United States Department of Agriculture

Forest Service

Washington Office Engineering

Driver-Operator Guide

EM–7130–2

July 2005 (Revised)

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OPERATORS

Authorized Drivers

Vehicles owned or leased by the United States Department of Agriculture (USDA) Forest Service shall be driven only by persons who have qualified according to the regulations established by the Office of Personnel Management, USDA, and the USDA Forest Service. A valid State driver's license for the size and class of vehicle being operated is mandatory and must be in the operator's possession during operation.

Instructions and procedures governing qualification requirements for USDA Forest Service motor vehicle operators are included in Forest Service Manual (FSM) 7134. All personnel who operate motor vehicles owned or leased by the Government must meet these requirements.

Unauthorized Drivers

Do not allow Government-owned or -leased vehicles to be driven by unauthorized persons. In cases of accident or vehicle damage, the authorized driver/operator is held responsible for the actions of the unauthorized driver/operator.

OPERATION

Operators are required to exercise caution when driving Government vehicles. Damage such as broken springs (from speeding on rough roads) or vehicle overloading and damage to tires, fenders, tie rods, gas tanks, and axles can usually be avoided. The operator will be held responsible for abusive use of the vehicle.

The operator is responsible for preventive maintenance checks before, during, and after operation of the vehicle. Operators should become thoroughly familiar with the travel and equipment sections of the *Health and Safety Code Handbook*, FSH (Forest Service Handbook) 6709.11.

Safety Rules

1. Observe all traffic laws, ordinances, and regulations of the State or local community in which the vehicle is operated. Consult the State vehicle code for applicable regulations.

2. Do not carry loose objects, such as tools or instruments, in vehicle passenger compartments unless passengers are shielded by a mesh divider or other protective devices. Keep dash and floor clear of objects.

3. Never drive a vehicle when the load or other objects obscure your view, interfere with your driving, prevent free access to emergency equipment, or prevent free and ready exit from the cab or driving compartment by any person. Additional information on securing loads and loose objects, hauling personnel, and so forth, is discussed in chapter 4.

4. Approach all railroad crossings at a speed that allows for safe stopping.

5. When traveling, maintain an interval of at least 2 seconds. Allow more distance if another vehicle is following at an improper distance, if road conditions warrant, or if required by State law.

6. Turn off the engine and two-way radio when any vehicle or engine is being fueled. Do not smoke within 50 feet of the vehicle or fuel supply.

7. Turn off two-way radios when passing near a blasting area or explosives storage area.

8. Pull off the road for a short rest, coffee break, or change of drivers if you are getting drowsy.

9. Open at least one window to provide interior ventilation when running the motor of a parked vehicle.

10. Equip every USDA Forest Service vehicle with seat belts, warning flags/reflectors, chains or traction devices, and a first aid kit. Use seat belts when provided.

11. Give proper signals before taking any action.

Defensive Driving

Motor vehicle accidents are a major cause of death and serious injury. Adopt a policy of defensive driving. This means:

1. Drive to avoid accident situations created by the mistakes of others or by weather and road conditions.

2. Yield the right-of-way, even when, by all rules of the road, it may be yours.

3. Watch far ahead for wildlife, livestock, people, or vehicles moving onto the road or stopping; watch for highway signs or signals, icy spots, chuckholes, or a vehicle on the wrong side of the road.

4. When passing, approach the vehicle carefully, ease in and out of traffic, and allow plenty of passing distance.

5. Make an unbroken series of concessions to other drivers who are thoughtless, unskilled, or ignorant of the hazards they create.

Speed

1. Be thoroughly familiar with State and local speed laws; comply with them at all times. Defensive driving requires driving at a safe speed rather than merely complying with the posted speed.

2. Drive at a speed that permits full control of the vehicle, allowing for all road, weather, and traffic conditions.

3. On curves, be able to stop the vehicle within less than half of the visible distance.

Thinking and Stopping Distances (Feet)
(Average on a hard-surfaced road)

Speed	Thinking distance*	Mechanical stopping distance after brakes are applied	Total feet
20 mph	22	28	50
30 mph	33	68	101
40 mph	44	127	171
50 mph	55	203	258

*Average 3/4 second

Turning Around

1. When turning around on mountain roads, always turn with the back of the vehicle toward the uphill bank; face danger.

2. Do not turn unless you have a clear view for 200 feet in each direction.

3. Use a helper (if available) who is on the ground and can see the dangers.

Braking

1. **Use your engine to assist the brakes.** When brakes are applied, heat is generated and some of the lining is worn away. If brakes are held continuously, the brake lining may be burned. Save the brakes by using the engine and transmission to slow the vehicle. Use the brakes to assist the engine. However, in doing so, avoid excessive engine revolutions per minute as this will damage the engine. Think ahead. Begin to slow down early by taking your foot off the accelerator while leaving the clutch engaged. Apply the brakes firmly but gradually. Remember that increasing the load increases the braking distance. This does not mean that the engine should be used as a brake by shifting to a lower gear for normal stops, such as stop signs or traffic lights.

2. **Be kind to your brakes.** When using the foot brake on hills, take the following precautions to prevent skidding or overheating the brakes:
   - Apply the brakes firmly but not abruptly. Abrupt application with full force may lock the wheels and cause the vehicle to slip or skid out of control.
   - Apply the brakes at intervals, only as needed.

3. **Parking brake.** The parking brake is designed to hold a stopped vehicle stationary. Do not use it to stop or slow down, except in an emergency. The foot brake is far more effective and will not crack an axle or drive shaft. Usually, the parking brake can be set more effectively by applying the foot brakes first.

Operation on Hills

It is risky to change gears while climbing or descending a hill; the safest procedure is to select the proper gear before starting to climb. However, if it is necessary to go to a lower gear, make the shift before the engine slows down to a stalling point.

Do not depend on the brakes alone on steep hills. If the road is slippery and the vehicle starts to slide when the brakes are applied, the wheels will lock, causing loss of control because the operator cannot steer. Use a lower gear and leave the clutch engaged. This will cause the driving wheels to turn, engine compression will slow the vehicle, and the wheels will revolve freely enough to permit steering control.

1. **Uphill.** If the engine stalls while climbing a steep hill and it is necessary to back down, apply the foot brake, set the parking brake, disengage the clutch, and shift quickly into reverse. If the vehicle does not slide or roll, start the engine while the clutch is still disengaged, and engage the clutch while releasing the brakes.

   If the vehicle slides or rolls while the clutch is disengaged, reengage it immediately after shifting into reverse, and release the brakes. If the engine does

not start turning immediately, use the starter to relieve the strain on the gears. Then back down.

2. **Downhill.** When approaching a downgrade, first select a suitable gear. A good rule is to use one gear lower than would be used for driving up the same hill. Keep the clutch engaged, the throttle closed, and the ignition on before the vehicle starts down. Then observe the following instructions:
   - Keep the vehicle under complete control at all times. Lives may depend on it.
   - Reduce speed, if necessary, by liberal use of the foot brakes.
   - Remember that the possibility of losing control over your speed on descents is greater when the vehicle is loaded.
   - Remember that slower speeds are required when weather and road conditions are unfavorable.
   - Never coast downhill in neutral.

3. **Runaway vehicle.** If the braking effects of both the engine and the brakes fail to hold the vehicle and it starts to run out of control down a hill, the last resort is to ditch the vehicle by running it off the road—against a bank if possible—at a gradual angle. This must be done before the runaway vehicle has gained too much speed. Prompt ditching of a runaway vehicle can prevent a much more serious accident.

Use of Sirens and Emergency Lights

Sirens and red or blue emergency lights are to be used only by authorized drivers. These sirens and lights warn the public of the presence of an emergency vehicle.

Before operating a red or blue light and siren, an employee must pass the necessary examination and have the qualifications shown on the Equipment Operator's Identification Card. Oral permission is not a qualification. Sirens and red or blue lights will be installed only by mechanics after the approval of the forest supervisor.

All emergency vehicles traveling to fires shall abide by traffic lights and stop signs, unless escorted by police.

Consult the State vehicle code for further details on the use of sirens and red or blue lights.

Trailer Towing

All drivers towing trailers must be properly qualified and authorized. Each forest or unit must have personnel qualified to train and to authorize drivers for towing trailers.

1. Vehicles towing trailers must comply with Federal, State, and regional requirements regarding size and weight of towing vehicles. Do not exceed Gross Vehicle Weight Rating (GVWR), Gross Combination Weight Rating (GCWR), or the trailer weight rating. See FSH 7109.19 to determine safe towing combinations.

2. To provide for breakdowns on the road, all towing vehicles and trailers shall be equipped with flags or other suitable signal devices.

3. Trailer houses must be equipped with adequate signal devices.

4. All trailers must have proper brakes and lights to meet State and U.S. Department of Transportation requirements.

5. All trailers must be equipped with adequate safety chains.

Backing

The rearview mirror does not show the area immediately behind the vehicle. It is essential that a driver look behind the vehicle before backing or be guided by a helper standing behind and to the side of the vehicle. The following safety precautions also should be observed:

1. Close all vehicle doors.

2. Back slowly. Be sure there is sufficient clearance when backing into garages or other narrow places.

3. Avoid long-distance backing.

4. Avoid backing downhill.

5. Turn the vehicle around on dead-end roads before parking.

Parking

1. Use chock blocks or other blocking devices when parking on a grade.

2. Always park well off the pavement or roadway.

3. If it is necessary to park on the road in an emergency, be sure to place flags, signs with reflectors, or red lights 200 feet in each direction from the vehicle.

4. Avoid leaving the motor running when a vehicle is parked.

5. Do not park a vehicle over dry vegetation. Exhaust system temperatures can ignite dry vegetation.

Winter Driving

Skillful driving is especially important under unfavorable driving conditions. Adverse conditions, such as wet or icy road surfaces, greatly lengthen stopping distances and increase driving hazards. Always reduce speed under such conditions.

Driving in hazardous weather demands special techniques.

1. How to avoid skids:
   - Keep speed well below dry-road speed.
   - Keep vehicle pulling steadily.
   - Make no sudden changes in speed, gears, or direction.
   - Avoid driving too fast on curves.

- Avoid applying the brakes too suddenly or too hard. Pump the brakes to slow down.
- Avoid driving too fast for surface conditions.

2. How to get out of a skid. If the vehicle should start to skid, the following procedures will help you recover:
   - Avoid braking. Slamming the brakes when a vehicle is skidding locks the wheels and causes loss of traction and steering.
   - Turn the front wheels in the direction of the slide. As the car begins to straighten, straighten the front wheels.
   - Avoid oversteering. Turning the steering wheel too far whips the rear end into a skid in the opposite direction.
   - Avoid lifting your foot from the accelerator suddenly. Maintain power to driving wheels and slow down.

Use of Tire Chains

Tire chains provide the best traction on snow- or ice-covered roads. But there are limits to the help they can give. Even with chains, you cannot safely drive at dry-road speeds on snow- or ice-covered surfaces. It will take about twice as long to bring the vehicle to a stop on ice or packed snow as on a dry road surface, so driving speed should be cut in half. Tire chains are designed to move on the tires and should be tightened only by hand. Reduce speed when using chains to cut down on chain wear and maintain maximum control over the vehicle.

Economic Operation

Fuel Consumption

Every operator of a Government vehicle should drive as efficiently as possible to reduce fuel consumption. Gasoline is wasted by:

1. Excessive speed.

2. Delayed shifting (at 20 mph, second gear uses 20 percent more gas than high gear).

3. Needless idling (long periods of idling may overheat the engine and transmission; never leave the vehicle with the engine running).

4. Incorrect tire pressures.

5. Slipping the clutch to hold the vehicle on hills.

6. Incorrect wheel alignment.

7. Poor engine tuneup.

8. Hauling unnecessary loads.

9. Fast getaways at green lights.

10. Fast speedups and slowdowns.

Starting
Improper starting may damage the vehicle.

1. Do not crank the engine excessively. Continued cranking of the engine discharges the battery rapidly and may shorten its life. Do not keep the starter engaged for longer than 10 to 15 seconds; you may damage the starter. Disengage the clutch when using the starter to reduce the load on the starting motor and battery. If the engine fails to start after being turned over several times, check the fuel supply and ignition system for loose connections and short circuits. The battery will not start the engine if the engine is not getting fuel or spark.

