking against Bill of Lading.
    - pay attention to special handling requirements
- o Refuse or notate freight that is short, damaged, or poorly packed,
    - don't accept at shipper's risk
- o Make sure freight is properly loaded.
- o Make sure Bill of Lading is properly filled out.
    - Fill in pickup date and other information
    - Get full signature from shipper's agent (no initials)
    - Sign in proper place,
        - -- Full name and date
        - -- Company's name
        - -- Circle number of pieces to be picked up

## STEPS IN DELIVERING FREIGHT

### KEY POINTS

- Make sure you deliver to the right person.
- Handle payment for merchandise and shipping properly.
- Get proper signatures on Freight Bill and Bill of Lading.
- Follow company policy for problems and special pickup or delivery situations.

### STEPS IN DELIVERY

- Check and unload freight
- Use an orderly system to avoid mixing up freight.
- Check each piece against shipping papers before it is unloaded.
- Check again as each piece is unloaded.
- Have shipping agent check freight with you against shipping papers after it is unloaded.
- Collect shipping and merchandise payments.

### SHIPPING PAYMENTS

If Bill of Lading says COLLECT, obtain cash or certified check.

If PREPAID, no further action.

### MERCHANDISE PAYMENTS

Check Bill of Lading for method of payment.

If C.O.D., obtain cash or certified check

If Order notify Bill of Lading, don't surrender freight until you get yellow copy of order notify Bill of Lading.

Notes:

# THE HANDLING OF HAZARDOUS MATERIALS AND WASTES

When you deal with hazardous materials you have to follow a lot of United States Department of Transportation and State regulations. That only makes sense because when your are transporting items like explosives or poison chemicals it is a big responsibility.

You must receive special training before you handle hazardous material cargo. Why? The chart which follows shows the classes of hazardous material. When you look at it you will see the obvious dangers of these materials.

## Labeling and Placarding

Only specially trained personnel will load and unload hazardous material. The driver, besides driving these dangerous cargos, has a big responsibility too. He must make sure the vehicle carrying hazardous material is properly placarded. The charts on the following pages show the labels which go on the packages of hazardous materials. That is the shipper's responsibility. From those labels and the instructions on the shipping paper, the driver can determine which hazardous material placard should be on his vehicle. The chart of placards is also shown. And, again, the shipper must provide the placard. But the driver must make sure it is on the vehicle and he must remove it when the vehicle is no longer carrying the hazardous material.

### Why Is Placarding Used?

The placard identifies the class of hazardous material being transported.

Why all this precaution? First, it alerts all other road users that the vehicle is carrying dangerous material. That includes you when you approach another truck carrying explosives or flammable material.

Second, it helps emergency fire and rescue personnel when a mishap occurs, such as a spill or fire. The placards alert them to provide information about the specific hazardous material. That information tells them how to handle the situation and about the dangers of a specific material to the public.

Remember the penalties for noncompliance with the United States Department of Transportation hazardous materials requlations can subject both you and/or your employer to very severe penalties (fines of as much as $10,000 or possibly jail terms). Don't take chances! If you are not trained leave it alone until you are, thereafter when in doubt, check it out with your supervisor.

## DRIVER'S HAZARDOUS MATERIALS RECAP

1. Always check your freight bills.

2. If you are carrying hazardous materials - the bills must say so. Bills must also show the shippers certification regarding classification, packaging and labeling,

3. If you are transporting hazardous materials your vehicle probably will require placards.

4. Never, ever operate your vehicle without placards when they are required and never display placards when they are not required.

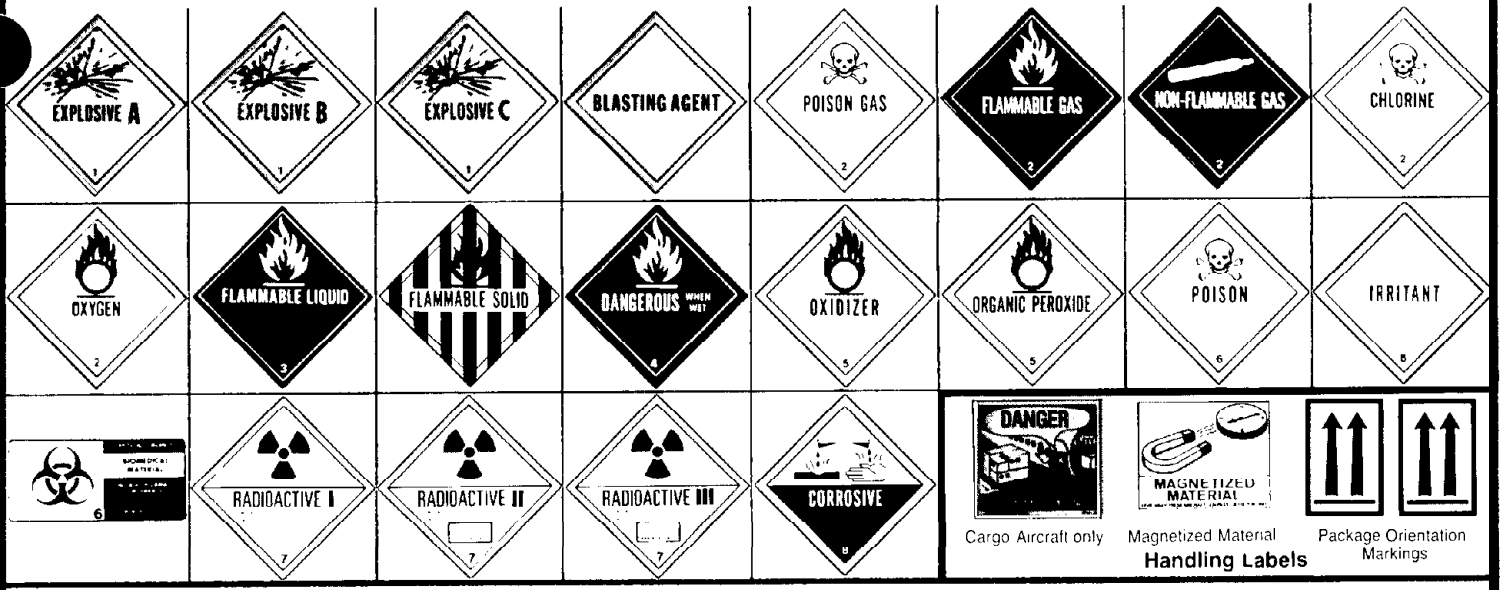
5. If your vehicle is placarded you must comply with the special requirements of Part 397 of the Federal Motor Carrier Safety Regulations.

Notes:

Notes:

# Hazardous Materials Warning Labels

## DOMESTIC LABELING




Cargo Aircraft only | Magnetized Material | Package Orientation Markings

**Handling Labels**

## General Guidelines on Use of Labels

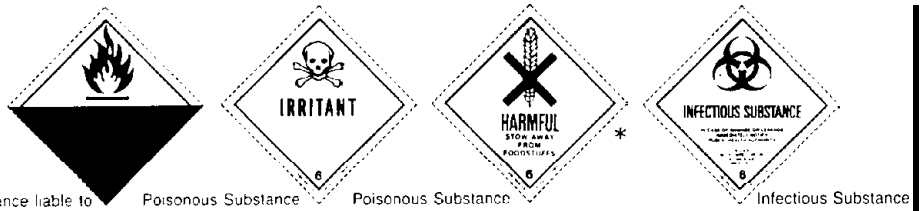
- Labels illustrated above are normally for *domestic shipments* However some air carriers *may* require the use of International Civil Aviation Organization (ICAO) labels
- Domestic Warning Labels *may* display UN Class Number Division Number (and Compatibility Group for Explosives only ) Sec 172.407(g)
- Any person who offers a hazardous material for transportation MUST label the package, if required [Sec 172 400(a)]
- Label(s), when required, must be printed on or affixed to the surface of the package near the proper shipping name. [Sec 172.406(a)].
- When two or more different labels are required, display them next to each other [Sec 172 406(c)].
- Labels may be affixed to packages (even when not required by regulations) provided each label represents a hazard of the material in the package. [Sec 172-401]
- The Hazardous Materials Tables, Sec 172 101 and 172 102, identify the proper label(s) for the hazardous materials listed

## UN Class Numbers

Hazardous materials class numbers associated with the hazard classes

Class 1—Explosives
Class 2—Gases (Compressed, Liquefied or dissolved under pressure)
Class 3—Flammable liquids
Class 4—Flammable solids or Substances
Class 5—Oxidizing Substances
Class 6—Poisonous and infectious Substances
Class 7—Radioactive Substances
Class 8—Corrosives
Class 9—Miscellaneous dangerous Substances

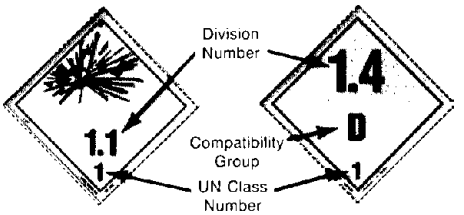
## INTERNATIONAL LABELING




Substance liable to pontaneous Combustion | Poisonous Substance | Poisonous Substance | Infectious Substance

### EXAMPLES OF INTERNATIONAL LABELS

- These are examples of International Labels not presently used for domestic shipments
- Most of the domestic labels ( illustrated above ) *may* be used Internationally.
- Text, when used Internationally *may* be in the language of the country of origin.
- Text is *mandatory* on Radioactive Material, St Andrews Cross, * and Infectious Substance labels




### EXAMPLES OF EXPLOSIVE LABELS

- The NUMERICAL DESIGNATION represents the CLASS or DIVISION.
- ALPHABETICAL DESIGNATION represents the COMPATIBILITY GROUP (for Explosives Only)
- DIVISION NUMBERS and COMPATIBILITY GROUP combinations can result in over 30 different "Explosives" labels (see IMDG Code/ICAO).

For complete details, refer to one or more of the following:

- Code of Federal Regulations, Title 49, Transportation, Parts 100-199 [All Modes]
- International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by air [Air]
- International Maritime Organization (IMO) Dangerous Goods Code [Water]
- Canadian Transport Commission (CTC) Regulations. [Rail]


U.S. Department of Transportation

**Research and Special Programs Administration**

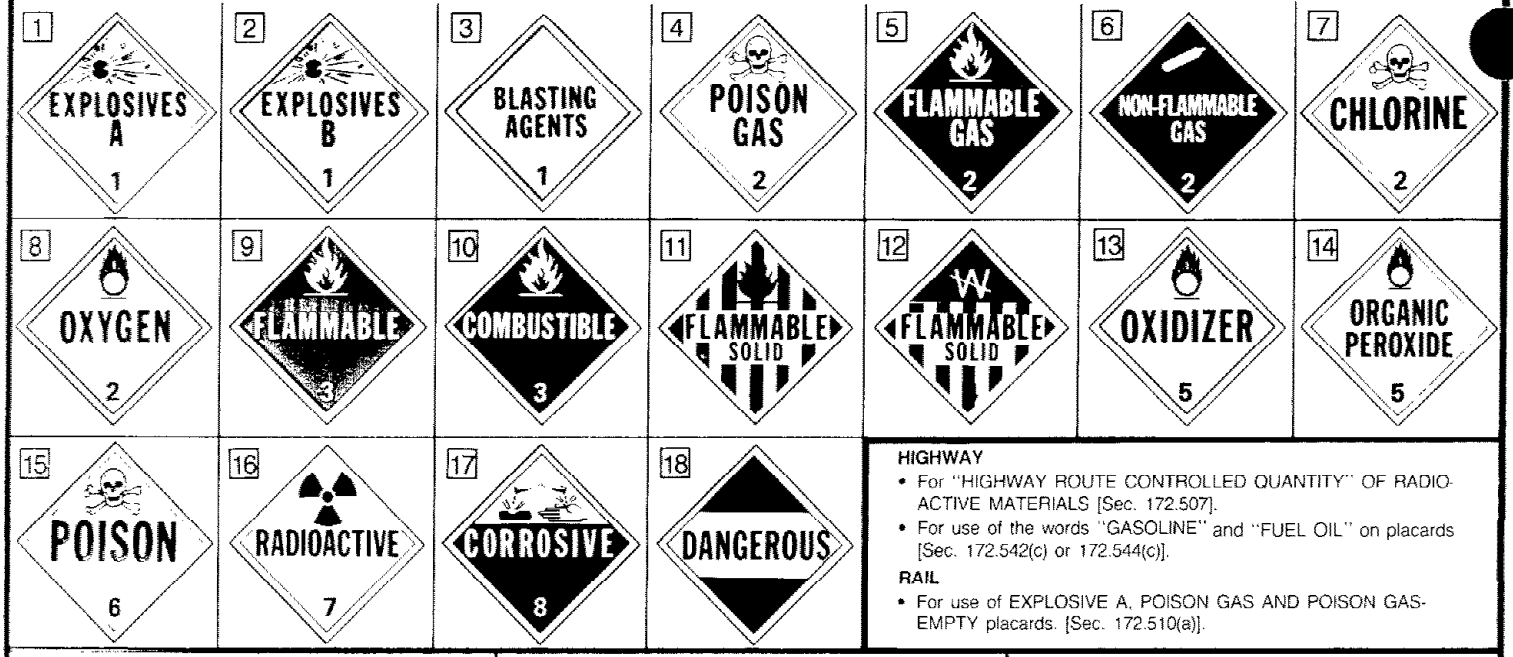
Materials Transportation Bureau
Washington, D.C. 20590

CHART 8
JANUARY 1985

# Hazardous Materials Warning Placards

## DOMESTIC PLACARDING

Illustration numbers in each square ( 1 through 18 ) refer to TABLES 1 and 2 below.




**HIGHWAY**

- For "HIGHWAY ROUTE CONTROLLED QUANTITY" OF RADIOACTIVE MATERIALS [Sec. 172.507].
- For use of the words "GASOLINE" and "FUEL OIL" on placards [Sec. 172.542(c) or 172.544(c)].

**RAIL**

- For use of EXPLOSIVE A, POISON GAS AND POISON GAS-EMPTY placards. [Sec. 172.510(a)].

### TABLE 1

| HAZARD CLASSES | *NO. |
|---|---|
| Class A explosives | 1 |
| Class B explosives | 2 |
| Poison A | 4 |
| Flammable solid (DANGEROUS WHEN WET label only) | 12 |
| Radioactive material (YELLOW III label) | 16 |
| Radioactive material Uranium hexafluoride fissile (containing more than 1.0% $U^{235}$) | 16 & 17 |
| Uranium hexafluoride, low-specific activity (containing 1.0% or less $U^{235}$ | 16 & 17 |

NOTE For details on the use of Tables 1 and 2, see Sec 172 504 (See footnotes at bottom of tables )

### Guidelines

- Placard motor vehicles, freight containers, and rail cars containing *any quantity* of hazardous materials listed in TABLE 1.
- Placard *motor vehicles* and *freight containers* containing 1,000 pounds or more gross weight of hazardous materials classes listed in TABLE 2.
- Placard *freight containers* 640 cubic feet or more containing *any quantity* of hazardous material classes listed in TABLES 1 and/or 2 when offered for transportation by *air or water*. Under 640 cubic feet, see Sec. 172.512(b).
- Placard *rail cars* containing *any quantity* of hazardous materials classes listed in TABLE 2 except when less than 1,000 pounds gross weight of hazardous materials are transported in *Trailers* or *Containers* on Flat Car Service.

### TABLE 2

| HAZARD CLASSES | *NO. |
|---|---|
| Class C explosives | 18 |
| Blasting agent | 3 |
| Nonflammable gas | 6 |
| Nonflammable gas (Chlorine) | 7 |
| Nonflammable gas (Fluorine) | 15 |
| Nonflammable gas (Oxygen, cryogenic liquid) | 8 |
| Flammable gas | 5 |
| Combustible liquid | 10 |
| Flammable liquid | 9 |
| Flammable solid | 11 |
| Oxidizer | 13 |
| Organic peroxide | 14 |
| Poison B | 15 |
| Corrosive material | 17 |
| Irritating material | 18 |

## INTERNATIONAL PLACARDING

- Most international placards are identical (color and pictorial symbols) to the Domestic placards illustrated above
- International placards are enlarged ICAO or IMO labels (See International Labeling—Otherside)
- Placard MUST correspond to *hazard class* of material
- Placard *ANY QUANTITY* of hazardous materials when loaded in FREIGHT CONTAINERS, PORTABLE TANKS, RAIL CARS and HIGHWAY VEHICLES
- International placards *may* be used *in addition* to DOT placards for international shipments

When required, *Subsidiary Risk placards* must be displayed in the same manner as *Primary Risk placards* Class numbers are *not shown* on Subsidiary Risk placards.