2. Do not race a cold engine. Warm the engine with the throttle partly open. Start the vehicle moving as soon as the engine runs smoothly. Drive slowly, avoid hard pulls, and do not lug the engine. Continue driving at reduced speed until the engine temperature gauge reaches the normal position.

Transmissions

Automatic and standard transmissions are handled differently. Old habits may interfere with proper driving when changing from one kind of transmission to another. The danger is even greater when changing from automatic to standard transmission. Be sure new drivers have driven vehicles with clutches and gearshift levers before authorizing them to operate these vehicles.

1. **Standard transmission.** Do not "ride" the clutch. Keep your foot off the clutch except when starting, stopping, or shifting. Even a slight continued pressure on the clutch pedal wears out the clutch facings and release bearings. For the same reason, when stopped on a hill, never slip the clutch to prevent the vehicle from rolling back. Use the brakes instead.

2. **Automatic transmission.** When using a vehicle with automatic transmission:
   - Understand the position of the selector lever. Make sure the lever is in the correct position for starting.
   - Shift to a lower range when descending steep grades.
   - Always slow the vehicle with the brakes before shifting to low range on wet or slippery surfaces. Use short strokes on the brakes. Shifting to low range at high speed will cause the vehicle to skid or swerve and could damage the transmission.
   - Hold your right foot on the brake pedal during traffic stops to prevent creeping.
   - Never coast in neutral.
   - Use your right foot on the brake pedal.
   - Always have the car completely stopped before moving the control into the park position.
   - Do not push or tow a vehicle with automatic transmission to start the engine. Newer vehicles are not designed to start by pushing or towing. If an engine fails to start because of a discharged battery, use a booster battery and jumper cables to start it.
   - If it is necessary to tow an automatic transmission vehicle a long distance for repair, tow it with only the nonpowered wheels on the ground or, on

vehicles with rear-wheel drive, disconnect the drive shaft.
- Place the selector lever in the neutral position when the vehicle is being towed.
- Be sure to check the oil level in the transmission according to the lubrication guide.
- Select the proper *Drive* position.

Loading

1. ***Never drive a vehicle with an improperly distributed or secured load.*** Study the State vehicle code and U.S. Department of Transportation regulations for safe loading and binding requirements. Vehicle loading is outlined in FSH 7109.19, chapter 30. Chapter 4 of this guide contains additional information on loading.

2. ***Never drive an overloaded vehicle.*** Overloading can reduce vehicle performance and cause structural failures. It also may lead to increased maintenance requirements. Load limits for each type of vehicle are set by regulation and manufacturer's recommendations to comply with safety rules and maintenance requirements. Limits are posted in the logbook or in a conspicuous place in the vehicle. Do not exceed these limits. Operators may be held liable for accidents or equipment damage caused by overloading. If a citation is issued, the driver is responsible.

ACCIDENT REPORTS

All accidents, property damage, and injury are to be reported. A detailed report must be made when a Government vehicle is involved in an accident with a private vehicle or other private property, regardless of how minor the damage may be. This report must be forwarded through the proper channels to the regional forester. The same report is required if only Government property is involved. Comply with all laws of the State in which the accident occurred.

When private property is involved, do not make any commitments or sign or make any statements to anyone other than the ranger, forest supervisor, or authorized USDA Forest Service investigator.

Sometimes when private property is not involved and damage to Government property is minor, accidents can be handled by administrators at the local level. However, the driver cannot make this decision.

Every accident, regardless of the extent of damage, must be reported by the driver to the immediate supervisor, who will decide what action to take. Form SF-91, Operator's Report of Motor Vehicle Accident, provided in all Government vehicles, is used to report accidents.

PREVENTIVE MAINTENANCE

Preventive maintenance is the systematic care, servicing, and inspection of equipment to keep it in good operating condition and to detect and correct mechanical deficiencies.

The driver is the single most important factor in preventive maintenance. Use equipment as it is intended to be used. Perform daily and other scheduled services as recommended by the manufacturer, region, and forest. Operating conditions may require more frequent service.

Operation Checks

Before-Operation Check

Each operator shall ensure that the vehicle is in mechanically safe condition by visually checking the following:

1. Tires—for inflation, cuts, breaks, and excessive or uneven wear

2. Leaks—fuel, oil, water, transmission and axle lubricants

3. Crankcase oil level—adequate

4. Coolant level in radiator—adequate

5. Lights and signal devices—operating properly

6. All glass (including rear window and light lenses)—clean and unbroken

7. Mirrors—properly adjusted, clean, and unbroken

8. Fuel supply—adequate

9. Horn—operational

10. Brakes—adjusted and functional

11. First aid kit, chains, and tire-changing tools—available and adequate

12. Steering—normal free play

13. Equipment logbook—up to date and properly recorded

14. Battery—clean terminals and adequate water level

15. Windshield wipers—operational and blades in good condition; proper washer fluid

16. Body—dents or other damage

17. License plates—present on the vehicle

During-Operation Check

Some vehicle defects can be detected only while the vehicle is operating. An accident or serious damage can be avoided by keeping constantly alert for signs of defects, such as unusual noises or vibrations, and taking immediate corrective action. Major items to check include:

1. Foot and parking brakes for proper operation and adjustment

2. Clutch for free-travel adjustment, slippage, and chatter

3. Transmission for noise and proper shifting

4. Transfer case for proper gear selection, noise, and proper shifting

5. Engine and controls for unusual noises, proper response, exhaust system leakage or noises, and visual checks for water, oil, and fuel leaks

6. All instruments for functioning within proper ranges

7. Steering gear for looseness, slack, wear, and pull to the left or right

8. Differential for unusual noise in the power train

9. Body for loose components and rattles

After-Operation Check
This check is intended primarily to correct any deficiencies found in the during-operation check. Report any malfunctions or needed repairs to your work supervisor. Where vehicles are on emergency use, the before-operation check should be made at the end of a trip to ensure that the vehicle is ready for emergency use.

Routine Maintenance

Lubrication
The responsibility of a driver does not end with the proficient operation of the vehicle. The driver must ensure that the vehicle is properly maintained and that it is ready to go at all times.

Lubricating the vehicle at the proper intervals is one of the most important preventive maintenance jobs. The intervals for lubrication and oil changes for each vehicle are established by regulation and the manufacturer's service standards.

The driver is responsible for ensuring that the vehicle is lubricated in accordance with manufacturer's service intervals, as well as regional and specific forest standards. When operation involves abnormal conditions, such as snow, water, and dust, more frequent lubrication is required. Operators should check with their supervisors when such circumstances arise.

Emergencies, such as fires and floods, are the only acceptable reasons for extending lubrication intervals. These emergencies should be noted in the maintenance record, and the vehicle should be lubricated at the earliest possible opportunity.

When the vehicle is lubricated commercially, the driver must make a spot check of the finished job to see that it was done correctly and that the billing is accurate.

When a unit is provided with a reminder card or plate, the driver is to post due dates of required services. The driver is also responsible for maintaining a record of this service using form FS 7100-2, Equipment Maintenance Record.

Inspections

Inspections determine maintenance needs and compliance with standards. They also identify appropriate times to take action for maximum efficiency, safety, and economy. Three kinds of inspections are necessary for satisfactory results: daily, monthly, and mechanical. The equipment operator performs the first two inspections and a qualified mechanic performs the third inspection.

1. **Daily inspection.** Drivers or operators are responsible for performance of the daily inspections as outlined in this guide.

2. **Monthly inspection.** The driver, operator, or individual assigned responsibility for the vehicle/equipment is responsible for the monthly inspection, which is performed and recorded using form FS 7100-9, Driver's Safety and Preventive Maintenance Inspection.

3. **Mechanical inspection.** All fleet equipment owned or leased by the USDA Forest Service shall receive a periodic safety inspection performed by a journeyman-level mechanic. In the absence of other State requirements, minimum frequency is once every year. Regions, stations, or forests, may require more frequent inspections. Drivers-operators are responsible for seeing that mechanical inspections are performed on time.

Batteries

For extended battery life and safety, observe the following guidelines:

1. **Proper care of batteries.** Batteries require attention to give satisfactory service.
   - Check and maintain the proper electrolyte or water level. Do this every 2 weeks—every week during periods of high temperatures or continuous heavy battery use. Do not overfill. (This does not apply to maintenance-free batteries.)
   - Keep the battery tight in the carrier case and terminals clean at all times. Baking soda may be used to remove corrosion around terminals.
   - Keep batteries charged at all times.
   - Never use the starter for more than 10 seconds at a time. Allow the battery to rest between starts after extended use of the starter motor.
   - Prevent batteries from freezing by keeping them charged when they are not being used.
   - Store batteries on wood; never store them on a concrete floor.
   - Keep batteries cool.
   - When a battery has been discharged, recharge it according to the manufacturer's recommendations.

2. **Use of booster batteries.** Booster starting of a battery can be dangerous. When the water level is low, there is extra space for hydrogen gas to be trapped. The slightest spark can cause an explosion. Always use batteries of equal voltage and follow these safety steps:

When using jumper cables, remove cell caps from both batteries. Leave them off during the process to let hydrogen gas vent.

- Connect one cable to ungrounded terminal of the weak battery.
- Keep the other end of the cable from touching either vehicle until it is connected to the terminal of the same polarity on the stronger battery. (Positive to positive or negative to negative.)
- Connect second cable to other terminal of stronger battery.
- Important final step: Connect remaining cable to vehicle frame or starter ground below the level of the weak battery. This reduces the risk that sparks might cause an explosion.

Tires

1. **Care and maintenance.** Check tires for proper inflation at least once a week. Check tires of vehicles hauling heavy loads and on long hauls daily and adjust inflation if necessary.

   Recommended pressures are shown on tire sidewalls. Adjust tire pressure the first thing in the morning or when the tires are cold. Do not, under any circumstances, remove air from tires after sustained running or when the tires are warm.

   Overloading tires greatly shortens their life; avoid it. Inspect tires visually during the preventive inspection and take steps to correct anything that causes unusual wear. Some examples of improper wear and their causes include:

Improper Wear and Probable Cause

Type of wear	Probable cause
Small, flat spots every few inches	Wobbly wheels or loose wheel bearings
Excessive wear on edges of tread	Underinflation
Excessive wear on center of tread	Overinflation

Improper Wear and Probable Cause *(continued)*

Type of wear	Probable cause
Excessive wear on one edge of tread	Too much camber or caster; sprung axle
Two flat spots diametrically opposite	Eccentric brake drums
Excessive wear on one tire	Dragging or seizing brake
Feather edge or sharp corner on either edge of front tires	Too much toe in or toe out; bent tie rod

Rotating tires every 4,000 miles can extend tire life by as much as 20 percent. Include spare tires in the rotation cycle.

2. **Recapping.** Under no circumstances should tires be worn beyond the point of recapping, that is, to the wear bar strip. Tires that are worn down to a faint tread line should be inspected in shops by qualified personnel and recapped for further use.

Washing, Cleaning, and Polishing

Intervals for washing and cleaning will be determined by the conditions under which the vehicle is operated. A good mechanical or safety inspection cannot be made if the vehicle is dirty. Operators should clean their vehicles before each preventive inspection and as often between inspections as necessary to have the vehicle reflect credit on the USDA Forest Service by its appearance.

Steam cleaning and pressure washing should be done by qualified mechanics. Polishing is optional. Polish reduces the frequency of need for cleaning and lessens paint oxidation.

Vehicles Equipped With Radios

Vehicles equipped with two-way radios and radio telephones require special care.

1. Radios must be installed by qualified radio technicians.

2. Keep the batteries filled and clean in vehicles equipped with radios.

3. Keep the generator and alternator, alternator belt, and regulator in good condition.

4. Start the vehicle and keep the battery charged when using the radio for extended periods of time. Continued heavy use of the radio rapidly discharges the battery.

5. Turn off two-way radios when near a blasting area or construction job.

Emission-Control Equipment
The emission-control equipment installed by the vehicle manufacturer to meet Federal and State requirements must be maintained properly. The operator is responsible for making sure such items as air pumps, PCV valves and tubing, distributor advance and retarding mechanisms, and other related components are checked by a mechanic when the vehicle is serviced. There is no acceptable reason for removing or tampering with any emission control equipment.

Maintenance Records

Equipment Logbook
This logbook contains certain records that are pertinent to the operation and maintenance of the equipment. Some of these records may be optional in some regions and stations. Equipment logbooks should contain use records, service records, operator safety and preventive maintenance inspections, and equipment identification.