- COMPATIBILITY GROUP DESIGNATORS *must* be displayed on EXPLOSIVES PLACARDS
- UN CLASS NUMBERS and DIVISION NUMBERS *MUST* be displayed on hazard class placards when required

## UN and NA Identification Numbers

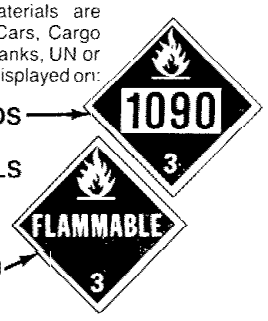
- The *four digit* UN or NA numbers *must* be displayed on *all hazardous* materials packages
- UN (United Nations) or NA (North American) numbers are found in the Hazardous Materials Tables, Sec 172 101 and the Optional Hazardous Materials Tables Sec 172 102 (CFR, Title 49, Parts 100-199)
- UN numbers are displayed in the same manner for both Domestic and International shipments
- NA numbers are used only in the USA and Canada

When hazardous materials are transported in Tank Cars, Cargo Tanks and Portable Tanks, UN or NA numbers *must* be displayed on:

PLACARDS OR ORANGE PANELS

1090

and




Appropriate Placard must be used.

EUROPEAN NUMBERING SYSTEM—

**Top Number**—Hazard Index (Identification of Danger, 2 or 3 figures) Example: 33 – highly inflammable liquid

33
1088

**Bottom Number**—UN Number of substance Example: 1088 ACETAL

For more complete details on identification Numbers see Sec. 172.300 through 172.338

Notes:

## UNIT 5.2 - PROBLEM-SOLVING EXERCISE: PREPARING A BILL OF LADING

Use Today's Date and Your Name for this Exercise

You are a pickup and delivery driver for the:

X.Y.Z. Trucking Company
123 East Avenue
Baltimore, Maryland 22115

Vehicle #: 2455

When you make a delivery to the National Office Services Company, the owner asks you to pickup several packages for shipment. The packages will be taken back to your main terminal in Baltimore and shipment will continue from there. You call your supervisor and he says it's okay. He reminds you to follow company policy and make sure that the correct Bill of Lading is filled out. Since National Office Services Company is a small company, they do not have any copies of the Bill of Lading. You have a packet of forms and the owner asks you to help fill out the Bill of Lading.

Use the information below to help you fill out the form up to the point that you and the shipper will sign.

Freight: Two cartons labelled "12 copies of Office Procedure Manuals"

You and the owner weigh the cartons. Each weighs 15 lbs.

Your company shipping rate is $6.80 CWT and the owner wants to ship the packages C.O.D.

The shipping label on the packages addresses each to:

Acme Office Supply Company
200 Main Avenue
Dover, Delaware 34567

When you have filled out the Bill of Lading with the above information, assume the role of the owner for a moment and sign his name, John L. Kent, in the proper place,

Review the document to make sure it is properly filled out and sign your name in the appropriate place.

Which copy will you give the owner? Which copies will you take back with you to Baltimore?

# UNIFORM ORDER BILL OF LADING

**Original—Domestic**

Shipper's No.
Agent's No.

..... Carrier.

RECEIVED, subject to the **classifications** and tariffs in effect on the date of the issue of this Bill of Lading.

**From** ....., **Date** ....., 19.....

**At** ..... **Street,** ..... **City,** ..... **County,** ..... **State** .....

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown) marked, consigned, and destined as shown below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own railroad, water line, highway route or routes, or within the territory of its highway operations, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on the back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

The surrender of this Original ORDER Bill of Lading properly indorsed shall be required before the delivery of the property. Inspection of property conveyed by this bill of lading will not be permitted unless provided by law or unless permission is indorsed on this original bill of lading or given in writing by the shipper.

Consigned to Order of .....

Destination ..... Street, City, ..... County, State .....

Notify .....

At ..... Street, City, ..... County, State .....

Routing .....

Delivering Carrier ..... Vehicle or Car Initial ..... No. .....

| No. **Packages** | Kind **of Package, Description of Articles,** Special **Marks,** end **Exceptions** | *Weight (Subject to Correction) | **Class** or Rate | Check Column |
|---|---|---|---|---|
| | ..... | | | ..... |
| | ... | .... | ... | ..... |
| | ..... | | ..... | ..... |
| | .... ..... | | | |

Subject to Section 7 of **conditions,** if this shipment is to **be** delivered to the consignee without recourse on the consignor the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without **payment of freight and all other** lawful charges.

(Signature of consignor)

If charges are to **be prepaid** write or stamp here "To be Prepaid."

Received **$** ..... to apply in prepayment of **the** charges on the property described hereon.

Agent or Cashier

Per. .....

(The signature here acknowledges only the amount prepaid)

* If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is carrier's or shipper's weight."

**Note—Where** the rate is **dependent** on value, shippers are required to state specifically in **writing** the agreed or declared value of the property.

**The agreed** or **declared** value of the property is hereby **specifically** stated by the shipper **$** .....

**be** [illegible] xc8edlng ..... Per

Charges advanced:

Shipper ..... Agent.

**Per** ..... Per .....

**Permanent address of Shipper:** Street, ..... City, ..... State

Notes:

# HANDLING OVER, SHORT AND DAMAGED FREIGHT CHECKLIST

## HANDLING "SHORT" FREIGHT

First priority - prevent the situation
Second priority - follow company procedures

### Steps To Follow

- Count and check before unloading
- Discover "short" situation before consignee does
- Double check
- Call company for instructions if required
- Call company to notify 0, S, and D clerk if required
- Deliver short freight
- Get proper notation on shipping papers
  - -- exact description of missing pieces
  - -- future claims based on transaction
- Don't try to resolve situation yourself

## PROCEDURES FOR HANDLING "OVER" FREIGHT

When freight is over in one place, it is probably short somewhere else.

Example

10 boxes shipped to Chicago
2 boxes get mixed up and are routed to Cleveland
"Over" freight to Cleveland
"Short" freight to Chicago

Steps to Follow for "Over" Freight

- Identify specific pieces that are over
- Call company for instructions
- Make delivery of freight and note exceptions
- Do not deliver over freight to wrong place
- Handle over freight based on instructions
  - -- return to terminal
  - -- ship to proper destination
    - -- use "ASTRAY Bill of Lading"

## PROCEDURES FOR HANDLING "DAMAGED" FREIGHT

- o Prevent it if you can
- o Don't try to assess blame
- o Protect your company's interest
- o Follow procedures for inspecting damaged goods
- o Describe damage as specifically as possible
  - -- Exact number of pieced damaged
  - -- Type of damage

Example

"3 packages wet - contents examined and two boxes baking soda found damaged"

- o Note properly on shipping papers
- o Indicate what happened to damaged goods
  - -- Did consignee accept?
  - -- Did driver reload and return it?
- o Be courteous and don't lose your temper
  - -- Customer might be angry about damaged goods
  - -- Be helpful
    - direct him to your company's Claims, 0, S and D or Tracing Department

UNIT 5.3
HOURS OF
SERVICE
REQUIREMENTS

# UNIT 5.3 HOURS OF SERVICE REQUIREMENTS

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn

- o the requirements of the Federal Motor Carrier Safety Regulations on hours of service and how to comply with them.
- O to maintain a complete, neat, and accurate record and recap of your daily activities.
- o to complete your daily log correctly.
- o to interpret hours of service categories correctly.
- o to add and subtract correctly on your recap chart so that you can figure out how many driving hours you have left.
- o the serious consequences that can result if you do not comply with the hours of service regulations

## WHAT WILL HAPPEN IN THIS UNIT

All activity will take place in the classroom. Throughout the unit during the presentation of information there will discussions to help you learn the hours of service regulations. There will also be exercises that let you practice filling out daily logs and monthly recap charts.

## Outline of Classroom Lessons

Lesson 1 - Basic Requirements of Hours of Service Regulations

I. Overview and Introduction to Logbooks
   - A. Purpose of Hours of Service Regulation
   - B. Basic Requirements of Hours of Service Regulation
   - C. Distribution of Logbooks
   - D. Introduction to Logbooks

II. Status of Driver Categories
   - A. Status Situations
     1. Off Duty
     2. Sleeper Berth
     3. Driving
     4. On Duty--Not Driving
   - B. Student Exercise: Identifying Correct Status

III. Driving and On-Duty Rule
   A. Requirements for 8 Hours Consecutive Rest
   B. On-Duty Rule
   C. Questions for Review

IV. Preparing a Daily Log

V. Additional Examples

VI. Preparation Exercise

VII. Completing a Log Recap

VIII. Direct Method of Determining Hours Available

Lesson 2 - Complying with the Hours of Service Regulations

I. Interpretations of Hours of Service Regulations for Routine Situations

II. Extending Driving Time

III. Using Sleeper Berth Time

IV. Exceptions to Hours of Service Regulations

V. Driver's Multi-day Logs

VI. Maintaining Good Logs and Avoiding Violations
   A. Maintaining Accurate and Current Logs
   B. Errors in Maintaining Logs

VII. Class Discussion

Lesson 3 - Log Keeping Exercise

Explanation of Exercise

II. Completion of Exercise

III. Review of Exercise

IV. Additional Log Keeping Practice

STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Copy of the Federal Motor Carrier Safety Regulations
- Driver's Daily Log Completion Exercise (for use in class)
- A copy of a Driver's Daily Log Form
- Log Recap Exercises - (for use in class)
- Exerpt from a U.S. D.O.T. Accident Report - (for use in class discussion)

## UNIT 5.3 - DRIVER'S DAILY LOG COMPLETION EXERCISE

This exercise will be completed in class. Brief instructions are provided below for reference. The instructor will answer your questions about the exercise and help you if you have any problems. You may also refer to the reference material which explains how to fill out a Daily Log,

### Instructions

Fill out a Driver's Daily Log form and total your hours.

- o Use your name and today's date.
- o Your company is Fast Freight Inc., 290 West 44th Street, New York, N.Y.
- o Vehicle numbers: Tractor 6244, Trailer 53306. If you change trailers you can indicate by using the notation "C/O."
- o Freight document numbers: Manifests #677453-383 and #153457-041.

### Information For Filling in Log Sheet

1. At one minute past midnight, you are home, off-duty. At 8 a.m. you are given an "alert" call, Your home is in Toledo, Ohio.
2. At 10 a.m., you report for work at the terminal in Toledo. You pretrip your vehicle from 10 to 10:30 a.m.
3. At 10:30 you start driving. You drive for 1-1/2 hours to Willard, Ohio.
4. In Willard, Ohio, you stop to change trailers. The new trailer number is 62470. You are finished by 1 p.m. and driving again.
5. You drive for 6 hours and 30 minutes to Milesburg, Pa., where you stop at 7:30 p.m. for a meal. It is this company's policy that the driver remain responsible for the vehicle and load at all times.
6. At 8:30 p.m., you start driving again and drive for 1-1/2 hours, until you reach your home terminal in Red Deer, Pa.
7. At 10 p.m., you are relieved of all responsibility to work or be ready for work. You go home and go to bed.
8. The total miles you drove--450 miles.

FORM-MCS 59-Prescribed by the
U. S. DEPT. OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION REV.-67

# DRIVER'S DAILY LOG

(One calendar day-24 hours)

Form approved. Budget Bureau No. 04-R2395
ORIGINAL-File each day at home terminal
DUPLICATE-Driver retains in his possession far one month

(Month) (Day) (Year) _____ (Total mileage today)

_____ Vehicle numbers-(Show each unit)

I certify these entries are true and correct:

_____ (Total miles driving today)

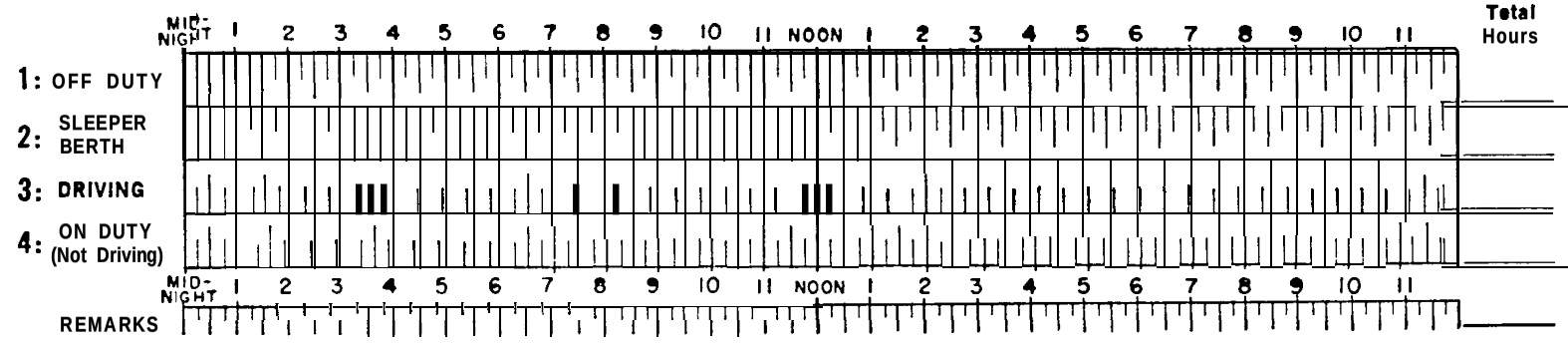
_____ (Driver's signature in full)

_____ (Name of carrier or carriers)

_____ (Name of co-driver)

_____ (Main Office Address)

_____ (Home Terminal Address)




Shipping document, manifest number, or name of a shipper and commodity. Information required by Section 395.8 (0). Check the time and enter name of place you reported and where released from work and when and where each change of duty occurred. Explain excess hours—Section 395.8 (0).

FROM: _____ (Starting Point or Place)

TO: _____ (Destination or turn around point or place)

USE TIME STANDARD AT HOME TERMINAL

## UNIT 5.3 - LOG RECAP EXERCISES

Example 1: 7 Days/60 Hours

Instructions

In the sample Log Recap Form shown below, the on-duty information is shown for the last 7 days of March and the first day of April.

Fill out the Log Recap Form for the period April 2 - April 7 using the information which follows. Determine the amount of on-duty time you have for each succeeding 24 hour period. The driver is under the 60 hour rule.

| | Hours on Duty |
|---|---|
| April 2 | 6 |
| April 3 | 0 |
| April 4 | 0 |
| April 5 | 10 |
| April 6 | 8-1/4 |
| April 7 | 12 |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| LAST SIX CONSECUTIVE DAYS IN PRECEDING MONTH | DAILY TOTAL DUTY & DRIVING HOURS | 7 DAYS — 60 HOURS | | |
| | 0 ✓ | TOTAL ON DUTY HOURS LAST 7 DAYS | TOTAL ON DUTY HOURS LAST 6 DAYS | HOURS AVAILABLE FOR ON DUTY TIME NEXT DAY (60 MINUS) (COL. 4) |
| | 9 | | | |
| | 8 | | | |
| | 10½ | | | |
| | 8 | | | |
| | 9 | | | |
| 1 | 8 | 52½ | 52½ | 7½ |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |

Example 2: 8 Days/70 Hours (To be completed in class)

Instructions

Use the 8 day/70 hour sample form below to complete this part of the exercise. The instructions are the same as for the first part of the exercise. The conditions are different since the driver is under the 60-hour rule, not the 70-hour rule.

| | Hours on Duty |
|---|---|
| April 2 | 10 |
| April 3 | 0 |
| April 4 | 0 |
| April 5 | 10 |
| April 6 | 8 1/4 |
| April 7 | 12 |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| | DAILY TOTAL DUTY & DR. HRS | | | |
| LAST SEVEN CONSECUTIVE DAYS IN PRECEDING MONTH | 8 | 8 DAYS — 70 HOURS | | |
| | 0 | TOTAL ON DUTY HOURS LAST 8 DAYS | TOTAL ON DUTY HOURS LAST 7 DAYS | HOURS AVAILABLE FOR ON DUTY TIME NEXT DAY (70 MINUS) (COL. 4) |
| | 9 | | | |
| | 8 | | | |
| | 10½ | | | |
| | 8 | | | |
| | 9 | | | |
| 1 | 8 | 60½ | 52½ | 17½ |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |

**EXCERPT FROM U.S. DEPARTMENT OF TRANSPORTATION**
OFFICIAL **ACCIDENT REPORT FOR** DISCUSSION

MOTOR CARRIER ACCIDENT INVESTIGATION

REPORT NO. 74-2

ACCIDENT - MARCH 28, 1974 - SOUTH BOSTON, VIRGINIA

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SYNOPSIS

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| | |
|---|---|
| DATE, TIME: | March 28, 1974, 3:40 p.m. |
| TYPE OF ACCIDENT: | Rear-end collision |
| LOCATION: | Route 304, near South Boston, Virginia |
| VEHICLES INVOLVED: | Tractor-trailer combination operated by _____ Company of Pittsburgh, Pennsylvania (hereinafter referred to as the "truck"). School bus operated by the Halifax County Virginia School Board (hereinafter referred to as the "school bus"). Two private automobiles (hereinafter referred to as the "Chevrolet" and the "Ford"). |
| ABSTRACT: | Two cars stopped behind school bus discharging passengers. The truck struck and overrode the Chevrolet from behind, shoving it under the school bus which overturned and rolled onto its roof. The truck then collided with the Ford. |
| RESULTS: | Two fatalities, 37 injuries, and $65,000 property damage. |
| PROBABLE CAUSE: | Truck driver inattentive, fatigued, traveling at excessive speed. |

## RESULTS OF THE ACCIDENT

The truck driver's only statement regarding the accident was: "I was coming down the hi71 and I just didn't see them in time," This statement was given to the investigating officer and to the company official to whom he reported the accident by telephone.

As a result of the accident, two children in the Chevrolet, one in the back seat, the other in the right front seat, were killed instantly. The child occupying the rear seat struck the steering column head first. The driver was somehow pushed to the left of the steering column and received only minor injuries* It was not determined whether any of the Chevrolet passengers were wearing seat belts,

Of the 42 children in the school bus (ages 6 to 14), 36 were injured but only 3 required hospitalization. Neither the Ford driver or the truck driver were injured. Both were wearing seat belts.

## EVENTS PRECEDING THE ACCIDENT

Comparison of the driver's logs, toll receipts, and plant arrival and departure times for the two days preceding the accident showed conclusively that the driver was falsifying his daily lags. His last eight days of logs indicated a pattern of exactly 8 hours off duty and exactly 10 hours driving, which coincides with Federal Motor Carrier Safety Regulations maximum hours of service limitations.

Reconstruction of the driver's probable activities for 2 days prior to the accident revealed the following:

He reported to the carrier's Greensboro, North Carolina terminal at 12:30 a.m., March 27, and was on duty, not driving until 1 a.m., at which time he departed for Edison, New Jersey. According to his daily log, the driver arrived at Edison, 492 miles away, at 11 a.m., and was off duty until 7 p.m., that evening- The terminal supervisor, however, reported that the driver arrived at the plant between 4 p.m., and 5 p.m., where he unhooked one trailer and hooked up another. A notation on the Edison terminal dispatch sheets shows that the driver called from Ashland, Virginia, at 10 a.m. that morning to notify them of his location. In effect the driver claimed a 9-1/2 hour trip, but actually made the 492-mile run in 15 hours.

The driver's route from Greensboro, North Carolina, to Edison, New Jersey, takes him past his home in Reidsville, North Carolina, 25 miles from the terminal. He may very well have stopped inReidsville, and not entered it on his log for obvious reasons. A stop of 4 or 5 hours at home could have interrupted his schedule enough so that he could not take the required off-duty time in Edison in order to meet his next dispatch.

The phone call from Ashland at 10 a.m., and toll receipts from Perryville, Maryland, at 1:30 p.m., and the Delaware Memorial Bridge at 2:16 p.m., reinforce the hypothesis that he stopped several hours during the early portion of his trip.

Dispatch records at carrier's Essington facility, which is 59 miles from Edison, show that the driver was "In" at 7:22 p.m., March 27, and "Out" at 2:27 a.m., March 28. His daily log shows him "Off Duty" at the Essington plant from 8:30 p.m., March 27 until 4:30 a.m., March 28. According to plant records, his actual time at the plant, which would include some "on duty, not driving" time was 7 hours and 49 minutes.

One final toll receipt from the Baltimore Harbor Tunnel at 7:04 a.m., suggests that the driver took 4 hours and 31 minutes to make the 96 mile return trip from Essington to Baltimore. The indication is that the driver either stopped along the way or did not leave Essington for another 2-1/2 hours.

Betwen 7:04 a.m., when the driver went through the Baltimore Harbor Tunnel, and 3:40 p.m., when the accident occurred, the driver covered 268 miles. At normal driving speeds, this would require no more than 5-1/2 hours, which suggests that he may have taken a 2-hour break somewhere in this 8-1/2 hours preceding the accident.

The resultant picture is that while the driver showed two 8-hour breaks in his daily logs, he actually only took one break of approximately 7 hours and several smaller breaks dispersed over the two-day period.

The evidence shows hours of service violations of Section 395.3 (a), driving more than 10 hours without 8 consecutive hours off duty, and log falsification.

## SUMMARY AND CONCLUSIONS

This accident took the lives of two people and had the potential for much greater severity. It was caused by the driver's inattentiveness which very likely stemmed from general fatigue and road weariness. He was familiar with the area and most probably had knowledge that school buses stopped on the main roadway while discharging passengers.

Analysis of the driver's daily logs reveals that he was falsifying logs in order to show that he was within the hours of service limitations while, in actuality, he was driving beyond prescribed hours of service limits. His logs fall into the pattern of exactly 8 hours off duty and exactly 10 hours driving, which coincides with Federal Motor Carrier Safety Regulation's maximum hours of service limitations. According to the driver's logs, he drove 917 miles in a little over 18 hours, for an average speed of 51 miles per hour.

## UNIT 5.3 - LOG KEEPING EXERCISES

This exercise will be completed in class. The instructor will explain the procedures in detail. General instructions are provided below.

General **Instructions**

Part I Solo Driver

In Part I of this log-keeping exercise, you are to complete daily logs and a log recap form for a six-day period based on a diary of activities

- o Use the information in the diary which follows to complete a daily log for each 24-hour period
- o Your carrier is the Benson Trucking Company
- o Your home terminal is Chicago, Illinois
- o Your carrier is using the 7 day, 60-hour rule
- o You have written instructions authorizing four breaks, e.g., you do not have to attend to the vehicle and cargo

The instructor will provide you with sufficient copies of logs to complete the exercise.

You may refer to reference materials about the Hours of Service regulation as you complete this exercise.

When you finish Part 1 of this exercise, continue the Part 2 which follows. Part 2 is a short exercise involving a two-person sleeper operation.

### 1. First Day's Activity (May 1)

Starting location: Wayland, Texas

You pulled in the night before last at 9 p.m. and have been on layover since then, staying at a 'local motel. The information below is a recap of your last seven day's activities, Use it to fill out the recap sheet and determine how many on-duty hours you have remaining* Keep a running total of remaining on-duty hours. throughout the exercise.

Daily Total Duty and Driving Hours

April 25 - 10 hours
April 26 - 10 hours
April 27 - 15 hours
April 28 - 4 hours
April 29 - 15 hours
April 30 - 0 hours

You are off duty today and have to report to the company's terminal in Wayland tomorrow at 8 a.m.

## 2. Second Day's Activity (May 2)

Starting location: Wayland, Texas

You get up at 7 a.m. and breakfast at the motel. You report to Operations at 8 a.m. and are assigned Tractor #2311, Trailer #11703. It's a sealed load of miscellaneous dry freight to be hauled to Dallas, Texas.

After a review of the shipping papers and trip instructions and a pretrip, you are ready to be dispatched. The Manifest Number is 12344A and the shipper is Acme Goods.

At 9 a.m., you are dispatched and on the road. You drive four hours straight with just incidental stops to check your tires and stop for lunch at 1 p.m. at a truck stop in Red River, Texas. Company policy says you are off duty during this lunch break that ends at 2 p.m.

You are on the road again at 2 p.m. You arrive at the terminal at 6:45 p.m. By the time you complete your maintenance reports and other paperwork, drop off the trailer, and secure the tractor, it is almost 7:30 p.m. And you are finally off duty. Tonight will be spent at a local motel and tomorrow you will probably pickup another load going north.

A long day's work and 263 miles.

## 3. Third Day's Activity (May 3)

Starting location: Dallas, Texas

At 6 a.m., you call Operations and are told to report at 8 a.m. to pickup a load for North Holland, Illinois.

After reporting for duty at 8 a.m., you go through the routine of checking your shipping papers for the sealed cargo. It's a miscellanous dry freight load, Manifest #2345A, the Smith Shipping Company. You have the same tractor and a different trailer, #1268. After coupling and pre-trip, you are ready for dispatch. You are dispatched and on your way at 8:45 a.m.

At 2 p.m. you stop for lunch in Houston. At 3 p.m. you start driving again on US 59, then US 259. You stop driving at 7:45 p.m. in Marshall, Texas, 456 miles and 80 gallons of fuel purchased in Texas today. You spend the night in a local motel.

## 4. Fourth Day's Activity (May 4)

Starting Location: Marshall, Texas

You get up at 5 a.m., 30 minutes for breakfast and 15 more for your pretrip. At 6 a.m., you are driving on US-59 to the Arkansas State line. You

Keep on 59 until you get t I-30. At 11 a.m., you stop in Little Rock for lunch, One hour later, at noon, you are back in the cab and rolling down I-55, When you reach Cape Giradena, Missouri, five hours later, you stop at a trucker's stop for 5 hours off duty. At 10 p.m., you climb in the sleeper berth for the night. 322 miles total today.

## 5. Fifth Day's Activity (May 5)

Starting Location: Cape Giradena, Missouri

You are up at 7 a.m., and eat a good breakfast, At 7:30 a.m., you do a 15-minute pretrip and spend 15 more minutes fueling and you are on the road at 8 a.m. You stay on I-55 until you get to Illinois and stop for lunch at Springfield, Illinois, at noon. At 1 p.m., you are back on the road and push on through to the consignee in North Holland, Illinois. You get there at 3:30 p.m. and help unload the trailer, until 6 p.m.

Now you have to bobtail back to Chicago but will need to rest first. So you climb back into your cab and drive for 1/2 hour to South Holland, Illinois. You spend 2-1/2 hours off duty at the truck stop, then climb into your sleeper berth at 9 p.m. Today you drove 135 miles in Missouri and 189 miles in Illinois.

## 6. Sixth Day's Activity (May 6)

Starting Location: South Holland, Illinois

You are anxious to get home. It's just another 3-hour run. You are up at 7 a.m. to grab a quick breakfast. It takes 15 minutes to pre-trip your tractor, from 2:15 to 2:30 a.m. You are on the road. There is no traffic and you arrive home terminal in Chicago at 5 a.m. 129 miles.

By the time you finish your paperwork, it's 5:30 a.m. You are off duty and climb into your car in the employees' parking lot. You're home at 6 a.m. to a family that is just getting up. The rest of the day is rest and relaxation.

## PART 2 CO-DRIVER

In this part of the exercise, you are to fill out your log as a co-driver in a two-man operation. We will give you a list of the activities and the completed log for your co-driver, John Smith. You must fill out your log to make maximum use of rules related to sleeper berth use and off-duty time. Your total on-duty time for the 24-hour period should not exceed 12-1/2 hours.

### List of Activities for Your Co-driver, John Smith

| Time Period | Activity |
|---|---|
| Midnight to 4 a.m. | Resting in sleeper berth. You drive (162 miles) |
| 4 a.m. to 5 a.m. | Stop to eat. Authorized break. Do not have to attend vehicle |
| 5 a.m. to 8 a.m. | Driving the vehicle (126 miles) |
| 8 a.m. to 9 a.m. | Repair stop. John Smith attends the vehicle. |
| 9 a.m. to 1 p.m. | Resting in sleeper berth. You drive (170 miles) |
| 1 p.m. to 2 p.m. | Dinner stop. Authorized break. Vehicle does not have to be attended. |
| 2 p.m. to 7 p.m. | Driving the vehicle (216 miles) |
| 7 p.m. to 8 p.m. | Service stop for refuel. John Smith is off-duty |
| 8 p.m. to 11:30 p.m. | John Smith rides as co-driver (136 miles) |
| | Arrive at destination at 11 p.m., 30 minutes to check out off duty at 11:30 p.m. |

A copy of John Smith's log based on the above activities will be projected on the screen in the classroom. Fill out your log based on the activities you should be performing.

# UNIT 5.4
# ACCIDENT
# PROCEDURES

# UNIT 5.4 ACCIDENT PROCEDURES

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- protect the scene of an accident to prevent further injury or damage.
- get the proper help.
- obtain all information needed for accident reports to the State, the Federal government, your employer, and the insurance company.
- help injured people if you can by providing first aid, but only if you have had the necessary first aid training.
- put out fires, including cargo, engine, electrical, and tire fires.
- avoid discussions of legal questions, such as questions about who was at fault in the event of an accident.

You will learn

- State laws and company requirements about stopping at the scene of an accident and helping people.
- Federal, State, insurance company, and employer requirements on reporting accidents.
- first aid procedures for treating the kinds of injuries you are likely to find at an accident.
- the kinds of fire extinguishers, the types of fires they should be used on, and how to use them.
- the methods for putting out fires.
- where to stop safely if you have a vehicle fire.

## WHAT WILL HAPPEN IN THIS UNIT

Most learning in this unit will take place in the classroom. At the end of the unit, there will be a lab lesson during which the use of a fire extinguisher will be demonstrated.

**Outline of Classroom Lessons**

Lesson 1 - Accidents and Accident Reporting

I. Steps to Take At the Scene of an Accident
   A* Facts to Know Before an Accident
   B. Steps to Take at the Scend of an Accidnet in Which You Are Involved

II, Protecting the Scene of an Accident, Breakdown or Fire
   A. Driver Responsibility
   B. Purpose
   C. Types of Warning Devices Required to Protect the Scene
   D. Purpose

III. Handling the Accident Scene

IV. Reporting the Accident

V. Evaluating the Accident
   A. Why Evaluate?
   B. Accidents Classified as Preventable Vs. Nonpreventable

VI. Accidents Involving Hazardous Materials

VII. Review and Problem-Solving Discussion

Lesson 2 - Principles of First Aid

I. Overview
   A. Know Your Role and Limitations
   B. Basic Principles of First Aid
   C. Procedures to be Discussed and Practiced

II. Evaluation of Injuries
   A. General Directions
   B. Priorities for Treatment

III. Evaluation and Treatment of Bleeding
   A. Determine Type of Bleeding and Amount of Blood Lost
   B. Evaluating Severity of Bleeding
   C. Control of Bleeding

IV. Instructor Demonstration and Student Practice: Treatment of Bleeding

V. Evaluation and Treatment of Breathing Stoppage
   A, Three Reasons Breathing May Stop
   B. Artificial Respiration

VI. Instructor Demonstration and Student Practice: Artificial Respiration

VII. Evaluation and Treatment of Shock
- A. Evaluation of Shock
- B. Treatment of Shock

VIII. Instructor Demonstration: Treatment of Shock

IX. Summary

Lesson 3 - Fires and Fire Fighting

I. Causes of Fires
- A. Scope of Problem
- B. Anatomy of a Fire
- C. Truck Fire Sources

II. Basic Prevention
- A. General Rules

III. Fire Extinguishers
- A. Classes of Fires
- B. Types of Fire Extinguishers
- C. Operation
- D. Inspection
- E. Recap

IV. Firefighting Methods
- A. Techniques for Specific Kinds of Fire
- B. Preview of Firefighting Demonstraiton

## Description of Lab Lesson

Lesson 4 - Fire Fighting Demonstration

In this lesson you will observe the use of a fire extinguisher in putting out a Class B (flammable liquid) fire. You will not be participating in the actual extinguishing of the fire.