Operator's Preventive Maintenance Check
Performance of this check is the direct responsibility of the driver or operator. While forest supervisors may permit delegation of this operator check, the responsibility for seeing that it is done correctly and that malfunctions are corrected rests with the operator.

Normally, inspections will be made once each month when the equipment is being used. Retain a copy of the last inspection in the equipment logbook. Use the regional form for this inspection. The driver must initial and enter the inspection in column 9 of the unit service record. Note the correction of any deficiencies on this form.

Long-Term Storage Standards

Before Storage

1. Clean the engine thoroughly and wash the unit.

2. Lubricate.

3. Fill the fuel tank.

4. Drain the crankcase and refill it with new oil.

5. Check the cooling system antifreeze for the lowest expected temperature; add additional antifreeze as needed. Check all hoses and hose connections. If the cooling system is to be drained, be sure that the radiator, engine block, water pump, and heater are drained completely. Tie a warning tag marked *Cooling System Drained* to the steering wheel.

6. Remove the air cleaner, start the engine, run it at a fast idle, and pour a half pint of oil through the carburetor air intake until the engine stops.

7. Clean, replace, and tighten the air cleaner.

8. Remove the battery. Clean and store it on a wooden base in a dry, frostproof place. Clean the cable terminals and battery carrier with a soda solution, and rinse them with clean water.

9. Block up the axles to take the weight off pneumatic tires.

During Storage

1. Leave air vents in the open position.

2. Leave the door window open about $\frac{1}{2}$ inch.

3. Store under cover if possible.

COMMERCIAL REPAIRS

When commercial repairs are required, coordinate repairs with local or forest fleet manager.

1. Before authorizing any major repairs, check with the nearest USDA Forest Service shop or forest fleet manager for permission to make the repairs.

2. Describe the work to be performed when known beforehand, or describe the nature of mechanical deficiencies. Avoid vague orders, such as “Fix it up,” which leave the job entirely to the discretion of the party performing the work.

3. Inspect the work performed for satisfactory quality and to determine whether corrections are needed. Test the vehicle, when applicable, to ensure that the deficiency has been corrected.

4. Satisfy yourself that the cost of the work performed is reasonable. If the work is unsatisfactory, have the garage do it again and stand behind its work. Do not pay two or more repair shops for the same job. Avoid unreliable repair shops.

Chapter 2—Four-Wheel-Drive Vehicles

Four-wheel-drive vehicles are designed to provide extra power and traction for traveling at a slow speed over rough or unusual terrain. Accidents and the high cost of operating four-wheel-drive vehicles are, in most cases, caused by abusive use or expecting the four-wheel drive to do the impossible. This chapter is intended to highlight safe, economical ways to get the most out of these vehicles.

OPERATORS

Drivers operating four-wheel-drive vehicles must be thoroughly trained and qualified (chapter 1, Authorized Drivers).

OPERATION

The same general safe driving practices for standard vehicles apply to four-wheel-drive vehicles (chapter 1, Safety Rules).

Four-wheel drive should be used only when greater traction and power are required than can be provided by a standard transmission in low gear. Use it in steep off-road operations, in snow or on icy roads, in mud or sand, or other conditions that require extra traction to travel at slow speed.

The gear train will be placed under stress when vehicles are driven on surfaced roads with four-wheel drive engaged. This causes difficulty in shifting out of four-wheel drive. To relieve this stress, back up a few feet or drive off the surfaced road. This will allow the wheels to slip.

Safety Rules

1. Four-wheel-drive vehicles usually do not perform as well on surfaced roads as conventional-drive vehicles. However, in most cases, four-wheel-drive vehicles can be operated up to the legal speed limit on main paved highways. Speed on unimproved roads should never exceed the safe limits allowed by terrain and

road conditions. Know the limitations of the vehicle, especially on hard-packed snow and ice.

2. When descending steep, unsurfaced mountain roads with heavy loads, proceed with the four-wheel drive engaged. Place the hubs in the locked position. This affords double safety in case one axle or drive shaft should break. It is a good practice to descend a grade using one gear lower than required to ascend the same grade.

3. Do not allow the engine revolutions per minute to exceed the manufacturer's recommended limits, particularly when the engine is under compression. Use a constant steady application of the brakes to maintain proper speed.

4. Be careful when driving on sidehills. Four-wheel-drive vehicles have a high center of gravity and will tip more easily than conventional vehicles.

5. Know the limitations of the vehicle and do not exceed them. Most accidents and breakdowns occur within that last one-quarter mile that should not have been attempted.

6. When operating in rough or brushy terrain, do not allow anyone to ride outside of the cab; in open jeeps, drivers must be alert for limbs or brush.

Operating Procedures

Shifting Into and Out of Four-Wheel Drive

For best results, do the following:

1. Review and follow the instructions in the operator's manual provided by the manufacturer.

2. A shifting device with position diagram will be mounted in a conspicuous place in the cab of all four-wheel-drive vehicles. Study the diagram carefully and practice shifting as directed before driving the vehicle.

3. If the vehicle is equipped with front hubs, lock them into position before shifting the transfer case into four-wheel drive. Most four-wheel-drive vehicles of current make employ a single-lever control for the transfer case. The lever engages the front differential. The lever normally allows the operator to select four-wheel-drive high, four-wheel low, a two-wheel high range, and a neutral position for power takeoff equipment.

4. The operator can shift from two-wheel high to four-wheel high, or vice versa, while the vehicle is stationary or moving at moderate speeds. If the vehicle is moving, let up on the accelerator before shifting.

5. To shift from two- or four-wheel high to four-wheel low, bring the vehicle to a virtual standstill; four-wheel low range should be used only in the most severe conditions. When shifting out of four-wheel, low range into two- or four-wheel, high range, the vehicle should be stopped.

6. Analyze the terrain and select the proper gear before attempting to travel over difficult terrain. Failure to do so often results in a vehicle becoming stuck or damage to the power train.

Front-Wheel Hub Locks

In addition to transfer case gear selections, the front wheels of some four-wheel-drive vehicles are equipped with locking hubs. These hubs are provided so that the front axle can be disengaged when driving in two-wheel drive. When locking hubs are used properly, the wear on the front-end gear train is greatly reduced. Unlock front hubs when appropriate.

Do not force hub locks in or out of the locking position with makeshift tools; rock the vehicle slightly and the splines will engage.

Some hubs are manually controlled. Other models engage and disengage automatically. Be sure to check the type on the vehicle.

1. **Manually controlled hubs**—Never shift into four-wheel drive with manual-control hubs in free position—drive train damage could result.

2. **Automatic hubs**—Automatic hubs will engage when the transfer case is shifted into four-wheel drive.

Winches

When selecting a winch, choose one with a single line rating at least $1\frac{1}{2}$ times greater than the vehicle weight rating. This allows the winch to pull the vehicle weight and overcome the added resistance caused by whatever the vehicle is stuck in. Never exceed the rated capacity. Rigging a double line with a snatch block will reduce the load on winch and cable by about half.

Avoid running a winch cable over rocks or wrapping it around parts of the vehicle that could cause the cable to fray or kink during winching. Never put the winch cable around an object and hook back on the cable. This will damage the cable.

Never pull at an angle to the load.

Always wear heavy leather gloves when handling the winch cable.

If a tree is used as a solid anchor for winching, be sure to use a tree truck protector.

Always drape a blanket or floormat over the middle of a stretched winch cable to prevent the cable from whipping back if it breaks or comes loose. A cable that snaps under stress is extremely dangerous. Its loose ends can sever a leg or kill a person. All persons shall stand clear before the winch line is tightened.

When rewinding the cable after use, either drag a weight until the cable is almost all rewound or use a helper to hold the cable taut to ensure the cable is distributed evenly and tightly on the drum. Never allow the cable to slide through your hands. Do not allow the cable to stack on the drum unevenly. Hook the cable to the proper anchor on the truck, and draw it taut. Mashed, pinched, or frayed areas on the cable severely reduce its original tensile strength. For safety's sake, replace the cable when it is damaged.

1. **Power Takeoff (PTO) Winches.**
   - Check the PTO shift lever plate for the correct operating positions. Always depress the clutch pedal of the vehicle (disengaging the clutch) before engaging the power takeoff.
   - When the winch is not being used, lock the shift lever in neutral.
   - Never operate the winch above 1,500 engine revolutions per minute.
   - Use the high-speed position of the winch when pulling light loads and reeling in the cable.
   - Pay out cable by disengaging the sliding-jaw clutch on the winch, then pull the cable out by hand. Reverse gear may be used for lowering a load.
   - PTO winches are provided with shearpins as a safety precaution to prevent overloading the cable or winch. The shearpin is located in the yoke of the universal joint that drives the winch worm-gear shaft; it is designed to break before the cable or winch. Never use makeshift pins to replace a shearpin. Do not depend on the shearpin for safety—a damaged cable may break before the pin does.

2. **Electric Winches.**
   - Pull cable off the drum by hand, using the winch's clutch to free the spool, rather than using the winch's motor to unwind the cable. This saves time and battery power.

- On hard winch pulls, stop winching every 1 to 2 minutes to prevent the electric motor from overheating. Do not operate the winch with the motor lugged down to low revolutions per minute because heat could build up rapidly, possibly damaging the motor. Allowing the motor to cool with intermittent operation will also allow time for the battery to recharge while the vehicle engine is running.
- The electric remote control lead should only be plugged into the winch during actual operation to prevent accidental operation or injury. When using the remote control lead from inside a vehicle, always pass the lead through a window to avoid pinching the lead in the door.

Parking on Hills

When parking a four-wheel-drive vehicle on steep, off-highway grades, remember the following points:

1. Place the vehicle in four-wheel drive low range, and shift into the lowest gear.

2. Set the parking brake by first engaging the foot brake and then applying the parking brake.

3. Park at a cross angle to the grade if the grade is not too steep.

Tire Chains

When tire chains are required, they should be used as recommended in the owner's manual. Use tire chains on all four wheels only under the most severe conditions. When tire chains are used on all four wheels, excessive maintenance costs can be expected. The user must be prepared to justify such use.

MAINTENANCE

1. Always keep the engine oil level at the full mark. This may require carrying extra oil when operating over rough, steep terrain. This is necessary to ensure lubrication when the oil pan is tipped.

2. Check for water in the gearboxes and engine after fording streams.

3. Because four-wheel-drive vehicles usually are used under more severe conditions, they must be checked and lubricated more often than conventional vehicles. Check the logbook and reminder card or data plate for lubrication, safety, and mechanical inspection intervals. Under extreme use where mud, snow, water, or heavy dust is excessive, it may be necessary to service the vehicle daily.

4. Mismatched tires will cause early failure of the axle assemblies and transfer cases and accelerate tire wear. All tires should be matched to within $^1/_8$-inch circumference. Mismatched tires will result in a windup of the gear train and can be detected by a locking-up action when attempting to shift out of four-wheel drive.

5. Rotating the tires, including the spare, when wear is noted, will help keep the tire size as nearly equal as possible. Never use snow tires, which are normally larger than standard tires, on rear wheels only. If snow tires are necessary, they should be used on all four wheels.

Chapter 3—Fire Suppression Engines

OPERATION
Operating Procedures

1. When taking a fire suppression engine from the station on an emergency call, be certain that the warning lights are on before starting. Drive carefully, and remember that the driver is responsible for the safety of everyone riding in the truck. The first consideration is to get the personnel and equipment to the fire in good condition.

2. Although fire engines are classed as emergency vehicles, they must always be driven in a safe, responsible manner, and in compliance with all State laws. Stop signs and traffic lights must be observed.

3. When arriving at a fire, determine quickly where the truck should be positioned. Place the transmission in *neutral* position and set the parking brake. Always place chock blocks at the front and rear wheels to prevent the truck from rolling.

4. When returning to the station from an emergency call, comply with all State and city traffic regulations. Know the provisions of the Uniform Vehicle Code, especially the section on emergency vehicles.

5. Tank trucks equipped with sirens and red lights are governed by instructions in chapter 1, *Use of Sirens and Emergency Lights*.

Safety Rules

1. A tired person should not be permitted to drive. On long drives, the supervisor or other qualified crewmember should periodically relieve the driver.

2. Drive at a safe speed for the road conditions, road alignment, type of road surfacing, visibility, and traffic conditions encountered.