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- o Copy of the Federal Motor Carrier Safety Regulations, Parts 390-397
- o Steps to Take at an Accident in Which You Are Involved
- o Placement of Reflectors to Protect the Scene of an Accident (3 situations)
- o Two Accident Scenes (for classroom discussion)
- o Basic First Aid Principles Checklist (and illustrations)

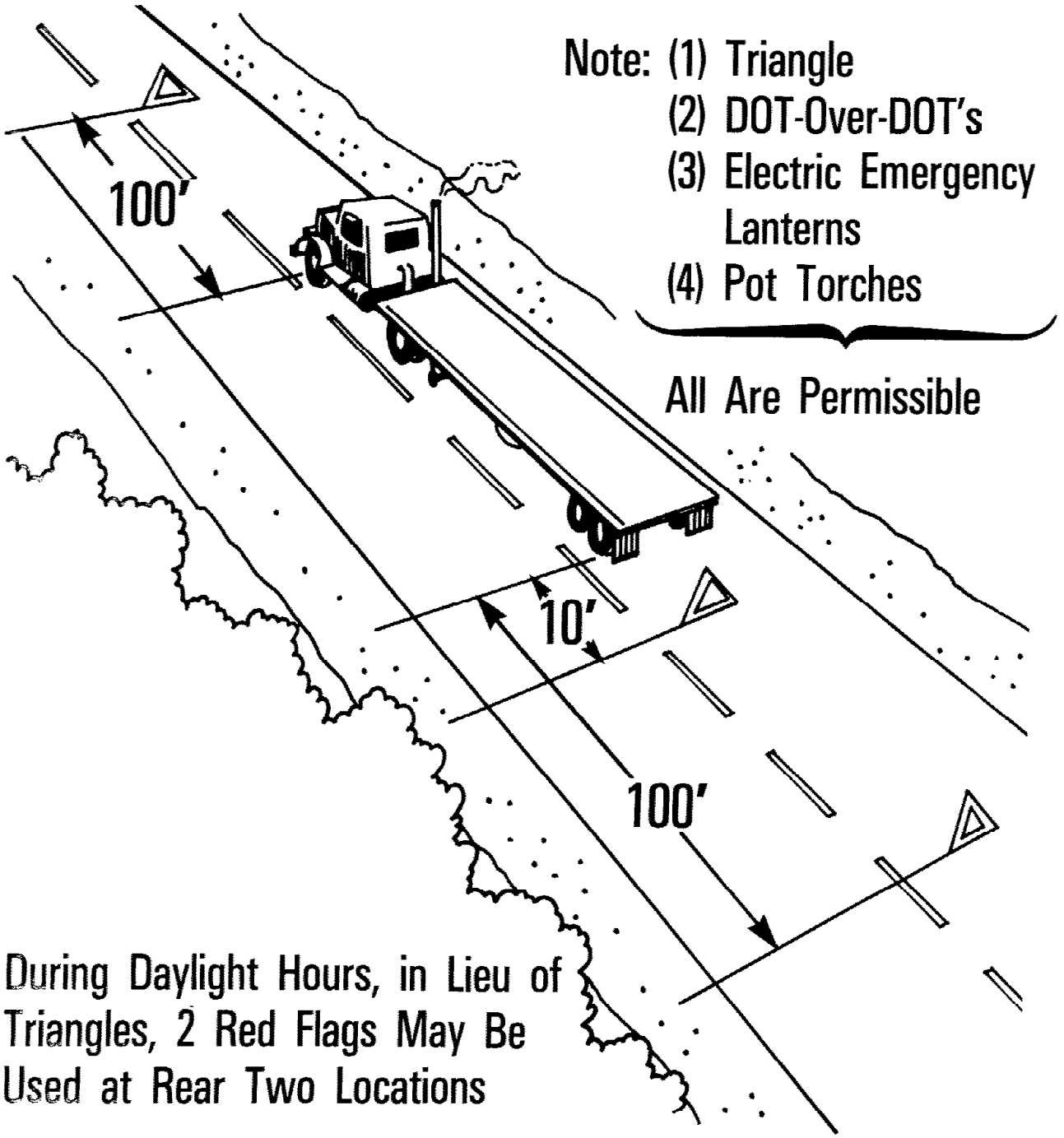
- Basic Fire Prevention Steps
- Classes of Fires
- Fire Extinguisher Class Checklist
- Fire Extinguisher Operation Checklist
- Fire Extinguisher Inspection Checklist

STEPS TO TAKE AT THE SCENE OF AN ACCIDENT IN WHICH YOU ARE INVOLVED

1. stop
2. Protect the Scene With Warning Devices
3. Assist the Injured
4. Call Police and Ambulance
5. Collect Names of Witness or Jot Car License Numbers
6. Stay at the Scene
7. Identify Yourself to Others When Requested
8. Phone or Radio Your Company
9. Make Your Own Written Record
10. Don't Sign or Volunteer Anything Not Required
11. Insist That Anyone Who Claims Injury Get Medical Help
12. Don't Try to Settle the Accident at the Scene
13. Use Tow Truck Properly

# *Emergency Warning Devices*

## *Two Lane or Undivided **Highway***



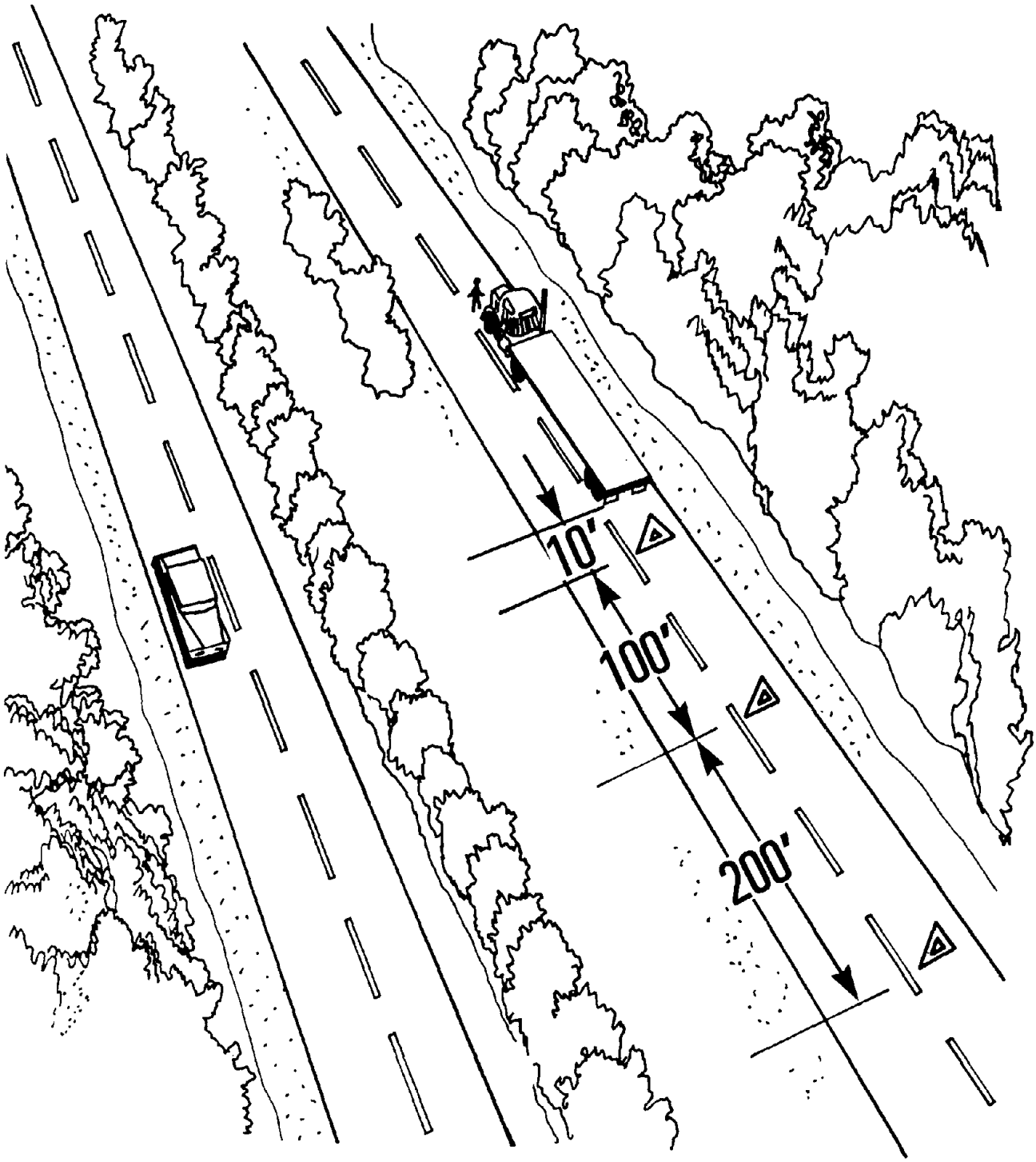

Note: (1) Triangle
(2) DOT-Over-DOT's
(3) Electric Emergency Lanterns
(4) Pot Torches

All Are Permissible

During Daylight Hours, in Lieu of Triangles, 2 Red Flags May Be Used at Rear Two Locations

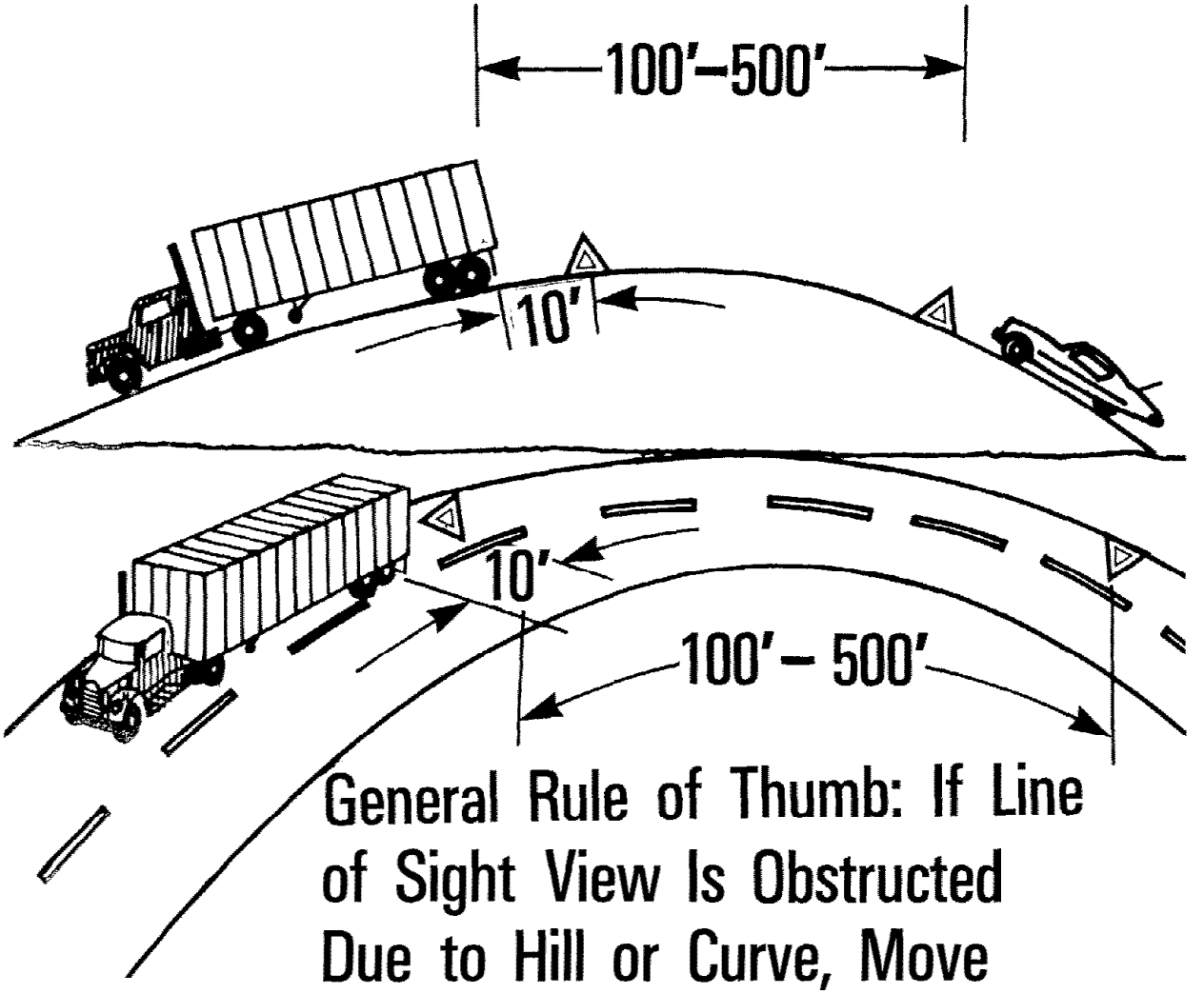
# *Emergency Warning Devices*

## *One-Way or Divided Highway*



# *Emergency Warning Devices*

## *Obstructed View*




General Rule of Thumb: If Line of Sight View Is Obstructed Due to Hill or Curve, Move the Rear Most Triangle to a Point Back Down the Road So That Adequate Warning is Provided

## UNIT 5.4 - TWO ACCIDENT SCENES

(These situations will be discussed during class)

Situation A

Driver A was making a right turn with his tractor-trailer. The driver of a subcompact approaching from the opposite direction apparently did not leave enough side clearance and when she put on her brakes, she sideswiped into the rear of the trailer.

Driver A figured that the accident was very minor and also assumed that the woman driving was clearly at fault. There was no apparent damage to the trailer and little damage to the subcompact. The woman, however, was extremely upset because her expensive sunglasses were broken in the accident. While she wasn't hurt, she did complain that her neck was bothering her a little. To help calm the woman, Driver A told her not to worry, his company would probably pay for the glasses. And since there was only very minor damage and apparently no real injuries, both drivers exchanged license numbers, names and insurance information and drove away.

Situation B

Driver B was driving a tanker truck loaded with fuel on a foggy night. He spotted a fender bender on the highway and he pulled his rig off to the shoulder in order to give assistance. He left the rear end of the tanker about a foot from the paved portion of the highway, put on his four-way flashers and then dashed across to give assistance.

## UNIT 5.4 - BASIC FIRST AID PRINCIPLES CHECKLIST

### Know Your Role and Limitations

Your Role

Give aid and assistance at scene of an accident

Your Limitations

Knowledge and skill in first aid

Company policies and State law

DEFINITION: Immediate and temporary care given victim until professional help arrives.

### Key Steps

- Keep calm,
- Do not move persons unless threatened by fire, traffic.
- Summon assistance.
- Make the person comfortable.
- Check all injuries and look for serious signs.
  - -- bleeding
  - -- stoppage of breath
  - -- shock
- Give immediate attention to most serious injuries.
- Keep the injured warm.
- Don't give water to unconscious or partly unconscious person.
- Keep spectators away.
- Try to calm the victim.

## Evaluate Injuries and Set Priority for Treatment

Three types of severe injuries that require prompt treatment:

- Severe bleeding
  - -- person bleeding profusely may be dead in minutes
- Blocked airway or stoppage of breath
  - -- most people can be saved by artificial respiration
  - -- if breathing stopped for 5 minutes only 25 percent chance of saving the victim
- Shock
  - -- vital body functions are depressed
  - -- shock can cause death even if injury is not life threatening

## CONTROL OF BLEEDING

### Direct Pressure

1. Apply a dressing or pad directly over wound.
2. Use the cleanest material available (preferably a pad of sterile gauze). A dirty cloth is better than uncontrolled bleeding.
3. Apply direct, even pressure, using your bare hand if necessary when bleeding is serious and when a dressing is not immediately available.
4. Leave dressing in place.
5. Continue pressure by applying a bandage.
6. *Secure* bandage in place, checking to be *sure* it is not too tight, thus cutting off circulation.
7. Elevate the limb above heart level except when there is a possible broken bone.
8. Treat for shock.
9. If blood soaks through the dressing, do not remove it but apply more dressings.