3. Use good judgment in braking and know the distance required to stop the vehicle at different road speeds. Usually it is a good practice to descend a steep grade in one gear lower than required to ascend it—never roll down any grade in neutral. Vehicles equipped with a two-speed rear differential should be in low range before descending a hill.

4. Always position the engine so there is a way out. If the direction of fire spread will endanger the truck, turn around and head the other way. Keep hose lines clear of the wheels so the truck can be moved in an emergency without uncoupling the hose lines.

5. When engines are parked on the road, place warning signs on the road 200 feet in front of and behind the engine to warn approaching traffic.

6. In running attacks or when working close to a fire, always keep one charged hose line ready to protect the engine.

7. When attacking an extremely intense fire, a second hose line should be used for backup in case of flare-backs.

8. Do not move the engine ahead of a fire or through a hot burn without first scouting the area to make sure it is clear and that retreat is possible.

9. Do not let the engine stand in hot burns or remain too close to the fire without hose protection to keep the engine cool. Reflected or radiant heat can soon raise the temperature in the gasoline tank and cause large quantities of vapor to be discharged. If the vapors reach sparks or embers or reach the flash-point, they can ignite and carry the fire to the gas tank.

10. Use safety cans only for filling the engine with gasoline in the field. Ground the spout to the tank to reduce the possibility that static discharge will ignite vapors.

PREVENTIVE MAINTENANCE

Engines must be maintained to the highest possible standards so they are ready to go at all times and so they will not fail during use. In addition to the standard lubrication guide and mechanical inspection program used for all other equipment, special guides are available to assist in keeping the truck in first-class condition. Check with your immediate supervisor for such guides.

Check batteries, ignition, and air brake systems regularly. The standard vehicle checks are: before, during, and after operation.

Chapter 4—Heavy Trucks and Buses

OPERATORS

Only fully qualified personnel shall drive USDA Forest Service trucks and buses. This qualification must be listed on the driver's OF-346, Operator's Identification Card, with the maximum size of the vehicle noted. All drivers must have a physical examination certificate that meets State and Federal requirements and a valid State license for the class of vehicle they operate.

OPERATION

1. The operator is responsible for complying with all local, Federal, and State requirements for loading and hauling.

2. Obtain required State and local permits for overweight, overheight, and overwidth loads.

3. Ensure that the overall length of the vehicle and the load is in accordance with local and State regulations.

Safety Rules

Follow the general safety practices and inspection procedures described in chapter 1. Additional guidance follows:

1. On a vehicle with air brakes, follow the procedures below to detect problems before new brakes are needed:
   - Check the slack adjustment on S-Cam brakes.
   - Check the brake drums, linings, and hoses.
   - Test the low air-pressure warning signal.
   - Check to see that the spring brakes come on automatically.
   - Check the rate of air pressure buildup.
   - Test the air leakage rate.
   - Check the air compressor governor cutout pressure.
   - Test the parking brake and service the brakes.

- Check the safety relief valve, and bleed off the condensation from the air tanks unless the system has automatic drain valves.
- Check the manufacturer's and commercial driver's license (CDL) brake test requirements and specifications.

2. Obey established State and local speed limits. Adjust your speed according to driving conditions. You should always be able to stop within less than half the distance you can see ahead. The rule is that you need 1 second of following interval for each 10 miles per hour, up to 40 miles per hour and an additional second for reaction time. Speeds greater than 40 miles per hour require 5 seconds following distance. Allow 2 seconds and an additional second for every 10 miles per hour over 20 miles per hour, up to 5 seconds for trucks over 18,000 GVWR.

3. Ensure that the load hauled on a truck or a truck-trailer is properly balanced and secured. If required, ensure that it is covered.

4. Ensure that the vehicle is equipped with the following:
   - Lights, reflectors, and markers. Ensure that lights, reflectors, and markers comply with State vehicle code requirements.
   - Flares or other authorized warning devices. Flares or fusees can be dangerous at an accident scene because they can set fire to leaking fuel. Safety officials recommend using reflective triangle devices instead of flares or fusees, if possible.
   - Chock blocks. All heavy trucks should be equipped with chock blocks.

5. After 8 continuous offduty hours, operators may drive for 10 hours. They must be off duty for another 8-hour period before driving again. The 10 hours of driving must be accomplished within the first 15 hours on duty. After that, even if no driving occurred during that onduty time, the operator cannot drive until having had 8 hours of rest. Hours may be more restrictive for fire suppression activities.

Transporting Personnel

1. All vehicles used for transporting personnel shall have:
   - A seat belt for the driver's seat.
   - Seats properly anchored to the vehicle.
   - Sufficient steps for loading and unloading.

2. Personnel and tools or supplies shall be transported together only:
   - When tools are enclosed in a substantial toolbox that is attached to the vehicle and equipped with a securely fastened cover.
   - In emergencies, with tools wrapped in canvas or other material and lashed to the vehicle.

3. Passengers shall not be permitted to ride on top of any load.

4. Passengers shall not ride in a passenger vehicle that is carrying explosives, toxic materials, or flammable substances. Gasoline in U.S. Department of Transportation-approved 2-gallon safety cans that are adequately secured may be carried with passengers.

5. The driver or person in charge shall be sure that everyone is seated and supervised while the vehicle is in motion.

6. Do not overload or crowd personnel in a vehicle.

7. Passengers shall ride only in the cab of a motor vehicle. This means:
   - Each passenger shall have an approved seat position.
   - Arms and legs must not extend outside the vehicle cab.
   - Passengers must be seated while the vehicle is in motion.
   - No one is permitted to ride on the hood, fender, or running board.

- Riders may stand behind the driver's seat, but may not stand farther forward than the rear of the driver's seat.

8. Avoid fueling a vehicle with passengers inside unless absolutely necessary. Never refuel in a closed building with passengers inside.

Operating Procedures

Use of Gears

1. Operators must be thoroughly familiar with the use of gears for descending hills. Be in the correct gear before starting down the hill. Use a lower gear for going down the hill than would be required to go up the hill. Vehicles equipped with a two-speed rear differential should be in low range before descending a hill.

2. To avoid changing gears while climbing a hill, select the proper gear before beginning to climb.

3. If it is necessary to shift while climbing, do so before the motor lugs down.

4. If the vehicle stalls and must be backed downhill, shift into reverse gear.

5. Do not coast in neutral or by depressing the clutch.

Tire Care

Vehicles must not be driven with rocks lodged between the duals. Avoid running over or sideswiping rocks and other objects that will damage tires. Check tire wear. You need at least $^{4}/_{32}$-inch tread depth in every major groove on the front wheels and $^{2}/_{32}$ inch on all other wheels. Fabric should not show through the tread or sidewall. Regrooved tires on the steering axle are prohibited. Recapped or retreaded tires are prohibited on the steering axle of buses, but are permitted on other kinds of vehicles.

Two-Speed Axle

When a truck or bus is equipped with a two-speed rear axle, the driver must be trained in its use to ensure maximum efficiency and safety. Follow the instructions located on the dash or in the operator's manual. Avoid clashing gears.

Special Types of Equipment

Dump Trucks

1. When working on a truck with the bed raised, securely block the bed in position.

   When it is necessary to lower a load, do so with extreme caution to avoid damage to the hoist's pump or truck frame. Such damage can be avoided by slowly releasing the hoist control until the bed starts creeping downward. Maintain this position until the bed is completely down.

3. When combination dump and stake beds are being used as dump trucks, take special care to avoid overloading.

4. Center the load over the rear axle.

5. Disengage the power takeoff when it is not being used.

6. Ensure that the hoist control mechanism cannot be accidentally engaged when hauling.

7. Always get out of the truck and stand clear when the truck is being loaded by a swing-boom loader that swings over the cab.

8. Only dump truck drivers or dump bosses shall trip the tailgate.

Stakeside Trucks

1. Maintain all racks, tailgates, and steps in good condition.

2. Take extra caution when hauling horses, cattle, or any other live cargo.

3. Check the load at least once each hour to ensure that it has not shifted and that the binders are tight.

Special Heavy-Duty Vehicles
Transports weighing more than 26,001 pounds GVW require special skills to operate.

1. Federal, State, and local regulations for securing the load, weight limits, and truck routes vary greatly. Know the regulations for the areas in which you will be driving.

2. On flatbed trucks and trailers without sides, tiedowns are required to keep cargo secure. The combined strength of all cargo tiedowns must be strong enough to lift 1½ times the weight of the piece of cargo that is tied down. Cargo should have at least one tiedown for each 10 feet of cargo.

3. When transporting a unit equipped with a turbo-charged engine, seal the intake and exhaust ports to prevent possible turbocharger damage.

PREVENTIVE MAINTENANCE

1. Preventive maintenance is covered in chapter 1, *Preventive Maintenance*. All drivers must be fully familiar with that material before operating any vehicle.

2. Preventive maintenance and safety checks must be made as directed by form FS 7100-9. All drivers must be familiar with the purpose and use of that form.

3. Special attachments, such as hoists and winches, must be checked as part of a form FS 7100-9 check to ensure that they are being properly maintained.

4. Different makes and models of vehicles require different kinds of lubrication. Every vehicle has a maintenance manual and lubrication guide that gives the details for proper lubrication of that vehicle. Drivers should study these details carefully.

Chapter 5—Heavy Equipment

OPERATORS

Only qualified heavy equipment operators shall be permitted to operate heavy equipment. The qualification shall show on the operator's OF-346, Operator's Identification Card. Trainees shall operate heavy equipment only under the immediate supervision of a skilled and certified operator. For proper licensing, an employee must be recommended for licensing by the employee's supervisor to a Certified Heavy Equipment License Examiner.

OPERATION

Know the equipment, its capabilities, and its limitations. Always operate the equipment properly for safety and maximum efficiency.

1. Before operating an unfamiliar piece of equipment, read the operator's manual. Do not assume that one piece of equipment will work exactly like a similar piece of equipment. For example, a Case 680H and a Cat 435 are both backhoes, but they are operated differently. ***Always read the operator's manual provided by the manufacturer.***

2. Before operation, appraise the job and decide how the machine may best be used to accomplish the work.

3. After the equipment has been started and all visual warnings have been released, operate the equipment under light loading. When normal temperatures are reached and proper operation checks are completed on all attached components, proceed with normal operation.

4. Let the engine idle for 5 minutes before turning it off. This permits it to cool down gradually, which is especially important for turbocharged engines.

5. Select the proper gears to do the job and minimize engine lugging. Avoid clashing gears when shifting.

6. When operating over rough or rocky ground, use the lowest gear and idle the engine down.

7. Make proper blade adjustments before starting operation and check the condition of the cutting edges regularly.

8. Change the blade adjustments as necessary after making an experimental pass or two on the material you are working.

9. For the most efficient use of equipment, always readjust the blade when the material changes.

10. Never operate equipment with your feet resting on the brakes or clutch. (Place your feet on the pedals only when necessary.)

11. Repair cracks or breaks immediately. Do not allow them to deteriorate beyond repair.

12. To prevent equipment parked overnight and on weekends from being pilfered, park in a nearby secured area, or park out of sight of the public. Always protect equipment from vandalism.

Safety Rules

When machinery or equipment, including that under contract, is received, remodeled, or repaired, it shall be inspected for safe operating condition by a qualified person before it is turned over to the operator.

1. Do not operate defective or unsafe equipment. “Red tag” it for repair.

2. Investigate and correct hazards before moving machines into operating positions. Machines shall be located and operated in areas where operators will not be endangered by blasts, cave-ins, or other hazards. Operators shall move machines into blasting areas only after being instructed to do so by the person in charge.

3. Stop all engines before refueling.

4. When the fuel tank is being filled, keep the funnel or container in contact with the tank to avoid the possibility that a spark of static electricity might ignite the fuel.

5. When changing operators, the person in charge shall discuss the plan of work, existing hazards, hand signals, and other safety aspects of the job with the new operator and crew.

6. When not in use, any machines with parts that raise and lower, such as shovels, buckets, dozer blades, and skid loaders, shall be left with those parts resting on the ground.

7. Provide additional fire extinguishers for machines that may cause fires, such as asphalt distributors.

8. Do not stand directly in front of, or in back of, a self-propelled machine being started by another person.

9. Do not attempt to start a piece of equipment while standing on the ground beside it.

10. Do not go under or into dangerous places around equipment without notifying the operator and being on the lookout for hazards.

11. Do not get on or off of moving equipment.

12. Operate only the equipment that you are qualified and certified to operate.

13. Provide ample clearance for a person between any solid material and the tail swing of a dragline, shovel, or crane.

14. Use a sound-level meter to check all equipment for excessive noise levels. If noise exceeds 85 decibels, provide the operator with hearing protection, which must be worn.

15. Keep cables in good repair and spooled properly. All cable fittings shall be positioned properly and tightened.

16. Make a thorough preventive maintenance check at the beginning of each job.

17. Have a journey-level mechanic inspect all equipment annually.

18. Suspend all crawler-tractor operations during storms and continue the suspension until good traction is ensured.

Guards and Safety Devices

1. Guards shall be supplied with all gears, sprockets, driver belt or chains, pulleys, drums, fans, or other hazardous moving parts.

2. Guards shall not be removed or made ineffective, except while making repairs.

3. Power for machines shall be shut off until repairs are made and guards are replaced.

4. Operating platforms surfaced with nonskid material, footwalks, ladders, steps, handholds, guardrails, and toeboards necessary for safe operation shall be installed before a machine is operated.

5. Suitable protection against falling objects, swinging loads, and similar hazards shall be provided for all operators.

6. Safety glass or a Lexan-type material shall be used in enclosed cabs.

Signaling

1. A competent flag person shall be posted at dangerous or congested points, near crews, and near blind areas.

2. Only one person shall give signals.

3. The correct use of hand signals shall be observed. Ensure that signals and instructions are clearly understood.

4. The flag person shall get as close to the operator as safety permits so that the operator can clearly see signal movements.

5. All signal motions shall be large enough to be understood by the operator. Repeat signal motions frequently.

6. When a slow pull or easy move is wanted, the signal motions shall be made at a slow tempo; signal motions shall be faster for fast pulls or moves.

7. The following signals shall be observed when directing drivers of vehicular or construction equipment, except when standard industrial specialized signals are agreed upon and understood in advance (*Health and Safety Code Handbook*)
   - Come ahead: Wave your arm in front of your body, from your waist to your arm's length above your head.
   - Reverse or back up: Move your arm in a full circle in front of your body.
   - Turn: Move your arm on the side of your body from your hip to your shoulder.
   - Slack up: Position one arm in front of you with your hand moving up and down.
   - Raise: Raise one hand, palm up.
   - Lower: Lower one hand, palm down.
   - Stop: Swing your arm back and forth (horizontally) in front of your body at your waist.
   - Caution: Wave your arm in a half circle over your head.

Transporting Equipment

1. Before moving heavy machinery, check the travel route for hazards, such as overhead and side clearance, culverts and bridges, and overhead lines.

2. Know the load weight, width, and height; obtain all State and local permits; and comply with all requirements.

3. Never haul a piece of equipment on a truck or trailer with a false bottom.

4. Block heavy equipment sidewise and lengthwise on truck beds. Bind the equipment securely to the truck or trailer bed, both front and rear or on each side, with chain or cable, and tighten with load binders. Chains used as a component of a tiedown assembly must conform to the requirements of the most recent edition of the National Association of Chain Manufacturer's welded and weldless chain specification applicable to all types of chain and must match load requirements. The load binders must be as strong or stronger than the tiedown assembly.

5. Angle or remove tractor blades or secure a special permit to comply with State laws pertaining to the width of the load.

6. Do not leave loose tires, planks, or other material on moving equipment.

Crawler-Tractor Operation

1. Injuries from crawler-tractor operation are usually serious, often fatal. Practice defensive operation at all times. This means:
   - Understand the equipment and its limitations. Accept competent advice.
   - Always keep accident prevention in mind.
   - Avoid doubtful or spectacular operations.
   - Allow apprentices to operate a crawler-tractor only under the immediate supervision of a skilled operator.

2. Do not operate a crawler-tractor if any part of the control, hoist, or hydraulic system, including the steering and brakes, is not in safe operating condition. Notify the supervisor or mechanic if a crawler-tractor is unsafe.

3. Before starting the engine of a direct-drive crawler-tractor, put the transmission in *neutral*, disengage the master clutch, and keep the blade down. For a power-shift transmission, place the transmission gearshift lever in *neutral* and lock it by placing the safety control in the on position.

4. Keep clear of a crawler-tractor that is moving. To stop the operator, signal from a safe distance.

5. When stopped and the engine of a direct-drive crawler-tractor is idling, put the transmission in *neutral* and engage the master clutch so the tractor cannot be jarred into gear. When motion is stopped and the engine of a power-shift type crawler-tractor is idling, apply the foot brake and lock in the safety control lever.

6. On a direct-drive crawler-tractor, gently engage the master clutch, especially when going up a hill or pulling out of a ditch. On a power-shift crawler-tractor, select the proper gear and adjust the speed control lever for additional power.

7. Always study the ground to be traveled and the job to be done. If you cannot see the ground clearly from the driver's seat, dismount and examine it before proceeding, unless a spotter is available for guidance. Avoid setups for upsets.

8. Always be especially careful around overhanging rocks, on rock slides, and near dead trees.

9. Only a trainee or mechanic engaged in actual repair is permitted to ride on the seat with the operator, and then only if the slope is less than 30 percent. Exceptions may be made only during fire emergencies.

10. Handholds to assist the operator when mounting and dismounting should be installed and maintained as necessary.

11. A heavy mesh screen should be installed on the rear of the cab protector between the operator and the rear-mounted towing winch, to protect the operator's back.

12. Know the location of all persons nearby.

13. Use extreme caution while going over obstacles when headed downhill. Be sure the slope is safe. Use caution when steering downgrade on steep slopes.

14. Observe the safe limits of crawler-tractor operation on side slopes. Small narrow-gauge crawler-tractors are more dangerous than wide-gauge equipment.

15. Reduce speed before making any turn or applying the brakes. When the speed of a crawler-tractor is doubled, the danger of overturning is increased four times.

16. When on steep side slopes, take the following precautions:
    - Do not run over obstacles with the upper track or wheels.
    - Keep off solid rock faces.
    - Have the transmission in gear when the crawler-tractor is going down steep grades; use the blade as a brake.
    - Usually, lock the uphill track and immediately turn the machine if the crawler-tractor slides sideways.
    - Make turns so that the operator is on the uphill side if possible.

17. Lower the dozer blade whenever the operator dismounts.

18. Do not get under an unblocked, raised blade for any purpose.

19. When dozing downhill or over embankments, it is best to doze several loads to the edge of the hill and push the loads in one pass.

Hitching and Towing

1. Do not ride on the drawbar, dozer blade, frame, or materials.

2. Use a bar or stick to steer the coupling bar into drawbar jaws.

3. When the towing winch is in operation, keep hands away from the cable and working parts.

4. Look behind before backing up to slack the chain or cable. Do not take up slack in the chain or cable with a jerk.

5. When towline is being hooked to the front pull hook, rest the blade on the line on soft ground or on a block or rock; then the worker can climb over the blade to attach the line.

6. Hookers and other people directing or assisting on the ground shall stand clear of all chains and lines and shall stay away from the crawler-tractor for at least the length of the towline.

7. When working near an electric powerline, the length of the cable attached to the load shall be at least 10 feet shorter than the distance from the tractor to the powerline so that the cable cannot strike the line.

8. Operate the crawler-tractor so that it does not nose up or tip when pulling a heavy load upgrade or slide sideways when pulling around a sidehill.

9. In most cases, the crawler-tractor should be stopped, taken out of gear, and the brake set before the load is released.

10. After each work shift or after each hard haul, the crawler-tractor operator and towline setter shall inspect the equipment, including rope and eye splices on the winch, choker eye splices, and ferrules.

11. Avoid sharp turns when pulling draft equipment such as carryalls or rippers. Do not “two-block” the sheaves.

Timber Operations

1. Crawler-tractors used in dangerous, timbered country or in places where there is danger of falling objects, shall be equipped with protective canopies and an approved rollover protective structure (ROPS), including front (logging) sweeps and side screens that will protect the operator.

2. Look for hazards, such as dangerous snags, green trees, and trees uprooted while piling brush.

3. Before operating alone, crawler-tractor operators shall be skilled in pushing over trees. Never run the crawler-tractor into a tree and try to knock it over by speed and force. When felling trees, leverage can be increased by raising the dozer blade as high up the tree trunk as possible. If the tree measures more than 14 inches in diameter and is difficult to push over, it is best to make passes on three sides of the tree, cutting the roots. If the tree is still difficult to push over, build a ramp on the side opposite the fall. This will give the crawler-tractor added leverage. When the tree begins to fall, back away so that the upturning roots will not damage the crawler-tractor.

4. When using a crawler-tractor to clear land, lower the blade just far enough into the ground to remove the brush and roots. Be alert for protruding trees and limbs when operating in timber or when piling brush.

5. After the towlines are set, the setter moves to a safe place where the setter can see the operator, and

vice versa, at all times. Both shall watch for falling trees and limbs and warn each other of dangers.

6. The towline setter stays at least 10 feet behind the load.

7. The towing winch is adjusted only when the motor is stopped. For adjustments requiring the motor to be in operation, put the transmission in neutral and engage the master clutch.

8. Before work is done on the towing winch, lower the dozer blade to the ground.

9. Do not hoist the dozer blade repeatedly with one corner caught under a stump or other heavy object. This may result in blade damage. Use the center of the blade rather than the corners for this type of operation.

Sidehill Operations

1. A competent, well qualified, experienced person is needed to supervise and direct sidehill tractor operation. Such a person could be a construction superintendent, crew leader, or an equipment operator who knows tractor capabilities. This person has the responsibility to ensure project safety, the proper care of equipment, and to monitor production.

2. Select only fully qualified equipment operators, experienced in firefighting, logging, or other tractor sidehill operations.

3. Tractors must be in top mechanical condition.

4. Sidehill operations can be very difficult. During these operations, it is particularly important for operators to be vigilant about safety and use mature judgment.

5. Check equipment often enough to ensure that it is completely safe. Unsafe units must be shut down and repaired before continuing to work.

6. All machinery must be equipped with ROPS, safety belts, and a rearview mirror positioned to give the operator full view of rear attachments.

7. Check all work areas for loose logs, rocks, stumps, bedrock outcroppings, and similar hazards. Identify and remove all hazards before work begins. The safe maximum slope on which a crawler-tractor should be operated is 42 percent on firm ground. To operate on a maximum slope, the operator must control the machine, recognizing the following conditions that may upset tractor stability:
   - Speed of travel.
   - Roughness of terrain.
   - Attachments.
   - Characteristics and nature of the ground (for example: track slippage caused by excessive loads can cause the downhill track to dig in, increasing the possibility that the crawler-tractor will roll over).
   - When using a high-mounted drawbar, a crawler-tractor is less stable than when a drawbar with a standard or lower height is used.
   - Wide-track shoes tend to decrease digging in, making the crawler-tractor more stable.
   - Jerking the steering clutches or brakes may make the crawler-tractor less stable.

8. Whenever slopes steeper than 45 percent must be worked, use the dozer blade to build a trail or roadway wide enough to accommodate the crawler-tractor.

All rollovers or tipping of crawler-tractors onto their sides will be investigated and reported to the regional forester. ***Operators in training will work only under the direct supervision of a qualified operator; they will not work on slopes steeper than 20 percent.***

Fire Operations

1. When crawler-tractors are operated in front of a fire, build a safety strip for retreat in case the fire makes a run. This is especially necessary when working along a ridgetop above fire in a canyon below.

2. Avoid fast travel over rocky ground or through dense, unburned brush or stands.

3. Generally, firefighters shall not try to outrun the head of a fast-moving fire. Instead, they should first try to get around to the flanks.

Terracing Operations

1. Trainee operators shall not be allowed to operate a tractor on terracing work.

2. When more than one crawler-tractor is working on a project, organize operations so that one crawler-tractor is working directly below another.

3. Provide a safety scout where ground visibility is poor because of dense brush or weeds.

4. Do not drag the dozer blade backward over rocks and stones.

5. Limit heel trenching with the lower corner of the dozer blade to slopes no steeper than 35 percent.

6. When moving downhill from one terrace to another, lower the dozer blade and back the crawler-tractor downhill.

7. If the slope is steeper than 65 percent, build a road from one terrace to another.

Endloader and Scraper Operation

Endloaders

1. Only the operator and trainee ride on the seat of the vehicle and then only when supervised by a competent crew leader.