### Pressure Points

If direct pressure does not control the bleeding, put pressure on the artery (pressure point) closest to the wound in need.

Temporal artery--located in the hollow just in front of the ear

Facial artery--located in the small crevice about one inch from the angle of the jaw

Carotid artery--located deep and back on each side of the Adam's apple

Subclavian artery--located deep and down in the hollow near the collarbone

Brachial artery--located on the inner side of the upper arm about three inches below the arm pit.

Femoral artery--located midway in the groin between the crotch and hip

**Tourniquet**

**Warning:** Dangerous to use

Causes tissue injury and stoppage of entire supply of blood below it, resulting in gangrene and loss of 'limb

Only use for severe, life-threatening hemorrhage

Try to control first via direct pressure or arterial pressure

**Applying the Bandage**

1. Leave dressing on after bleeding is controlled (even if saturated)

2. Apply additional layers of cloth to form good sized covering

3. Bandage the wound snugly and firmly

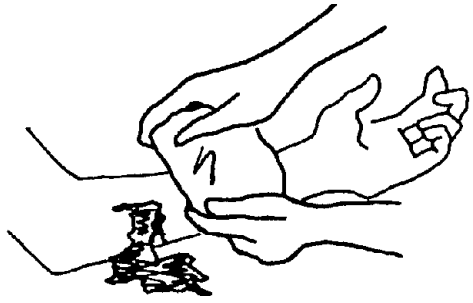
4. Check to see if bandage is too tight to avoid additional injury
   Loosen the bandage if necessary
   Swelling around the wound indicates that the bandage is interfering with circulation

**Treating for Shock**

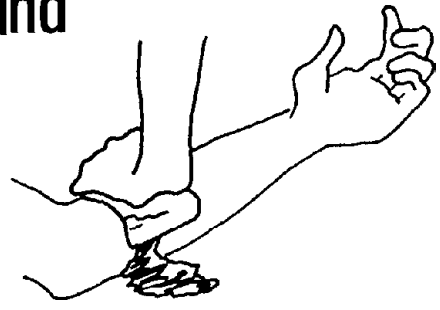
Loss of blood can cause shock

If symptoms persist treat for shock

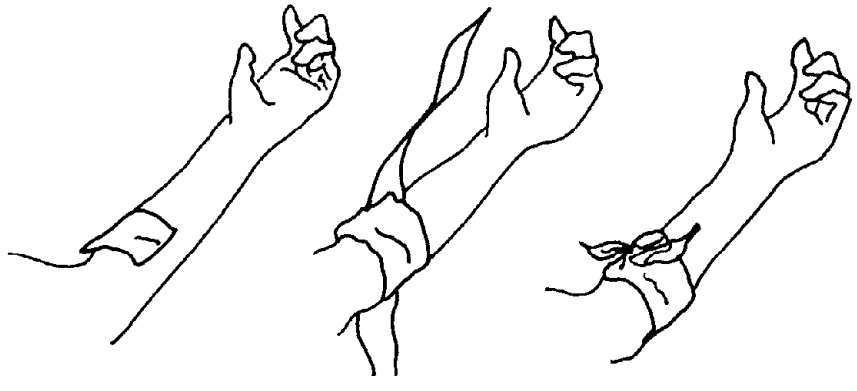
# *Apply Direct Pressure to Control Bleeding*



1. Apply Dressing Pad or Bare Hand Over Wound

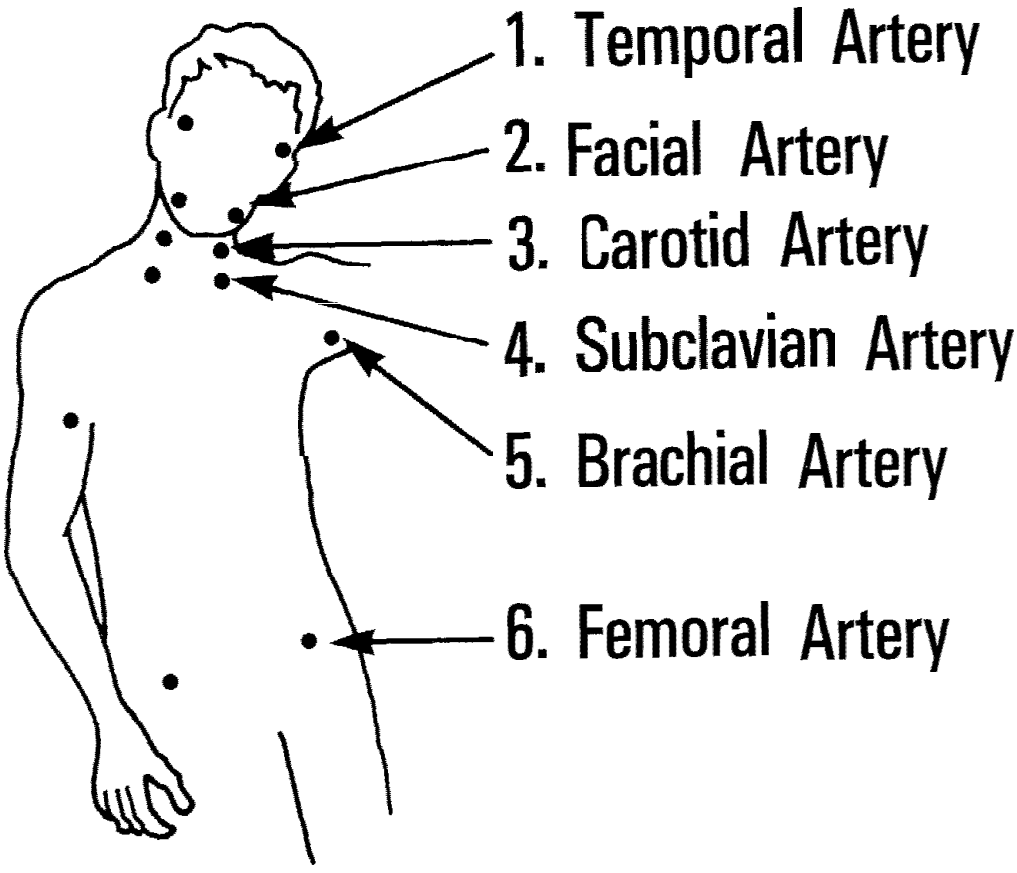


2. Continue Pressure Until Bleeding Stops or Slows Enough to Apply Bandage



3. Apply Bandage
   Check to See if It's Too Tight and Cuts Off Circulation

# *Arterial Pressure Points on the Human Body*



## ARTIFICIAL RESPIRATION

### Mouth-to-Mouth Method or Mouth-to-Nose Method

Simplest and most effective way to give artificial respiration

1. Place the victim on his back.

2. Open his mouth and clear out foreign matter, remove any food, dirt, or false teeth.

3. Tilt head back so chin points upward.

4. Tilt lower jaw beneath and behind so it juts out.
   This helps move base of tongue so it does not block air passage to the lungs.
   If this air passage is blocked, no amount of effort will get air.

5. Blow air into the person's lungs through his mouth or nose.
   Open mouth wide and place it tightly over person's mouth.
   Pinch his nostrils shut or close his mouth and place your mouth over his nose (air can be blown into a person' mouth even through clenched teeth).
   Blow into his mouth or nose.
   Continue to hold the lower jaw so it juts out to keep air passage open.

6. Remove your mouth from victim's mouth.

7. Turn head to side and listen for return of air outflow from lungs, if you hear air outflow, exchange of air has occurred.

8. Continue breathing for the victim.
   Blow vigorously into mouth or nose about 12 times a minute.

9. Remove mouth after each breath and listen for air exchange.
   If there is no air exchange turn person on side and strike him several times between shoulder blades with considerable force to dislodge any obstructions in air passage.
   Check position of head and jaw.
   Double check to make sure no foreign matter is in his mouth.

Return of normal breathing should occur in 15 minutes.
If normal breathing does not return continue process until medical aid arrives.
Electric shock and drug or carbon monoxide poisoning may require longer periods of artificial respiration.

The first sign of restored breathing may be a sigh or gasp.
Breathing may be irregular at first.
Continue artificial respiration until breathing becomes regular.

Watch for relapse

When normal breathing occurs, person usually recovers rapidly.
Be prepared for breathing stoppage again and repeat process.

**Back Pressure Arm Lift Method of Artificial Respiration**

Second most desirable method

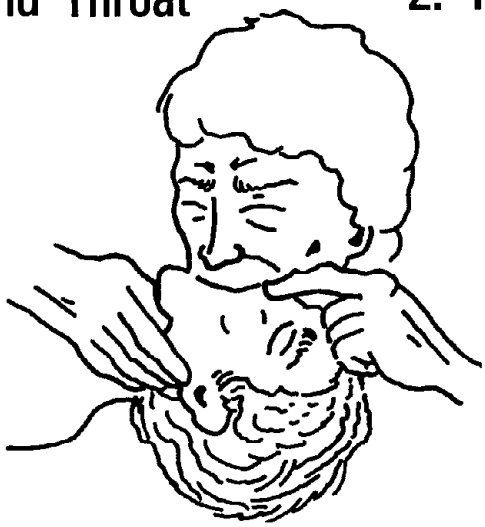
Use when injuries to head or face prevent mouth to mouth

1. Place victim face down with his hands crossed in front of his face.
2. Face victim.
3. Place your hands on his lower back.
4. Use rocking motion with smooth even pressure.
5. Press.
6. Release.
7. Pull elbows of victim forward.
8. Release.
9. Repeat rocking motion.

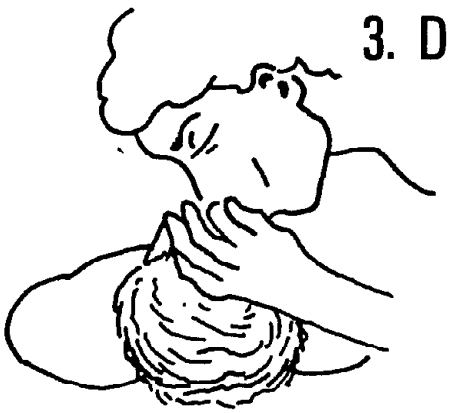
# *Mouth to Mouth Artificial Respiration*

1. Clear Mouth and Throat

2. Tip Head Back



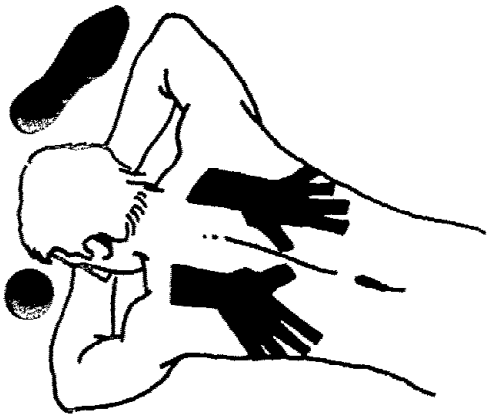
3. Don't Blow Too Hard



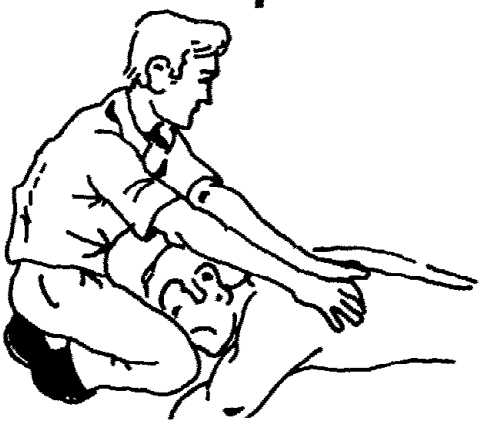
4. Pinch Nostrils

5. Use Mouth to Nose When Necessary

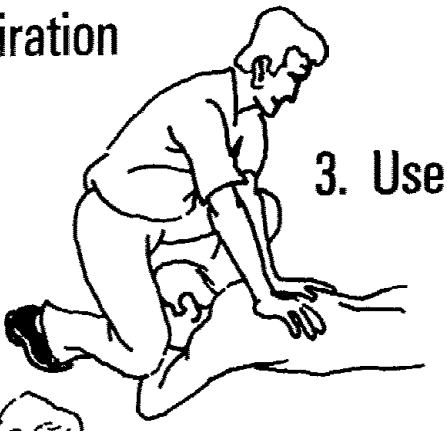
# *Steps in Back Pressure Respiration*



1. Position for Back Pressure Respiration



2. "Press-Release" Start Rocking Motion



3. Use Smooth Even Pressure

4. "Lift-Release" Grasp Arms Above Elbows

5. End Cycle

## Use Only When Mouth to Mouth Method Is Not Possible

## TREATMENT OF SHOCK

1. Have the injured person lie down.

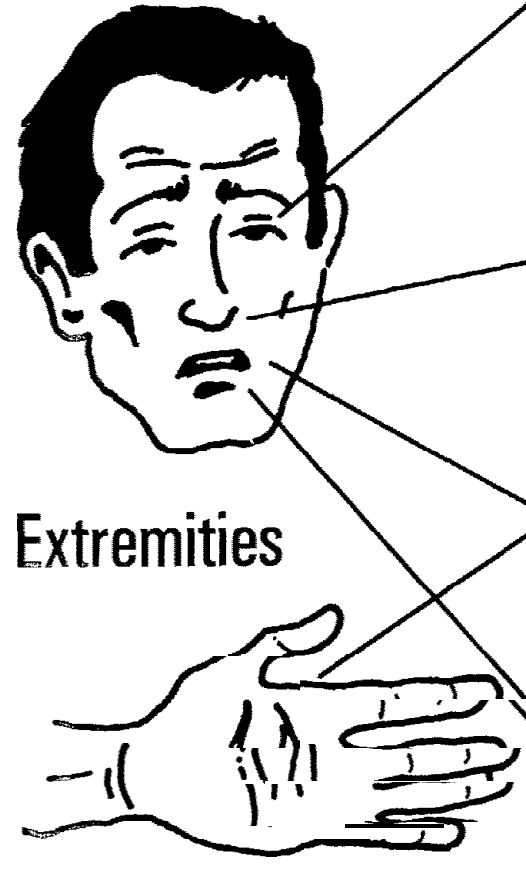
2. Elevate his feet and legs 12 inches or more.
   This helps the flow of blood to his heart and head.
   If the person has received a head or chest injury, or if he has difficulty breathing, elevate his head and chest rather than his feet.

3. Keep the person warm, but not hot.
   Place a coat, jacket, newspapers, or any available covering under him.
   Depending on the weather, cover him, i.e. on warm days or in a hot room, no covering is necessary.
   Avoid getting him so hot that he perspires, this draws blood to the skin and away from the interior of his body where it is needed.

4. If water is available, give him some every 15 minutes in small amounts if his condition permits.
   If he is unconscious, do not attempt to give anything to drink.
   If he vomits or is nauseated, postpone giving liquid until the nausea disappears.

5. Keep the person quiet.
   See that bleeding is controlled and injured parts are kept still.
   Assure him that he will get the best care you can give.
   Reassurance is a potent medicine.

# *Signs of Shock*




Eyes –Vacant
Lack luster

Pupils –Dilated

Breathing–Shallow
Irregular

Pulse –Weak or Absent

Skin –Pale
Cold
Moist

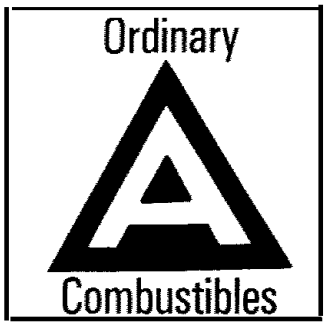
Nausea

## UNIT 5.4 - BASIC FIRE PREVENTION STEPS

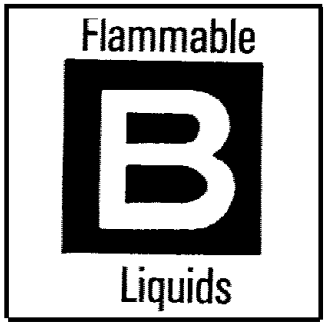
- Drive defensively and avoid accidents.
- Don't be careless with cigarettes.
- Check for fire hazards during pre-trip.
- Monitor for fire hazards enroute.

| CAUSE | PREVENTION |
|---|---|
| Tires | o Check for low pressure and "kissing" duals.<br>o Check at each stop. |
| Brakes | o Inspect for fire hazards.<br>0 Use properly. |
| Electrical System | o Inspect for damage or "shorts".<br>0 Use proper fuses. |
| Exhaust System | 0 Inspect for loose parts.<br>o Don't park over vegetation. |
| Fuel System | o Inspect for leaks.<br>o Fuel safely and legally. |
| Fusees and Flares | o Follow rules for use and storage. |
| Cargo Heaters | o Follow carrier rules. |

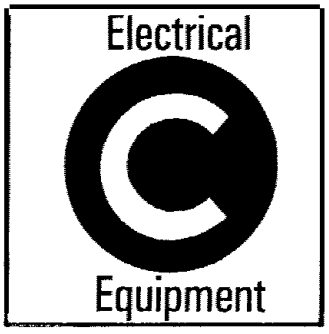
# *Classes of Fires*




A. Wood, Paper, Ordinary Combustibles
Extinguish by Cooling and Quenching
Use: Water or Dry Chemicals




B. Gasoline, Oil, Grease, Other Greasifying Liquids
Extinguish by Smothering, Cooling, Heat-Shielding
Use: Carbon Dioxide or Dry Chemicals




C. Electrical Equipment Fires
Use Nonconducting Agents: Carbon Dioxide or Dry Chemicals
DO NOT USE WATER


D. Fire in Combustible Metals
Use: Specialized Extinguishing Powders

## UNIT 5.4 - FIRE EXTINGUISHER CLASS CHECKLIST

| FIRE EXTINGUISHER TYPE | FOR | CLASS OF FIRE |
|---|---|---|
| Regular Dry Chemical | | B, C |
| Multi-Purpose Dry Chemical | | A, B, C, or B, C |
| Purple-K Dry Chemical | | B, C |
| KCL Dry Chemical | | B, C |
| Dry Power Special Compound | | D |
| Carbon Dioxide (Gas) | | B, C |
| Halogenated Agent (Gas) | | B, C |
| Water | | A |
| Water with Anti-Freeze | | A |
| Water, Loaded Stream Type | | A, B |
| Foam | | B, some use on A |

## UNIT 5.4 - FIRE EXTINGUISHER OPERATION CHECKLIST

- Read and understand instructions **BEFORE** a fire occurs.
- Be prepared for the discharge.
- Hold it firmly.
- Aim at base of the flames.
- Make maximum use of length.
- Use slow side to side sweeping method.
- Stay away from fuel source.
- Watch for small pockets of flareups or flashbacks.
- Keep wind at your back to avoid flames, gases and smoke.

## UNIT 5.4 - FIRE EXTINGUISHER INSPECTION CHECKLIST

[ ] Check for proper weight

[ 1 Gauge/Indicator showing its in the operable range

Cl Safety seals intact

[ 1 Properly mounted in bracket

[ 1 No damage, rust, dirt

[ ] No nozzle obstruction

Then be sure you

- know how to use it.
- check it as part of your pre-trip inspection.
- remember it is required by FMCSR.
- have the right type for cargo being hauled.

# UNIT 5.5
# PERSONAL HEALTH AND SAFETY

# UNIT 5.5 PERSONAL HEALTH AND SAFETY

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- o avoid the use of alcohol and drugs that can affect your ability to drive safely.
- o use proper diet, exercise, and rest so that you will be alert while driving.
- o avoid fatigue by getting proper rest while off duty and by using rest stops while you are enroute.
- o obtain regular vision, hearing, and health checkups.
- o use personal protection gear (goggles, hardhat, etc.) when necessary.
- o use safe lifting techniques.
- o wear proper clothing for cold, hot, and other kinds of bad weather conditions.
- o avoid unsafe situations that could result in robberies, hijackings, and other loss of cargo.

You will learn

- o how alcohol, drugs, poor diet, fatigue, poor vision, hearing problems, and health problems can cause problems when you drive.
- o how various kinds of personal protection gear help to prevent you from being hurt.
- o Federal and State regulations on the physical requirements of drivers.
- o the importance of staying with a disabled vehicle if you get stranded in bad weather.
- o the kind of background and character you need to have in order to be a safe and successful truck driver.

## WHAT WILL HAPPEN IN MIS UNIT

All three lessons in this unit will take place in the classroom.

## Outline of Classroom Lessons

### Lesson 1 - Personal Health and Driving

I. Basic Physical Requirements
   A. Mental and Physical Condition
   B. Maintaining a Good Diet
   C. Exercise

II. Fatigue and Driving
   A. Causes of Fatigue
   B. Effects of Fatigue
   C. Dealing with Fatigue

III. Alcohol and Driving
   A, Myths and Facts
   B. How Alcohol Works
   C. How Alcohol Affects Driving
   D. Risks of Drinking and Driving
   E. Sobering Up
   F. Federal Law and Truck Drivers Drinking

IV. Drugs and Driving
   A. Effects of Major Categories of Drugs
   B. Rules for Using Drugs

V. Class Discussion

### Lesson 2 - Safety Equipment and Practices

I. Dressing Safely for the Job and Using Proper Equipment

II, Vehicle and Cargo Danger Zones: Falling and Other Hazards

III. Avoiding Injuries When Lifting

IV, Roadside Emergencies

V. Avoiding Crime

Lesson 3 - The Truck Driver's Environment

I. Driver Error: The Major Cause of Traffic Accidents
   A. Direct Causes of Traffic Accidents
   B. Underlying Causes of Driver Error

II. On- and Off-Duty Job Stresses
   A. Stress Leads to Driver Error
   B. Job Demands
   C. Job Conditions That Lead to Physical/Mental Fatigue
   D. Off-Duty Living Habits and Problems Affect Job Performance
   E. Responsibility of Professional Driver to Stay in Shape

III. Class Discussion

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Essentials of a Good Diet
- On-the-Job Exercise Routine
- Dealing with Fatique
- Drinking/Driving Laws and Penalties
- Common Drugs of Abuse
- Special Protective Equipment for Drivers
- Six Steps to Safe Lifting
- Two Scenarios (For use in classroom discussion)

## ESSENTIALS OF A GOOD DIET

- Wide variety of foods
  - -- Four basic food groups
  - -- Milk group
  - -- Meat group
  - -- Vegetable/fruit group
  - -- Bread/cereal group
  - -- Lack of variety = lack of necessary vitamins

- Avoid too many calories
  - -- Calories = energy
  - -- Take in only what you need
  - -- Too many calories = overweight, fatigue and lack of energy

- Avoid extremes of hunger and overeating
  - -- Hunger - lack of energy
  - -- Overeating = stuffy, lethargic feeling

- Example of well balanced meal

Breakfast

Fruit juices
Multivitamin
Bowl of grain cereal topped with fruit
Whole wheat toast
Nonfat milk

Snacks

Avoid quick sugar snacks (candy bars) and junk food
Try dried fruit or oatmeal cookies

## UNIT 5.5 - ON-THE-JOB EXERCISE ROUTINE

1. Bend over in front of the cab, stretch your arms, breath deeply.

2. Run two laps around the vehicle.

3. Stand in front of the vehicle with your arms behind your head, twist your body from side to side for about 30 seconds.

4. Spread your legs and pull up on the cab twice as though you were trying to lift it (not too hard, avoid a hernia).

5. Keep legs spread and do ten pushups off the cab bumper.

6. Get under the bumper and do ten pullups.

## Prevent it

Get proper rest

Avoid or be alert to fatigue causing conditions

- Job and home tension
- Improper diet
- Lack of exercise
- Use of drugs and alcohol
- Worry

## Recognize it

"Tired" eyes are sure sign

## Deal with it properly

Makes it worse

- Eating
- Coffee
- Pills and alcohol

Helps a little

- Opening the window
- Turning the radio up
- Chewing gum
- Talking to partner

Helps a lot

- A cool, air-conditioned cab
- Stopping for exercise
- Taking a nap or long rest

## FMSCR 392.5

Prohibits!

- Operating under the influence of alcohol
- Being under the influence of alcohol or taking a drink within 4 hours prior to duty
- Drinking on duty

## Other Risks and Penalties

Increased accident and injury risk

Damage
Injury
Loss of life
Injuring and killing others

Increased financial risks

Fires and penalties
Higher insurance
Loss of license
Jail sentence
Loss of job

## Common Drugs of Abuse

| CATEGORY | Drugs | Sample trade or other names | Medical uses | Dependence: Physical | Dependence: Psychological | Effects in hours | Possible effects | Effects of overdose | Withdrawal symptoms |
|---|---|---|---|---|---|---|---|---|---|
| CANNABIS | Marijuana | Pot, grass, reefer, sinsemile | Under investigation | Unknown | Moderate | 2-4 | Euphoria, relaxed inhibitions, increase in heart and pulse rate, reddening of the eyes, increased appetite, disoriented behavior. | Anxiety, paranoia, loss of concentration, slower movements, time distortion. | Insomnia, hyperactivity, and decreased appetite occasionally reported |
| | Tetrahydrocannabinol | THC | | | | | | | |
| | Hashish | Hash | None | | | | | | |
| | Hash oil | Hash oil | | | | | | | |
| DEPRESSANTS | Alcohol | Liquor, beer, wine | None | High | High | 1-12 | Slurred speech, disorientation, drunken behavior | Sh[redacted]ation, co[redacted]my ski[redacted]pils, weak and rapid pulse, coma, possible death | Anxiety, insomnia, tremors, delirium, convulsions, possible death. |
| | Barbiturates | Secobarbital, Amobarbital, Butisol, Tuinal | Anesthetic, anti-convulsant, sedative, hypnotic | High-moderate | High-moderate | 1-16 | | | |
| | Methaqualone | Quaalude, Sopor, Parest | Sedative, hypnotic | High | High | 4-8 | | | |
| | Tranquilizers | Valium, Librium, Equanil, Miltown | Anti-anxiety, anti-convulsant, sedative | Moderate to low | Moderate | | | | |
| STIMULANTS | Cocaine | Coke, flake, snow | Local anesthetic | Possible | High | ½-2 | Increased alertness, excitation, euphoria, increase in pulse rate and blood pressure, insomina, loss of appetite | Agitation, increase in body temperature, hallucinations, convulsions, possible death, tremors. | Apathy, long periods of sleep, irritability depression |
| | Amphetamines | Biphetamine, Dexedrine | Hyperactivity, narcolepsy | | | | | | |
| | Nicotine | Tobacco, cigars, cigarettes | None | High | High | 2-4 | | Agitation, increase in pulse rate and blood pressure, loss of appetite, insomnia | |
| | Caffeine | Coffee, tea, cola drinks, No-Doz | None | Low | Low | | | | |
| HALLUCINOGENS | LSD | Acid | None | None | Degree unknown | 8-12 | Illusions and hallucinations, poor perception of time and distance. | Drug effects becoming longer and more intense, psychosis. | Withdrawal symptoms not reported. |
| | Mescaline and peyote | Button, Cactus | | | | | | | |
| | Phencyclidine | PCP, angel dust | Veterinary anesthetic | Unknown | High | Variable | | | |
| | Psilocybin-psilocin | Mushrooms | None | None | Degree unknown | 6 | | | |
| INHALANTS | Nitrous oxide | Whippets, laughing gas | Anesthetic | Possible | Moderate | Up to ½ hr | Excitement, euphoria, giddiness, loss of inhibitions, agressiveness delusions, depression, drowsiness, headache, nausea. | Loss of memory, confusion, unsteady gait, erratic heart beat and pulse, possible death | Insomnia, decreased appetite, depression, irritability, headache |
| | Butyl nitrite | Locker room rush | None | | | | | | |
| | Amyl nitrite | Poppers, snappers | Heart stimulant | | | | | | |
| | Chlorohydrocarbons | Aerosol paint, cleaning fluid | None | | | | | | |
| | Hydrocarbons | Aerosol propellants gasoline, glue, paint thinner | None | | | | | | |
| NARCOTICS | Opium | Paregoric | Antidiarrheal, pain relief | High | High | 3-6 | Euphoria, drowsiness, respiratory depression, constricted pupils, nausea | Slow and shallow breathing, clammy skin, convulsions, coma, possible death | Watery eyes, runny nose, yawning, loss of appetite, irritability, tremors, panic, chills and sweating, cramps, nausea |
| | Morphine | Morphine, Pectoral Syrup | Pain relief, cough medicine | | | | | | |
| | Codeine | Codeine, Empirin Compound with Codeine, Robitussin A-C | | Moderate | Moderate | | | | |
| | Heroin | Horse, smack | Under investigation | High | High | 12-24 | | | |
| | Methadone | Dolophine, Methadose | Heroin substitute, pain relief | | | | | | |

Source: National Institute on Drug Abuse

## UNIT 5.5 - SPECIAL PROTECTIVE EQUIPMENT FOR DRIVERS

| Equipment | Situation/Hazard |
|---|---|
| Respirators | Handling chemical loads<br>Hazard: Overcome by fumes, lung damage |
| Splash plates | Offloading liquid chemical or fuels<br>Hazard: Burns caused by splashing liquids |
| Goggles | Loads with dangers to eyes<br>Hazard: Serious eye injuries could mean loss of livelihood |
| Dust masks | Handling dusty commodities<br>Hazard: Respiratory problems |

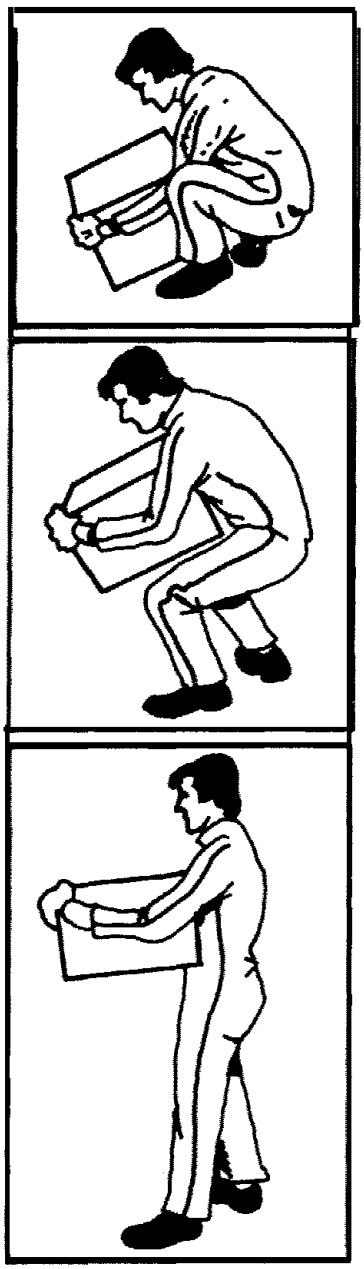
Know what special equipment to use when handling materials especially hazardous materials!

Know the hazards!

Use the equipment provided by supervisors or shipper/consignee!

# *Unit 5.5 – Six Steps to Safe Lifting Checklist*

1. Feet Parted–One Alongside, One Behind Object
2. Keep Back Straight, Nearly Vertical
3. Chin Tucked in
4. Grip the Object With the Whole Hand
5. Elbows, Arms Tucked in
6. Body Weight Directly Over Feet



## *Avoid Twisting:*

- Twisting Is Common Cause of Back Injuries

- Turn Forward Foot in the Direction of Movement

# UNT 5.5 - TWO SCENARIOS FOR CLASS DISCUSSION

## Instructions

Scenarios A and B are descriptions of brief periods in the lives of two young truck drivers. Read each of the scenarios. Then read the discussion questions and be ready to discuss the answers--first for Scenario A and then for Scenario B.