2. Be sure that the wheels or tracks are on firm ground.

3. Pick up loads under the center of their weight.

4. Start and stop machines slowly when raising and lowering the bucket and when traveling.

5. Maintain and use the brakes properly.

6. Avoid excessive slopes and speeds when traveling on roads.

7. Work only at right angles to the bank or fills.

8. Watch booms and buckets for clearance when working or moving.

9. Take extreme care when working an endloader downhill.

10. Install and maintain an automatic backup alarm.

Scrapers

1. Block up the bowl to prevent it from dropping when changing the cutting edges or working underneath the scraper.

2. Place blocks between the apron arms and scraper sides before the work is performed under the apron.

3. ***Keep hands away*** from the cable, sheaves, and linkage while the unit is operating.

4. Wear leather-faced gloves when handling cable.

5. When traveling down a steep hill, be ready to drop the cutting edge to the ground to serve as a brake if the scraper should start to jackknife or get out of control.

6. Replace weak or frayed cables immediately.

Grader Operation

1. Be alert to the danger of fatigue caused by monotony on the job.

2. Supervisors shall only allow competent operators to operate a grader. Trainees shall operate a grader only under the immediate supervision of a qualified operator.

3. The operator is the only one allowed on a machine when it is in motion, unless the operator is instructing a trainee or a supervisor is directing the work.

4. Never back a machine until you are certain that there are no hazards. Install and maintain an automatic backup alarm.

5. Avoid clashing the gears and spinning the wheels.

6. Mount and dismount a grader only when it is stopped and properly braked.

7. Post *Crew and Equipment Working* signs and flags on the section of road being worked to warn and protect forest users.

8. Plan blading so that a section can be completed each day. If a windrow must be left overnight, warning signs or lights shall be placed to warn motorists.

9. If it is impossible to park the grader well off the road, post reflectors or flags to warn traffic.

10. Keep the cab ventilated to avoid the effects of exhaust fumes. The exhaust tailpipe should be set at an angle of 45 degrees to the rear and right or left of the line of travel.

11. Adjust levers or controls directly. Never reach through the steering wheel to adjust them.

12. Watch the road for hazards. Dismount and look things over carefully if visibility is poor.

13. Pull—rather than push—logs and windfalls out of the road if they might slide or roll onto the machine.

14. Grade slowly enough to prevent the machine or yourself from being thrown out of control if you strike roots, rocks, or stumps.

15. Only on rare occasions should the grader be operated faster than 5 or 6 miles per hour.

16. Be sure the entire crew is in full view before starting, and be sure they do not get too close to the moving machine.

17. Shift into the lowest gear necessary to climb or descend a grade.

18. Maintain control on hills by keeping the machine in gear; never coast out of gear. Do not depend entirely on the brakes to hold the grader while traveling, working, or when parked.

19. Keep graders away from the edge of the road on fills.

20. When sloping a bank, watch above the cut for rocks, logs, and trees that may roll when loosened by the blade.

21. When turning a grader, point the front wheels toward the fill shoulder.

22. When backing, remember that the brakes do not hold as well in reverse as in forward gear.

23. Before refueling, doing maintenance work, or checking the machine, stop the engine; set the brakes; and lower the blade, scarifiers, or rippers to the ground or onto a block.

24. When fueling a grader, make sure that the refueling can or pump nozzle touches the fuel tank opening to prevent static electricity from creating a spark.

25. On motor graders and all units with pneumatic tires, be sure driving tires are matched for size and are installed so they rotate in the proper direction.

Grader Transport

1. Observe State requirements for headlights, taillights, and warning flashers.

2. Angle the moldboard enough so that both ends are within the width limits of the tires.

3. Mount a *Slow Moving Vehicle* sign on the rear of all graders.

4. On narrow roads, stop to let oncoming traffic pass.

5. Always travel at a safe speed based on road and weather conditions.

6. Point the end of the blade that is on the traffic side to the rear and away from the direction of travel.

Shovel and Crane Operation

1. A shovel or crane shall be operated only by a qualified operator or a trainee under the direction of a qualified operator.

2. Wear close-fitting clothing, such as coveralls and nonskid shoes.

3. Give a signal and wait until everyone is clear before hoisting materials.

4. Only hoist loads that are well within the rated crane capacity. When lifting heavy loads, a two-, three-, or four-part line shall be used to keep within the rated capacity of the hoisting cable. A data sheet showing operating ranges and capacity ratings with the boom at various angles should be posted in the cab.

5. Do not overload booms and cables.

6. The distance between operations and live high-tension lines shall be the length of the boom plus the length of the material being carried. This does not apply when the power has been cut off.

7. If the boom should contact overhead wires carrying electricity, the operator shall:
   - Stay on the machine until the boom is cleared or the power is shut off.
   - Keep personnel on the ground away from the machine.
   - Jump off if the operator must leave the machine. The operator must not step off.

8. Keep hands clear of moving cables and other moving parts.

9. Place all slings, ties, and hooks safely and securely before material is hoisted.

10. Keep away from a dipper, boom, or load being operated or moved. Use handlines for guiding long materials.

11. Do not go under an idle dipper or boom—it may drop if the brakes are damp or cold.

12. Keep away from the tail swing.

13. Load trucks only when they are safely placed and the driver is out of the truck's cab and in the clear.

14. Swing loads over the rear of a truck—not over the cab—when possible.

15. Mount the machine only when it is not moving.

16. Clear all personnel before a machine is backed up or moved.

17. Disengage the master clutch before leaving the grader's cab temporarily.

18. Shut off the power, lock controls, and secure movable parts before leaving the grader's cab for the day.

19. The dipper or other load shall rest on the ground before the operator leaves the cab. Never leave a dipper suspended.

20. Equip all crane booms with snubbers.

Placement

1. When a machine is placed near an excavation, keep shoring and bracing back from the edge for a distance at least equal to the depth of excavation.

2. Place the machine on ground that is as level as possible. If cribbing or shims are used to level a machine, be sure they are sturdy and will not overturn or shift. The machine shall be well blocked to prevent it from rolling or sinking after being placed in position.

3. Stabilize a pneumatic-tired, self-propelled machine with outriggers when necessary.

Transporting

1. Lower the boom so that its tip is no higher than the cab, if feasible. If the machine is provided with a cradle or rack to support the boom, use it.

2. Use a flagperson when there are hazards to the operator or other persons.

3. Watch for overhead obstructions, such as underpasses, low-hanging limbs, and wires.

4. Do not permit free rolling or coasting with the machine's traveling gear disengaged.

Crusher and Compressor Operation

Crushers

1. Permit crusher operation only under the supervision of a qualified employee whose only duty is plant supervision.

2. Make, post, and maintain a safety operating plan at the crusher.

3. Provide a safety switch (kill switch) or remote control for the switch to stop the motor in an emergency. If possible, place the switch near the chute to the crusher jaw.

4. Construct all walkways, ladders, and guards of sound materials, and complete them before the plant is operated.

5. Level and surface the crusher's feed platform with nonskid material, such as rough lumber.

6. Inspect all construction annually for evidence of possible structural failure.

7. When a crusher is operated from a platform above it, install guards around the crusher opening that will prevent workers from falling into the opening.

8. Use a rock hook to feed, turn, or remove rocks from the crusher.

9. When belts are removed or replaced, shut off the power.

10. Stop all machinery before it is cleaned, serviced, or repaired.

11. In portable crusher operations:
    - Stop the power before removing obstructions.
    - Do not stand on or close to the flexible power drive mechanism.

Compressors

1. Check the water and oil levels in the engine and compressor before starting.

2. Check other applicable items at proper intervals based on the manufacturer's recommendations. Mechanical shop inspections should be made at the same intervals prescribed for other heavy equipment.

3. Allow the engine and compressor to warm up to operating temperature before closing the drain valve.

4. Check the safety valve by operating it manually.

5. Check all gauges for proper operating pressures.

6. Clean and service the compressor air cleaner daily, or more often in extremely dusty conditions.

7. Check the compressor daily for air leaks.

8. Bleed the tank and leave the valve open when shutting down the compressor.

9. Leave the clutch between the engine and compressor disengaged when the engine is shut down.

Brush-Chipper Operation

1. The operator is responsible for safe operation of the chipper. All workers on the chipper crew shall obey the operator's instructions regarding safety.

2. Wear long-sleeved shirts and gloves that protect the wrist and hands at all times when feeding the machine. When conditions warrant, wear dust masks. Wear hearing protection when sound levels exceed 85 decibels.

3. Stop the driver motor before making any adjustments or repairs to the chipper.

4. Do not allow anyone to stand directly in front of the exhaust chute while the cutterhead is in motion.

5. No more than two persons may feed the chipper. If they must stand closer than 6 feet from the hopper, only one person feeds it, working from the side. ***Never*** reach into the throat of an operating chipper.

6. Only limbs between 2 and 6 feet long should be chipped. Dry and excessively crooked pieces should not be chipped. Use a long limb to feed short pieces into the chipper.

7. The diameter of limbs to be chipped is governed by the size of the chipper being used. Do not overload it.

8. Throw material butt-end first into the hopper.

9. Use a pusher stick or another limb to clear the hopper.

10. When adjusting blades, cover the cutting edge of the blades below the one being adjusted with a section of split hose. Gloves cannot be used safely in such a tight space.

11. Thoroughly clean pitch and sawdust accumulations from the seating surfaces of the cutter head and wedge blocks when blades are being changed.

12. Tighten wedge bolts and adjusting bolts according to the manufacturer's specifications. Recheck all bolts before the machine is started in the morning and at noon.

13. After the blades are changed and adjusted, rotate the cutter knife once by hand to make sure that all blades clear the bed knife.

14. After a blade change, stand well back from the machine while the operator brings the cutter head to operating speed slowly by engaging and disengaging the clutch. Run the machine at operating speed for a few minutes and then stop. Recheck the blade wedge bolts for proper tightness.

PREVENTIVE MAINTENANCE

Operator Responsibility

Operators shall maintain equipment to comply at all times with the items listed on form FS 7100-9a, Operator's Safety and Preventive Maintenance Inspection (Crawler-Tractors and Loaders), and form FS 7100-9b, Operator's Safety and Preventive Maintenance Inspection (Motor Graders, Wheel Tractors, and Loaders). Any questions about lubricants, lubrication requirements, or service adjustments should be referred directly to the immediate supervisor.

Lubrication is an essential part of preventive maintenance and, to a great extent, controls the useful life of the machine.

The operator is the most important person in the preventive maintenance program. The operator is the first one to notice that a machine is not functioning properly and should visually check the engine temperature, oil pressure, fuel pressure, ammeter, and so forth, while operating the machine. The operator should inform the supervisor or the mechanic of adjustments, repairs, and loose parts that need to be tightened. Inspection adjustments and minor repairs can be made while the machine is being lubricated.

To perform preventive maintenance checks correctly, the operator must know the machine thoroughly. The manufacturer's instruction manual was prepared so the operator would have the information needed for satisfactory performance. It should be reviewed regularly.

Lubrication Guide

Different makes and models of equipment require different kinds of lubrication at different points and intervals. Consult the lubrication guide for instructions on each make and model. Always keep lubrication equipment clean and in good operating condition. Replace worn or broken fittings.

Adjustments by the Operator

Operator's manuals should be consulted for adjustment procedures. If adjustments do not correct a situation, the operator should notify the immediate supervisor so a mechanic can be dispatched. Forms FS 7100-9a and FS 7100-9b list items that the operator must maintain in a satisfactory condition. They also are used to report repair or maintenance services needed. The operator is responsible for:

- Adjusting and maintaining hoist and power control units, foot and handbrakes, steering and master clutches, fan and generator belts, and tracks.
- Changing oil and fuel filters.
- Draining water from sediment bulbs, fuel tanks, and fuel filters.
- Installing new cables.
- Keeping parts tightened on the unit.

Operational Checks

1. **Before-Operation Checks.** The importance of proper startup and shutdown of construction equipment cannot be overemphasized. Following the recommendations in this guide and performing scheduled maintenance procedures will increase equipment life.

   Although an operator lubricates and services a machine daily, there is always a chance that something might happen during overnight and weekend shutdowns. A slow leak may deflate a tire on the motor grader; an oil or fuel leak might create a fire hazard or leave a machine without fuel or lubricant; or someone might tamper with the machine during the night.

   Before operating your equipment, open the valve under the fuel tank and drain at least a pint to run off any water that might have collected. Then check for:
   - Tampering or damage.
   - Leaks.
   - Adequate fuel, oil, hydraulic system, and water levels.

- Glass and rearview mirror—clean.
- Rim and flange nuts—tight.
- Tires—adequate inflation.
- Fan belt—adequate tension.
- Battery—tight, clean, and water up to required level.
- Gauges—operating properly.
- Lights—operating properly.
- Steering linkage—operating properly.
- Nuts and bolts—tight.
- Missing tools.
- Correct track adjustment.
- Enough antifreeze for freezing weather.

2. **Operation Checks.** Many defects can be detected only while the machine is actually being operated. Prevent serious damage to a machine, as well as lost time due to breakdowns, by keeping alert for signs of defects. Items to be checked include:
   - Steering brakes
   - Footbrakes and emergency brakes
   - Clutch
   - Transmission
   - Transfer case
   - Engine
   - Instruments
   - Hydraulic control system
   - Blade and power controls

STORAGE

To protect equipment during storage, follow the procedures listed below. NOTE: Catch and dispose of fluids in accordance with local regulations.

1. Thoroughly wash the complete unit, including the engine. Lubricate thoroughly.

2. Drain the engine and refill with new oil.

3. If the cooling system contains antifreeze, check for the lowest expected temperature and add additional

antifreeze if needed. Use the manufacturer's recommended coolant or its equivalent. Check all cooling system hoses and hose connections. If the cooling system is to be drained, be sure that the radiator engine block, water pump, and heater are drained completely. Tie a warning tag marked *Cooling System Drained* to the steering wheel or levers.

4. Drain the fuel filter element housing and install new filter elements.

5. Drain any accumulated dirt and water in the fuel tanks; replace the drainplug and completely fill all tanks.

6. Clean the sediment bulb to remove water.

7. Cover the magnetos with waterproof material.

8. Store the unit under cover, or cover it with canvas, giving preference to automobiles.

9. Release the power control unit's brakes by tying the handles in the *released* position.

10. Cover the exhaust and intake pipes.

11. Rest moldboards, end loader buckets, and scraper bowls on blocks or planks.

12. Coat moldboards and end loader buckets with heavy oil or grease.

13. Remove batteries, charge them, and store them on a wooden base in a dry, frostproof place.

14. Clean the cable terminals and battery carrier with soda solution and rinse them with clean water.

15. Block up axles to take the weight off pneumatic tires. Run track-type machines onto planks or poles to keep them from freezing to the ground if they are to be stored in the open or on a dirt floor.

16. Cover exposed pistons, cylinders, rams, gears, shafts, and all running parts with heavy grease or oil. Do not grease tracks.

17. Coat all exposed steering ball joints on drive axles with heavy grease or oil.

18. Remove exposed seats or backrests and store them under cover.

19. Open the drainplug or draincock and bleed the air receiver tanks on the air compressors.

Chapter 6—Trail Bikes and All-Terrain Vehicles

OPERATORS

Only four- or six-wheel, all-terrain vehicles (ATVs) will be used by the USDA Forest Service.

Training

An examiner who is qualified for the type of vehicle to be used will train and test operators of ATVs. Tests for new operators will include an *Operators Questionnaire for ATV Machines*.

Drivers of USDA Forest Service-owned or -leased ATVs must meet training requirements and hold a valid Operator's Identification Card, OF-346, or a USDA Forest Service-issued identification card or document authorizing use of ATVs.

Before anyone is permitted to ride a machine on a trail, the following instructions and training must be given:

1. Explain the uses, advantages, and disadvantages of the machines. Explain hazards and rules for use. Explain that the operator is responsible for checks before, during, and after operation of any vehicle.

2. Explain and demonstrate the following ATV features:
   - Brake system
   - Clutch—manual or automatic
   - Choke
   - Throttle—thumb or twistgrip
   - Starter—electric or rope recoil
   - Engine *stop/run* switch
   - Lighting *on/off* switch
   - Dimmer switch
   - Odometer and trip meter, if the vehicle has this feature
   - Gearshift lever
   - Reverse lever
   - Fuel priming pump, if the vehicle has one
   - Decompression lever, if the vehicle has one
   - Footrest
   - Steering
   - Fuel valve—*on*, *off*, and *reserve* positions

3. Show the operator how to start the engine, how to remove the machine from the kickstand while holding the rear brake, and how to mount the machine and start off.

4. Have the operator ride the machine on a road or level ground while the trainer is observing.

5. Have the operator practice balance and smooth application of power. The operator must show proficiency in these skills before being permitted to take the machine on an easy trail ride. New operators should keep off difficult trails until they have become proficient. The test ride should be about 5 miles long, take about 1½ to 2 hours, and be conducted under the supervision of a qualified trainer.

OPERATION
Safety Rules

1. The safety of the operator always comes first. Take great care when riding these machines on steep trails and extreme side slopes. Maintain balance and apply power evenly. If you lose control, do not try to hold the machine—let it go and save yourself by staying on the trail.

2. Avoid trail riding until you are proficient on easy, level terrain.

3. Speeds exceeding 8 miles per hour are dangerous. Practice defensive riding—reckless driving and horseplay are prohibited.

4. Do not allow a second person to ride an ATV except during emergencies.

5. Walk the machine past hazards such as trails along steep bluffs and areas with rolling rocks.

6. Avoid riding on wet, muddy trails.

7. When approaching stock, stop the machine, shut off the engine, and move it off the trail as far as possible.

8. Wear protective headgear that meets the Motorcycle, Scooter, and Allied Trades Association (MSATA) standards for crash helmets. Also wear proper field boots, adequate clothing (long-sleeved shirt and/or jacket), leather gloves, and safety goggles/glasses.

Operating Procedures

1. Read and understand the operator's manual for each make of machine being used.

2. Never leave the machine with the engine running. Always engage the parking brake and remove the ignition key when leaving the machine unattended.

3. Grasp the throttle on the right handlebar. To apply power, feed gasoline to the motor by depressing the thumb, or twisting the hand grip. Apply power smoothly.

4. When traveling up steep grades, lean forward on the machine. This places weight on the front wheels and prevents the front end from rearing up.

5. When traveling down steep grades, transfer body weight to the rear, shift into low gear, and descend with the throttle closed. Apply brakes to the front and rear wheels to reduce speed.

6. Never ford any stream with deep or swift-moving water. The tires may float, making the vehicle difficult to control.

7. Remain alert at all times for pedestrians, stock, and trail hazards. Use extreme caution when approaching turns, switchbacks, steep grades, bluffs, and similar hazards.

8. Do not drive on private property without the owner's permission.

EQUIPMENT AND PREVENTIVE MAINTENANCE

1. Trail ATVs are subject to more frequent mechanical breakdowns and need more frequent carburetor adjustment than other motor vehicles. A change in elevation of 1,000 feet or more can require carburetor adjustment. The drive chain can be broken if the drive sprocket strikes a rock with any force. Minor adjustments of brakes, belts, and the drive chain must be made often while in the field.

2. Each trail machine should be equipped with a small toolbox or a cloth bag containing at least a pair of pliers, an adjustable end wrench, three or four open-end wrenches, a screwdriver, two or three chain-repair links, extra spark plugs, a spark plug wrench, a repair kit for the drive chain, and any special tools required for the specific make of ATV. Other items, such as wire, tape, rope, and foul-weather gear also may be useful.

3. Each trail ATV should be equipped with a USDA Forest Service-approved spark arrester, an 8-ounce liquid fire extinguisher, a first aid kit, a flashlight, and other items as required.

4. Some manufacturers furnish only a spark plug (spring leaf) ground strap to stop the engine. Because this device is inconveniently located, especially when the machine is off balance, the operator is usually unable to reach it to stop the engine, which can be a disadvantage in critical situations. An engine ground switch should be installed within easy reach of the operator.

5. Perform required preventive maintenance before starting a trip. Always conduct an inspection before starting a ride. The following tests cover most models:
   - Make sure all parts, such as lights, levers, handles, pedals, frame, and tires, are undamaged.
   - Make sure all controls, such as brakes, lights, *on/off* switches, throttles, and choke, are working.

- Inspect tires for cuts and gouges and for proper air pressure.
- Check the wheels to ensure that lugnuts are tight; also, check axlenuts for tightness and a secure cotter pin. Grasp the tire at the front and rear, and try to rock it on its axle to detect worn-out bearings or loose nuts. There should be no free play or slip while the wheel is rocked.
- Check the oil level in the engine and transmission. Check the level of all other fluids.
- Check the fuel level and fill the fuel tank. Make sure the fuel valve turns to all three positions: *on*, *off*, and *reserve.* Turn the valve to on before starting.
- After starting the ATV, make sure the gearshift and all the gears, including reverse, are working.
- A two-way radio is recommended. Forest policy may make this item mandatory.
- After each field trip, inspect the ATV and perform necessary maintenance.
- Perform regular maintenance as specified in the operator's manual.

LOADING AND HAULING

1. Use a hauling vehicle rated to have adequate capacity and capability for the load.

2. A tilt-bed trailer, designed especially for the ATV being used, is the best unit for hauling these machines.

3. Employ safe methods to load an ATV in the bed of a pickup. If possible, back the truck into a bank so the bed is about even with the ground. When loading or unloading, use ramps that are wide enough for the ATV and that secure firmly to the bed of the truck.

4. Before transporting an ATV, put it in gear, set the parking brake, and tie it down securely. When a truck is hauling an ATV, the tailgate must be closed. Do not allow the ATV's wheels to damage the front of the truck's bed or the tailgate.

Chapter 7—Snow Machines

OPERATORS

Operators of oversnow vehicles will be trained and tested by an examiner who is qualified in the type of vehicle to be used. Tests for new operators will include an *Operators Questionnaire for Oversnow Machines*. Their qualifications will be noted on their Government Operator's Identification Card, OF-346, or a USDA Forest Service-issued identification card.

All official snow-machine travel shall be authorized by the work supervisor.

OPERATION

Operators must be instructed in the proper operation of the vehicle. Operators must understand each control. Operators should read the manual thoroughly, recognize the machine's limitations, and operate the machine accordingly.

Safety Rules

1. Before each trip, inspect the snow vehicle to determine whether it is in safe operating condition. Using the procedure outlined in the operator's manual, check to see that the vehicle has been lubricated and that safety and preventive maintenance procedures have been performed. Check brake and throttle action, the starting system, the oil level for the chain, gasoline supply, and lights. Lubrication and maintenance of the main drive clutch and the belt or drive train are especially important.

2. Before each trip, file the travel route and time schedule at the dispatcher's office or official station. If the destination is a staffed station, personnel there should be notified of the travel route and the expected arrival time.

3. All operators and passengers will be experienced in the use of skis and/or snowshoes and will be outfitted in boots, gloves, insulated coveralls, and other clothing adequate for winter foot travel. Tinted

goggles or glasses shall be part of each operator's personal equipment. Sunscreen lotion is recommended.

4. Each snow vehicle (including rentals) shall have the following equipment securely attached:
   - An adequate first aid kit.
   - A map of the area to be traversed.
   - A tool kit and parts for making common and simple adjustments as well as repairs peculiar to the make and model of vehicle—an extra drive belt, spark plug, starter rope (if applicable), towrope, and a small can of grease. If special tools are required, be sure they are with the machine.

5. When planning to stay overnight or when it would not be reasonably possible to travel to the destination by snow machine ***and return*** on skis or snowshoes in 1 day, take the following equipment:
   - A portable radio (if in an area where a radio will function)
   - An approved survival kit containing:
     –A 9- by 12-foot plastic tarp in a suitable container
     –100 feet of $\frac{1}{4}$-inch nylon rope
     –Emergency rations
     –Waterproof matches
     –A hatchet
     –Emergency flares (three or four)
     –A flashlight or headlight and extra batteries
     –Clothing and blankets or sleeping bags for cold weather
     –Water or other liquids

6. Avoid speeds that may cause you to lose control of the machine. Quick stops should be avoided. Speed should be reduced gradually before stopping.

7. The operator and passenger will ride only in the manner or positions approved by a qualified trainer for the machine. Avoid quick turns. Use handholds when provided.

8. If a sled or toboggan is pulled by a snow machine, use a rigid hitch, not a chain or rope.

9. Never leave the machine with the engine running. Always engage the parking brake and remove the ignition key when leaving the vehicle unattended.