## Discussion Questions

1. Are there any off-duty and job stresses that will affect the driver? If so, what are they?

2. How will the off-duty and job stresses affect the physical, mental, and emotional state of the driver? Give examples of what could happen.

3. Did the driver commit any legal violations? Is there a chance that he might commit a violation? What could happen?

4. Is the driver likely to make a driving error? What could happen?

## SCENARIO A

Joe Smith is a rookie driver for the ABC Trucking Company, He has just landed his first real driving job in the business, after an apprenticeship of helping out on the docks and relief driving. Joe is a veteran of several long-distance runs, but it is still pretty new to him. He is also newly married, and the bills are just starting to pile up. The honeymoon is over, and reality has set in,

It's Sunday night and he and his wife, Mary, have just returned from a physically exhausting camping trip. The ride home was not pleasant. Mary kept nagging him about their money problems. They both wanted to move to a new house. But Joe didn't think they were ready for that now. The bickering lasted till at least midnight. Then Joe got the cold shoulder treatment. He knew Mary was probably right because he wasspending a lot of money on camping and hunting, money they could use to get a better place to live, He slept fitfully.

The dispatcher's call came at 5 a.m. Be at the terminal at 7:30 a.m. to haul a load of LTL to Boston. It was an overnight trip, a one-man operation. He was short of cash, so he rifled through Mary's purse and got what he needed. In the parking lot of the terminal, Joe hastily updated his Driver's tog.

He fixed himself up as best as he could and reported to the dispatcher and got his papers. He noted that he was assigned to pull trailer #767. His tractor was #676.

He hurried out to the yard. After hastily hooking up, he gave a couple of tires a quick kick, then jumped in his rig and took off.

Once on the road, his mind returned to his problems. He even ignored the fact that the trailer seemed to be pulling a bit hard. Instead, he became very aware of the fact that he was hungry, It dawned on him that he had not eaten anything since coming home the night before,

## SCENARIO B

Jim Riley is a new driver at Brown Trucking Company. He has already completed a couple of long sleeper runs and likes his job.

Jim knew he was scheduled for a long haul to Buffalo tomorrow, not a pleasant prospect in January. It meant a layover, and he might have to deadhead to Cleveland to get a return load.

Jim also liked to party. He promised himself that he wouldn't stay out too late. But the party didn't end till well past midnight. He drank a lot of beer. Didn't get too drunk, but sure felt the effects.

Getting up at 7 a.m. was tough. But he made it to the terminal on time. The dispatcher was busy and didn't notice that Jim appeared a little fuzzy. After the routine in the yard, Jim got on the road by 8:30 a.m. He knew he had done a better job of pre-trip in the past and made a mental note to give the vehicle a better going over at the first rest stop. Except for Route 35 at the beginning of the trip, the rest of the route was not familiar to him. He hadn't had time to really go over the instruction and would look at them later. He remembers the dispatcher mentioned something about a detour and bad weather (possibly snow or sleet) ahead. So he turned on the radio full blast to get the weather and listen to music. It would help keep him awake too.

What was needed now was coffee. Chet's Diner was a great place to stop and was just outside of town before Route 35. It would put him a little behind schedule, but the cops were never around on that first stretch of Route 35. Traffic always moved a little faster, so he would make up some of the lost time.

Jim felt a little better now. Traffic was picking up and he pushed along right behind a small import. "C'mon. Get over in the right lane," he thought, "I don't want to spend all day getting to the diner."

He turned off the radio and flipped on the CB. He paid a lot of attention to that CB trying to get up chatter with some other drivers and maybe some company at the diner. The clouds darkened as he passed the time with another CB'er. Jim thought, "Only 15 more minutes to Chet's Diner."

(End of Reprint from Student Manual)

# UNIT 5.6 TRIP PLANNING

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- plan a route that is the best after you consider travel time, fuel costs, possible hazards, and Federal, State, and local restrictions on where a truck may be driven.
- obtain any special permits you might need because of the type of vehicle you are driving, the kind of cargo you are hauling, or the road you will be driving on.
- choose a safe place for stops and layovers, particularly if you are transporting hazardous materials.

You will learn

- the kinds of vehicles, cargo, and routes that call for special permits.
- common map symbols.
- procedures for route planning.
- laws and restrictions on vehicle size and weight.

You will learn how to

- 0 interpret maps correctly.
- estimate travel time and plan rest stops and layovers.
- estimate fuel consumption and plan fuel stops.
- estimate expense money you will need and obtain money or credit cards for use on your trip.

## WHAT WILL HAPPEN IN THIS UNIT

All learning in this unit will take place in the classroom.

## Outline of Classroom Lessons

Lesson 1 - Trip Analysis and Procedures

I. Trip Planning Principles
   A. What is Trip Planning?
   B. Class Discussion: Trip Planning Factors and Why They are Important
   C. Trip Planning Principles
      1. Type of Trip
      2. Factors Related to the Driver
      3. Factors Related to the Vehicle
      4. Factors Related to the Cargo
      5. Factors Related to Environmental Conditions

II. Federal, State and Local Regulations
   A. Federal Regulations
   B. State Regulations
      1. Permission to Operate
      2. Reciprocity Agreements
   C. Size and Weight Limitations

III. Hazardous Materials
   A* Federal Regulations
   B. State and Local Restrictions

IV. Record Keeping and Trip Reports
   A. Key reports driver must maintain
   B. Freight Documentation and Related Reports
   C. Trip Records and Related Expense Reports
   D. Tachograph Programs and Other Monitoring Records

V. Estimating Time, Fuel, and Money
   A. Estimating Time of Trip
   B. Estimating Fuel Usage
   C. Estimating Money Needed

VI. Map Reading
   A. Key Characteristics of Maps
   B. Sources of Maps
   C. Types of Maps
   D. Using a Map

VII. Summary

VIII. Assignment of Trip Planning Exercise

Lesson 2 - Trip Planning Exercise

I. Preparation for Classroom Activity

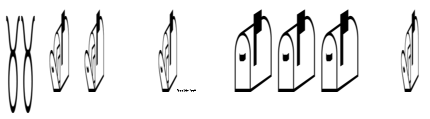
II. Student Presentations

III. Instructor Critique

## STUDENT AIDS

To help you learn the material in this unit, the following items have been included in your student material.

- Five Basic Steps in Planning a Trip
- Steps in Making Your Own Map
- Instruction for Trip Planning Exercise--for use in class
- Trip Planning Exercise Report Form--for use in completing the Trip Planning Exercise



## FIVE BASIC STEPS IN PLANNING A TRIP

Not all drivers are responsible for planning their trips. Some do no planning, some do part of the planning, and some do all of the planning. Drivers should know the basic steps in trip planning even if they will not be responsible for planning their trips. Sooner or later the information will be useful.

### 1. Make Sure All Paperwork is Up to Date

Paperwork includes driver logs, vehicle inspection reports, driver license, vehicle permits and licenses, and freight documents. Everything must be current, valid, and in compliance with the regulations and requirements of areas you will be traveling in (States, counties, cities, etc.).

### 2. Select the Route

This may be a dispatcher responsibility or a driver responsibility. There are many factors that must be considered. The size and weight of the vehicle might mean that certain roads cannot be used. If you will be carrying hazardous cargo, this will also determine which roads you can use. Unstable cargo (liquids, cattle, etc.) will mean that you want to avoid narrow, sharply curving roads if possible. You also need to consider time of travel, the kind of traffic you will be driving in, and what the weather will be. Heavy rush-hour traffic on certain roads will slow you down. Rain and snow on hilly or curving roads will be dangerous.

### 3. Estimate Traveltime and Plan for Rest Stops

Even if the company does it for you, this is a very important step. Your own safety depends on good planning. Examine your route and figure out where you will need to stop. This will help you to avoid dangerous fatigue, especially if you are driving at night. The basic formula for travel time is total distance of your trip divided by average mph. This will tell you about how many hours you will be driving. You will also have to consider things that will increase your travel time, such as heavy traffic, bad weather, number of stops, and so forth.

### 4. Estimate Fuel Usage and Plan for Fuel Stops

The company may do this for you or it may be your responsibility. It's an important step because if you run out of fuel, you might be stuck for some time. You may be able to plan rest and fuel stops together sometimes. You need to know how much fuel your rig carries and what the mpg is. After considering the type of traffic and road conditions and anything else that could increase the amount of fuel you'll need, check your map for fuel stops.

## 5. Plan for Expense Money and Personal Needs

This is your responsibility. The company will have policies on issuing money in advance, providing credit cards, and approved methods for paying bills and getting reimbursed for money you spend. You need to consider how often you will have to stop, the amount of fuel you will be purchasing, tolls, the number of meals you will have to pay for, whether you will be staying in a motel, etc. You also need to make sure you have money for personal expenditures (things that the company will not pay for). Finally, you need to make sure that you have all the clothing you will need, required tools, etc.

## STEPS IN MAKING YOUR OWN MAP

This will be discussed and practiced in class. Here are the five basic steps in making your own map.

### 1. Have Your Materials Ready

You will need notebook paper, sharp pencils, and road map(s) showing your starting and destination points.

### 2. Locate Your Starting and Destination Points

Use the map index if necessary.

### 3. Study the Map(s) and Select Your Route

Use main highways and streets whenever possible. Secondary roads usually have lower speed limits, and are narrower and more dangerous. After considering all factors, select your route.

### 4. Mark Your Starting and Destination Points on the Notebook Paper

Put your starting point at one end and your destination point at the other.

### 5. Draw an Approximate Map of Your Route

You will show only what you need to know. Checking a confusing road map while you are traveling is difficult and dangerous. Your map will make it easier for you to follow your route and make sure you are on the right road. You don't have to stop often to check your map, and when you do stop, you can check quickly without having to refer to several maps or search for your location. Write down the names of all the streets and highways you will be using. Mark the direction of travel for each road and indicate all the turns you will have to make. Mark approximate mileage, especially toward the end of the trip (e.g., Route 66, 5 miles). Print all names in large, easy-to-read letters. Make sure numbers are large enough to see at a glance.

## INSTRUCTIONS FOR TRIP PLANNING EXERCISE

In this exercise you will be assigned to a small group. Each group will plan a trip based on information and material supplied by the instructor. Each group will meet at least twice, once initially to divide the labor and a second time to make final route selection and summarize results.

### Exercise Directions for Each Group

1. Select a spokesman to act as chairman and to present results of exercise to the rest of the class.

2. Instructor will provide each group with the trip data required, starting place, destination, dispatch time, vehicle data, etc.

3. Record the trip data on the attached Trip Planning Exercise Report Form.

4. Instructor will provide copies of pertinent State regulations or similar information to aid in identifying required permits, tax stickers, etc.

5. Each group will identify all required permits, tax stickers, and other documentation which must be completed before the trip. Findings will be listed on the Trip Planning Exercise Report form, including cost of permits, where they can be obtained and when they must be obtained, e.g., 30 days before the trip.

6. Each group will investigate and list Federal, State and local regulations which will effect route selection or otherwise effect trip planning. Pertinent regulations and their effect on trip planning will be listed on the Trip Planning Exercise Report Form, e.g., vehicle or cargo weight restrictions, etc.

7. Groups will meet and select the route to be taken on the trip. Each group will use the map provided and make their selection based on the trip planning factors discussed in class. The route selected must meet all legal requirements and be the safest and most economical route among the alternatives.

8. Once the route is selected, each group will plot the route on notebook paper using the five step procedure listed earlier in this Student Manual.

9. Each group will estimate required fuel and cost of trip, supplies and other personal needs, and the time of the trip, including the estimate, time of arrival at the destination, and list that information on the Trip Planning Exercise Report Form.

10. Each group spokesman will prepare an outline of the group's findings and make a brief (5-10 minute) class presentation. The outline will be based on the findings recorded on the Trip Planning Exercise Report Form and will include:

    a. List of permits, tax stickers and other documentation required, costs, when and where they are obtained.

    b. Federal, State, local regulations which effect route selection and how they effect route selection.

    c. Route selected and at least three key reasons why this route was selected over other alternatives.

    d. Estimate of time, fuel, cost and supplies.

11. The group spokesman will be prepared to draw the groups plotted trip on the blackboard or flip chart or will make a transparency of the map.

Notes:

TRIP PLANNING **EXERCISE REPORT FORM**

I. TRIP DATA (SUPPLIED BY INSTRUCTOR)

**Points of Trip**

Starting Location _____

Dispatch Date and Time _____

Destination _____

**Vehicle and Cargo Information**

Vehicle and Cargo Information _____

Fuel Tank Capacity _____

Performance Information, e.g., Average mpg _____

_____

Cargo Description and Weight _____

Gross Vehicle and Cargo Weight _____

II. **TRIP REPORT FORM**

1. List permits, tax stickers and other documentation required.

**Documentation Required-----Where it's Obtained-----When it Must be Obtained**

_____

_____

_____

_____

_____

_____

2. List Federal, State and local regulations and how they will effect rout selection or trip planning, include how trip will be effected.

_____

_____

_____

_____

_____

## Report Form Page 2

3. Briefly describe alternative routes. Select the route that meets all trip planning requirements and list at least three key reasons for that selection. Also, plot the route on notebook paper using the five step method described in this unit.

4. Estimate the fuel, cost, time and supplies required for the trip,

**Fuel**

Number of gallons_____

**Cost**

Fuel $_____

Food $_____

Rest Stops $_____

Emergency money $_____

Layovers $_____

Other $_____

**Time**

Hours to complete trip _____

Estimated time of arrival_____

**Supplies** (e.g., special clothing, tools, emergency equipment)

UNIT 5.7
PUBLIC AND
EMPLOYER
RELATIONS

# UNIT 5.7 PUBLIC AND EMPLOYER RELATIONS

## WHAT YOU WILL LEARN IN THIS UNIT

You will learn to

- o show courtesy to other drivers by helping them when they need assistance, by not using your horn unless it's necessary, by not blocking driveways and entrances, and by pulling over to let faster vehicles pass you.
- o show courtesty to customers by not arguing with them and by referring any problems to the company.
- o dress neatly and propertly when you are on duty.
- o prepare job applications propoerly and be ready for job interviews.
- o help motorists when permitted by company policy.

You will learn

- o how unsafe and rude behavior by drivers gives the public a bad image of drivers, their employers, and the whole trucking industry.
- o the proper way for handling complaints of the public and customers.
- o how lack of driving courtesy can cause accidents.
- o that employer's rules are more important than any taught by the school.

## WHAT WILL HAPPEN IN THIS UNIT

This unit consists of two classroom lessons. As part of the second lesson, your school may elect to invite a guest lecturer from a local trucking company to discuss job opportunities and answer questions.

## Outline of Classroom Lessons

Lesson 1 - The Driver's Role in Public Relations

I. The Image of the Trucking Industry

II. Contact With the Public
   A. Maintaining a Good Image in Driving
      1. Following the Law
      2. Maintaining a Good Appearance
      3. Sharing the Road

B. Maintaining a Good Image in Public Contact
   1. On Duty
   2. Off Duty
   3. Rendering Assistance
   4. Standing up for the Industry

III. Customer Relations
   A. A Driver is His Company's Visible Contact with the Customer
   B. Assisting in Gaining Business
   C. Following Company Rules
   D. Displaying a Positive Attitude

IV. Class Discussion: Public Relations

Lesson 2 - Employer Relations

I. Basic Job Requirements
   A. Federal Motor Carrier Safety Regulations Requirements
   B. General Job Qualifications
   C. Basic Company Policies
   D. Opportunities for Advancement

11. Applying for a Job
   A. The Job Application Process
   B. Reference Checks
   c. The Job Interview
   D. Tests

III. Practical Exercises: Two Exericses in Applying for a Job
   A. Filling out a Job Application
   B. Practice Job Interviewing

VI. Guest Lecturer (Optional)

**STUDENT AIDS**

To help you learn the material in this unit, the following items have been included in your student material.

- four Checklists on Public Relations
- Guidelines for Taking Part in a Job Interview
- Sample of an Application for Employment Form
- Instructions for Practical Exercise: Job Interviewing (To be used in Class)

## IDENTIFYING GOOD AND BAD TRUCK DRIVER IMAGES

The driver and his/her vehicle are the image of the trucking industry to the public.

### Avoid a Bad Image!

Bad Image

- o Road hog
- o Speeder
- o Tailgater
- o Rough or uncouth language/behavior

Results

- o Public complaints
- o Letters to lawmakers
- o Laws restrict road use
- o Lower speeds
- o Higher use taxes
- o Tougher to make a living

### Maintain a Good Image

Good Image

- o "Knight Of the Road"
- o Safe, courteous, professional driver

Results

- o Benefits trucking industry, your company, your family and YOU! !

## MAINTAINING GOOD IMAGE IN DRIVING

### Follow the Law

**Do**

Obey a71 Federal/State laws
Create image of law abiding professional

**Don't**

Disobey laws

### Stay in Shape

**You**

Clean, neat image and in good physical, mental shape

**Your Vehicle**

Clean, well maintained and safe

### Share the Road

Watch for bad habits in sharing the road with public
Your bad driving can result in public resentment
Watch out for areas of conflict with public

- Space
- Speed
- Up hills
- Passing
- Intersections
- Use of horn/loud braking
- Use of headlights
- Going through towns/cities
- Exhaust noise/smoke
- Stopping and parking

## MAINTAINING GOOD IMAGE IN PUBLIC CONTACT

### While Driving

Don't retaliate

Always act like a professional

Don't use foul language on the CB Radio

### On Duty

Be courteous

Maintain good appearance

Avoid arguments

Be a good company representative

### Off Duty

Avoid loud, rowdy behavior

### Rendering Assistance

Help when possible

Learn first aid

Help stranded motorist

Use CB to help others

## MAINTAINING GOOD CUSTOMER RELATIONS

- Follow company procedures
- Don't argue or 'lose your temper
- Be courteous
- Be polite, honest, and helpful
- Always thank the customer

If you are careless in appearance and actions --

**YOU MIGHT LOSE THE CUSTOMER**

If you give that extra care --

**YOUR MIGHT GET MORE BUSINESS!**

**REMEMBER**

Driver has more contact with customers than any other person in the company.

## GUIDELINES FOR TAKING PART IN A JOB INTERVIEW

Before the Interview

1. Learn all you can about the company and its operations.

2. Be prepared to ask intelligent questions about: the job, company policies, benefits, opportunities for advancement, etc. Think about what you will want to know before you got to the interview. Write the questions down so you won't forget to ask something important.

3. Know your abilities and limitations. Be prepared to speak positively about the skills you have. Are you able to drive the kind of vehicles they use? If not, can you learn and will they train?

4. Be prepared for written or driving tests. You can sometimes find out ahead of time if tests will be given and what they will cover.

5. Bring all necessary paperwork to the interview with you: licenses, certificates, letters of reference, social security card, etc. You will have them if they are requested and you can volunteer them if you are asked.

6. Be on time or a few minutes early.

7. Dress neatly.

### During the Interview

1. Sell yourself. Present your qualifications and experience honestly and positively. Don't lie, brag, or try too hard to impress.

2. Try to relax and be yourself. But don't worry if you are a little nervous--everyone is a little nervous during a job interview.

3. Have a positive attitude throughout the interview. Show that you are interested and enthusiastic. Let the interviewer know that you are willing to learn.

4. Respond to the questions that are asked honestly, but don't go into unncessary detail. Give the interviewer the information he wants but keep things moving.

5. Remember to ask the questions you have concerning basic company policy, e.g., hours, pay, benefits, advancement, etc. Sometimes you can get them in during the conversation. Other times, you will need to ask them at the end when the interviewer says something like, "Do you have any questions about anything I said?" Remember, you want to work at a company that you will be happy with the your employer wants an employee that will be happy in this job. Don't wait till you start work to find out that this isn't the job for you.

6. Be courteous, polite, and friendly.

7. Don't smoke unless you are invited to.

8. When the interview is over, thank the interviewer for talking with you and express your desire to work for the company and your feeling that you will be able to make a contribution.

9. Find out the company's procedure for notifying successful job applicants, whether they will write or call and when you might hear something. Don't press for this information or try to pin the interviewer down.

10. Shake hands and leave.

Notes:

COMPANY _____ STREET ADDRESS _____

CITY STATE AND ZIP CODE _____

NAME _____ PHONE _____ SOCIAL SEC. NO. _____
(First) (Middle) (Last)

ADDRESS _____ HOW LONG? _____
(Street) (City) (State & Zip Code)

LIST ADDRESSES FOR PAST THREE YEARS

_____ HOW LONG? _____
(Street) (City) (State & Zip Code)

_____ HOW LONG? _____
(Street) (City) (State & Zip Code)

**(ATTACH SHEET IF MORE SPACE IS NEEDED)**

DATE OF BIRTH _____ (ANSWER ONLY IF APPLYING FOR DRIVING POSITION)

IN CASE OF EMERGENCY NOTIFY _____
(Answer After Employment) (Name) (Address) (Phone)

POSITION APPLIED FOR _____ TEMPORARY OR PERMANENT _____

HAVE YOU WORKED FOR THIS COMPANY BEFORE? _____ WHERE? _____

DATES FROM _____ TO _____ RATE OF PAY _____ POSITION _____

REASON FOR LEAVING _____

NAMES OR RELATIVES IN OUR EMPLOY _____

ARE YOU NOW EMPLOYED? _____ IF NOT, HOW LONG SINCE LEAVING LAST EMPLOYMENT? _____

WHO REFERRED YOU _____ RATE OF PAY EXPECTED _____

## PHYSICAL HISTORY

PLEASE DESCRIBE ANY POSITIONS, JOBS OR DUTIES FOR WHICH YOU SHOULD NOT BE CONSIDERED BECAUSE OF PHYSICAL, MEDICAL OR MENTAL DISABILITIES _____

DATE OF LAST DOT PHYSICAL EXAMINATION _____

HAVE YOU BEEN GRANTED A WAIVER UNDER SECTION 391 49 OF THE FEDERAL MOTOR CARRIER SAFETY REGULATIONS PERTAINING TO THE LOSS OF FOOT, LEG, HAND OR ARM? (FOR DRIVERS ONLY) _____

## EMPLOYMENT RECORD

**NOTE: D.O.T. Requires that Employment for at Least 3 Years be Shown (Attach Sheet if More Space is Needed)**

LAST EMPLOYER NAME _____

ADDRESS _____

POSITION HELD _____ FROM _____ TO _____ SALARY _____

REASONS FOR LEAVING _____

SECOND LAST EMPLOYER NAME _____

ADDRESS _____

POSITION HELD _____ FROM _____ TO _____ SALARY _____

REASONS FOR LEAVING _____

THIRD LAST EMPLOYER NAME _____

ADDRESS _____

POSITION HELD _____ FROM _____ TO _____ SALARY _____

REASONS FOR LEAVING _____

## EDUCATION

CIRCLE HIGHEST GRADE COMPLETED 1 2 3 4 5 6 7 8 HIGH SCHOOL 1 2 3 4 COLLEGE 1 2 3 4

LAST SCHOOL ATTENDED _____
(Name) (Address)

## GENERAL

HAVE YOU EVER BEEN BONDED _____ NAME OF BONDING COMPANY _____
(ANSWER ONLY IF A JOB REQUIREMENT)

HAVE YOU EVER BEEN CONVICTED OF A FELONY _____

HAVE YOU EVER WORKED FOR THIS COMPANY UNDER ANOTHER NAME _____

## EXPERIENCE AND QUALIFICATIONS — DRIVER

| DRIVER LICENSES HELD IN PAST 3 YEARS MUST BE SHOWN | STATE | LICENSE NO | TYPE | EXPIRATION DATE |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

A Have you ever been denied a license, permit or privilege to operate a motor vehicle? YES _____ NO _____

B Has any license, permit or privilege ever been suspended or revoked? YES _____ NO _____

C Have you ever been disqualified subject to section 39115 of the Federal Motor Carrier Safety Regulations? YES _____ NO _____

IF THE ANSWER TO EITHER A, B OR C IS YES, ATTACH STATEMENT GIVING DETAILS

**DRIVING EXPERIENCE**

| CLASS OF EQUIPMENT | TYPE OF EQUIPMENT (VAN, TANK FLAT, ETC.) | DATES FROM | DATES TO | APROX NO OF MILES (TOTAL) |
|---|---|---|---|---|
| STRAIGHT TRUCK | | | | |
| TRACTOR AND SEMI-TRAILER | | | | |
| TWIN-TRAILERS | | | | |
| OTHER | | | | |

LIST STATES OPERATED IN FOR LAST FIVE YEARS _____

SHOW SPECIAL COURSES OR TRAINING THAT WILL HELP YOU AS A DRIVER _____

WHICH SAFE DRIVING AWARDS DO YOU HOLD AND FROM WHOM? _____

## ACCIDENT REVIEW FOR PAST 3 YEARS (Attach sheet if more space is needed)

| DATES | NATURE OF ACCIDENT (HEAD-ON, REAR-END, UPSET, ETC.) | FATALITIES | INJURIES |
|---|---|---|---|
| LAST ACCIDENT | | | |
| NEXT PREVIOUS | | | |
| NEXT PREVIOUS | | | |

TRAFFIC CONVICTIONS AND FORFEITURES FOR THE PAST 3 YEARS OTHER THAN PARKING VIOLATIONS

| LOCATION | DATE | CHARGE | PENALTY |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

## EXPERIENCE AND QUALIFICATIONS – MAINTENANCE

List courses and training in maintenance work _____

| Indicate training and experience in the following: | Training (Check) | Years of Experience | Area | Training (Check) | Years of Experience |
|---|---|---|---|---|---|
| Drive Line Components | | | Body Work | | |
| Diesel Engine Tune-up and Rebuild | | | Electrical Repair | | |
| Gas Engine Tune-up and Rebuild | | | Frame and Wheel Alignment | | |
| Tire Service | | | Brakes | | |
| Trailer Repair | | | Cooling System | | |
| Preventive Maintenance | | | Safety Line Checking | | |

| Show equipment you can operate | Training (Check) | Years of Experience | Equipment | Training (Check) | Years of Experience |
|---|---|---|---|---|---|
| Woodworking Equipment | | | Wheel & Tire Balancing Mach. | | |
| Sheet Metal Equipment | | | Tire Recapping Mold | | |
| Frame & Axle Straightening E. | | | Engine Dynamometer | | |
| Engine Rebuilding Equipment | | | Chassis Dynamometer | | |
| Diesel Injection Equipment | | | Magnetic Crack Detector | | |
| Electric Welder | | | Engine Analyzer | | |
| Oxyacetylene Welder | | | Noise Measuring Equipment | | |
| Paint Spray Gun | | | Smoke Measuring Equipment | | |

## EXPERIENCE AND QUALIFICATIONS – CLERICAL

List courses and training in office work _____

| Indicate training and experience in the following: | Training (Check) | Years of Experience | | Training (Check) | Years of Experience |
|---|---|---|---|---|---|
| Typing* | | | Accounting | | |
| Shorthand* | | | OS&D | | |
| Billing | | | Interline | | |
| TWX | | | Claims | | |
| PBX | | | Cashier | | |
| Key Punch Operator | | | Dispatcher | | |
| Calculator | | | Tabulator | | |
| Dictating Machine Tanscriber | | | Mimeograph | | |
| Booking Machine | | | Rates (indicate tariffs with which you have worked) | | |
| Adding Machine | | | | | |
| Other: | | | | | |

*INDICATE WORDS PER MINUTE

## EXPERIENCE AND QUALIFICATIONS – PLATFORM

LIST TYPES OF PLATFORM EXPERIENCE AND YEARS OF EACH _____

LIST PLATFORM EQUIPMENT YOU CAN OPERATE (LIFT TRUCK, ETC.) _____

SHOW COURSES OR TRAINING IN PLATFORM WORK _____

## TO BE READ AND SIGNED BY APPLICANT

It is agreed and understood that any misrepresentations of information given above shall be considered an act of dishonesty.

It is agreed and understood that the employer or his agents may investigate the applicant's background to ascertain any and all information of concern to applicant's record, whether same is of record or not, and applicant releases employers and persons named herein from all liability for any damages on account of his furnishing such information.

It is also agreed and understood that under the Fair Credit Report Act, Public Law 91-508, I have been told that this investigation may include an Investigative Consumer Report including information regarding my character, general reputation, personal characteristics, and mode of living.

I agree to furnish such additional information and complete such examinations as may be required to complete my employment file.

(GA & KS) I understand that, as a condition of employment, I will obtain from the State Motor Vehicle Agency, within my probationary period, and without cost to the employer, a copy of my motor vehicle violations record.

(MA) "An applicant for employment with a sealed record on file with the commissioner of probation may answer 'no record' with respect to an inquiry therein relative to prior arrests, criminal court appearances or convictions. An applicant for employment with a sealed record on file with the commissioners of probation may answer 'no record' with respect to any inquiry relative to prior arrests, court appearances and adjudications in all cases of delinquency or as a child in need of services which did not result in a complaint transferred to the superior court for criminal prosecution."

(PA) I authorized my employer to obtain from the Registry of Motor Vehicles a copy of my Motor Vehicle Violations Record.

*It is agreed and understood that this application for employment in no way obligates the employer to employ me, and it is understood that if hired, I may be* on a probationary period during which I may be discharged without recourse.

I represent that this application was completed by me, and that all entries on it and information in it are true and complete to the best of my knowledge.

Date _____ Applicant's Signature _____

"Under Maryland law an employer may not require or demand any applicant for employment or prospective employment or any employee to submit to or take a polygraph, lie detector or similar test or examination as a condition of employment or continued employment. Any employer who violates this provision is guilty of a misdemeanor and subject to a fine not to exceed $100."

Date _____ Applicant's Signature _____

## APPLICANT – DO NOT WRITE BELOW THIS LINE
## PROCESS RECORD

APPLICANT HIRED _____ REJECTED _____

DATE EMPLOYED _____ POINT EMPLOYED _____

DEPARTMENT _____ CLASSIFICATION _____

(IF REJECTED SUMMARY REPORT OF REASONS SHOULD BE PLACED IN FILE)

### THIS SECTION TO BE FILLED IN BY RESPONSIBLE OFFICER OR COMPANY REPRESENTATIVE

| | SUPERIOR | GOOD | FAIR | BELOW AVERAGE | POOR | WRITTEN RECORD ON FILE |
|---|---|---|---|---|---|---|
| 1 APPLICATION | | | | | | |
| 2 INTERVIEW | | | | | | |
| 3 PHYSICAL EXAM | | | | | | |
| 4 PAST EMPLOYMENT | | | | | | |
| 5 WRITTEN EXAM | | | | | | |
| 6 ROAD TEST | | | | | | |
| 7 POLICE AND TRAFFIC RECORD | | | | | | |

SIGNATURE OF INTERVIEWING OFFICER _____

## TRANSFERS

FROM _____ TO _____ FROM _____ TO _____

DATE _____ DATE _____

REASON FOR TRANSFER _____ REASONFORTRANSFER _____

## TERMINATION OF EMPLOYMENT

DATE TERMINATED _____ DEPARTMENT RELEASED FROM _____

DISMISSED _____ VOLUNTARILY QUIT _____ OTHER _____

TERMINATION REPORT PLACED IN FILE _____ SUPERVISOR _____

## INSTRUCTIONS FOR PRACTICAL EXERCISE: JOB INTERVIEWING

In this exercise, you will be called upon to interview for a job at the Brown Trucking Company in response to an ad in the newspaper.

The ad called for a "dependable tractor-trailer operator" and did not specify experience or other duties.

You are looking for a full-time job and know very little about the company except that it is a small operation and you will be interviewed by the owern, Mr. Brown. It is a general commodities, dry freight operation.

Prepare for the interview by reviewing the "Job Interviewing Checklist" in your student manual.

use your own qualifications and experience in your discussion with Mr. Brown about a job in his company.