10. After each field trip, each snow vehicle shall receive an inspection and necessary maintenance.

11. Never make adjustments to the track or other power train components with the engine running.

12. Travel with no less than two machines, except in emergency situations.

13. Check the weather over the travel area before starting the trip and prepare for expected weather conditions. Be particularly cautious when snow and light create a whiteout condition in which it is impossible to see where you are going. Know snow conditions: powder during the late fall and rotten snow during late spring will not hold a machine and will be extremely hard on equipment. Spring travel should be done in early morning while the crust is hard. Plan on getting back before the crust gets soft because travel could become impossible later in the day, leaving you stranded.

14. Do not plan a trip involving travel after dark. Begin the return trip early enough to allow time for having trouble while still getting back before dark.

15. Stay on marked trails when possible. Do not leave the scheduled route of travel unless hazardous conditions make detours advisable. If a detour requires several miles of unscheduled travel, radio the change in route to the dispatcher, if possible.

16. Stay off frozen streams or lakes whenever possible. During essential emergency crossings, test the surface carefully to ensure safety before proceeding.

17. Do not chase or disturb wildlife. Take extra precautions to avoid disturbing wildlife on their winter ranges.

18. Establish and adhere to a radio reporting schedule. Check in as necessary, but at least ***every 3 hours.***

19. Do not drive the snow machine on streets, roads, or highways unless it is legal and necessary to do so. Avoid this type of travel under normal circumstances.

20. Avoid operating the machine at speeds that create added danger of windchill.

21. When traveling in areas where there is a possibility of avalanche danger, follow these procedures:
    - Always carry:
      –A sectional or collapsible probe
      –A collapsible snow shovel
      –Avalanche beacons attached to each person
    - Always travel so that only one person at a time is exposed to avalanche danger.
    - Stay off an avalanche path unless you are accompanied by trained avalanche personnel who certify that there is no danger in the path. Be especially careful to avoid fracture zones. Accident records show that most avalanche victims started the avalanches themselves. The safest route around an avalanche path is over the top by way of the ridges; the next safest route is along the valley floor beyond the avalanche path.
    - Do not make rest stops under or on an avalanche path.
    - Stay out of hazardous areas during or immediately after heavy snowfall or prolonged periods of high wind. Most avalanches occur during these periods. (Danger may persist for many days if temperatures are low.)
    - Do not assume a slope is safe because it did not slide when the first machine crossed it.
    - Beware of lee areas where the wind deposits snow, the slopes beneath cornices, and deep drifts, especially those with a convex (mounded) profile.

These are prime locations for avalanche fracture zones.

- Do not assume that avalanches are confined to open slopes. Dense timber is usually good protection, but open or scattered timber stands may not hold the snow.
- Before crossing an avalanche slope in the backcountry, ask “Will it slide?” and “What will happen if it does slide?” It may not be possible to guess whether the slope will slide, but it may be possible to make a good estimate of the risk involved if it does slide. Stay off slopes where there is a significant risk of being hurt.
- Be careful on or below 60- to 100-percent slopes. Most dangerous avalanches originate on slopes within this range. Snow tends to slough off steeper slopes before accumulating.

22. When planning and making an oversnow trip:
    - Do not drive on private property without the owner’s permission.
    - Do not travel on public roads after snow has been plowed, or you may become a traffic hazard.
    - Avoid developed ski areas.
    - Stay out of active logging areas, unless a timber management assignment requires you to be there.
    - Know the country being traveled.
    - Recognize snow conditions and the machine’s capabilities when traversing slopes.

23. If confronted with trouble:
    - Radio your location and conditions, if possible.
    - Do not abandon snowshoes or skis for any reason.
    - If you must remain with the machine, start a fire and prepare for survival.

24. Each operator should be familiar with common trail signs:

LOADING AND HAULING

1. Use a hauling vehicle rated to have adequate capacity and capability for the load.

2. A tilt-bed trailer, designed especially for the snowmobiles being used, is the best unit for hauling these machines.

3. Securely tie down the snow vehicle before hauling it.

4. Provide a cover or tarp for machines when they are being hauled. The cover shall be secured to the snowmobile. Always haul machines with the front end to the front of the trailer. Wind resistance may break the windshield off if the machine is hauled with its back end to the front of the trailer.

Chapter 8—Garbage Packers

OPERATORS

Operators of garbage-packer trucks must be qualified to operate trucks as large as those on which garbage packers are mounted. After such qualification, they should be trained to operate the packer unit.

OPERATION

The garbage packers purchased by the USDA Forest Service are well designed, efficient, and safe when used as intended. They are also expensive and potentially dangerous. It is of the utmost importance that the units be maintained properly and operated correctly.

Safety Rules

1. When the packer is being used for refuse collection, one member of the crew shall be designated as the packer operator. The packer operator shall be the only member of the crew authorized to operate the packer functions. The prime responsibilities of the packer operator include:
   - Seeing that the collection crew is clear of all packer functions before operation.
   - Ensuring that the packer is maintained correctly, all safety equipment is included, safety regulations are understood and followed, and that safety interlocks are working properly.

2. ***Never allow*** anyone to stick a head, arm, or any other limb inside the packer during the refuse collecting operation.

3. Crewmembers wear snug-fitting clothing.

4. Storing articles inside the packer is prohibited.

5. The operator and helpers should wear shoes with nonskid soles.

6. Never allow anyone to get in the packer unless the packer blade is adequately blocked.

7. Wear hardhats at all times.

8. The barrel lifter must clear the opening of the packer before the automatic blade cycle valve is operated. Keep the barrel lifter and step in their stored position when traveling.

9. Keep your body clear of the barrel lifter and make certain your hands and arms are out of the barrel lifter's path.

10. Do not leave garbage in the packer overnight.

11. The following safety equipment shall be with the packer at all times:
    - Stiff arm for rear bubble or door
    - Five-pound A, B, C-rated fire extinguisher
    - Packer-blade block
    - Backup alarm
    - Chock blocks
    - First aid kit
    - Hardhats
    - Reflectors or flares
    - Tire chains
    - Fire tools

Operating Procedures

1. To engage the power takeoff, first place the truck transmission in neutral. Depress the clutch pedal and engage the power takeoff control. Release the clutch pedal slowly. Let the oil in the packer's hydraulic system circulate for several minutes. The clutch should be depressed when disengaging the power takeoff. Always disengage the power takeoff before moving the truck, even when only moving a short distance.

2. Before loading refuse, make sure that the packer blade is retracted against the forward wall. Refuse must never be dumped in front of the blade. Always check to see if the tailgate clamps are locked.

3. Most packer controls are equipped with an automatic cycle. This cycle compacts the refuse and returns the blade to the forward wall. If, at any time, it becomes necessary to stop the blade movement, place the control lever in the *neutral* position. On some packer models a swinging latch is located just below the valve handle and may be swung up to hold the handle in the *neutral* position.

4. Engine speed and hydraulic pump flow are controlled by an electric accelerator solenoid. This solenoid sets the engine revolutions per minute, which gives the correct blade cycle time.

5. After each load is dumped, check to see that the tailgate is sealed properly when closed.

PREVENTIVE MAINTENANCE

The basic truck shall be maintained in accordance with standard regional policy for such vehicles. A complete manufacturer's guide to lubrication should be included with the packer unit.

1. Tire pressure is of critical importance. Load variations in a garbage packer are common and driving is hazardous with incorrect pressures. Check the pressure in each tire daily.

2. The oil level in the hydraulic system should be checked once a week. Always check the unit for leaks. If the hydraulic system is low, use the manufacturer's recommended hydraulic system oil.

3. The ram-blade runners shall be lubricated at least twice a week.

4. Grease the zerk fittings on equalizer shafts, ram blade arms, step assembly, and tailgate lock assembly at least once a week.

5. Oil the hinge points on the container, lift unit, step assembly, and tailgate once a week.

6. Clean the packer and truck thoroughly, inside and out, at least every 2 weeks.

Chapter 9—Boats

CLASSES

For regulatory purposes, motorboats are divided into the following four classifications:

1. Class A, motorboats shorter than 16 feet.

2. Class 1, motorboats 16 feet or longer, but shorter than 26 feet

3. Class 2, motorboats 26 feet or longer, but shorter than 40 feet

4. Class 3, motorboats 40 feet or longer, but not longer than 65 feet

OPERATORS

1. Only trained and qualified personnel may be licensed to operate power-driven boats. Show qualified boat classes on the operator's regional identification card, a boat operator's license, or OF-346.

2. Trainees shall operate boats only under the immediate supervision of a licensed boat operator.

3. One licensed person shall be in charge of the boat at all times. This person is responsible for the safe operation of the boat and for protecting personnel and Government property.

Training and Licensing

1. Potential boat operators must successfully complete a boating class developed for their unit or attend the U.S. Coast Guard Boating Skills and Seamanship class.

2. Training can be developed by a unit to fit its particular needs. At a minimum, the training will cover the following items:
   - Float plans
   - Basic mechanics of boats and engines

- Proper loading
- Personal flotation devices (PFDs)
- Basic U.S. Coast Guard regulations applicable to the unit
- Tides and currents, if applicable
- CPR and first aid
- Basic boat handling and anchoring
- Use of USDA Forest Service two-way radios, if applicable
- Survival skills appropriate to the area
- U.S. Coast Guard *Rules of the Road*

3. On-the-job training shall consist of a designated minimum number of hours. A trainee will conduct boat operations under the direct supervision of a licensed boat operator. Minimum hours of on-the-job training will be established and published by each unit based on types of waters and conditions encountered locally.

4. Potential operators will take a practical hands-on field test with a licensed operator. Boat licenses are not issued based on need, but on demonstrated skill and prior experience.

5. A yearly boaters' meeting will be scheduled for all operators. This is a time to discuss policy/rule changes, additional safety needs, near misses (potential accidents), and boating program needs.

6. Boat operator licenses will expire every 4 years. Operators must show evidence of boating experience in the previous 2 years, or repeat the training described above.

OPERATION
Safety Rules

1. Be familiar with and adhere to U.S. Coast Guard, USDA Forest Service, and State rules and regulations pertaining to required equipment and boat operation.

2. Each boat will have a pretrip checklist. Before each trip, the operator is responsible for checking this list to ensure that all safety equipment is aboard and that the boat and engine(s) are operating properly.

3. Check the short-, and if applicable, the long-term weather forecast for the area. Always respect small-craft advisories, squall lines, and thunderstorm activity.

4. Consider precautions to prevent capsizing, which can be caused by high-speed turns, overloading and improper loading, and improper heading in bad weather. Be sure the boat is ready and that the operator has the experience to meet any challenge the weather may present.

5. Falling overboard has caused many fatalities. Attention to safety is critical. Here are a few examples of safe practices:
   - Ensure that the operator and all passengers are seated. Do not run the boat at excessive speeds. Do not stand or move around while in progress. Do not sit on decks or gunwales.
   - Ensure that *every* passenger not in a cabin is wearing a personal flotation device (PFD).
   - Make sure the deck is free of oils and items that could trip someone.
   - When boarding a small boat, step into the center, not onto the side.
   - Always wear proper footwear.
   - Do not allow horseplay.

6. Report safety and mechanical problems to ensure that they are corrected.

7. Equipment requirements for the four classes of motor boats are established by Federal and State laws. Exhibit 1 lists the minimum Federal equipment requirements enforced by the U.S. Coast Guard on the navigable waters of the United States.

8. PFDs come in a variety of shapes, colors, and materials. Some are more rugged and last longer. Some protect the wearer from cold water. No matter which PFD is chosen, be sure to get the one that is right for the wearer and for the expected water conditions. Exhibit 2 explains some features of U.S. Coast Guard-approved PFDs.

9. Never fill portable fuel tanks while in a boat. Invisible, heavier-than-air gas vapors that escape from the tank during refueling can settle into the bilges in explosive proportions. Gasoline expands, so do not fill tanks completely if the temperature is likely to rise before some fuel is consumed.

10. To refuel boats fitted with permanently installed tanks, follow these precautionary procedures in this order:
    - Moor the boat securely to prevent movement during the refueling operation.
    - Do not smoke; ***extinguish all lights and fires***.
    - Stop motors and turn off electrical devices that may produce sparks.
    - Remove all passengers from the boat.
    - Close all cabin and compartment openings.
    - Check fuel-tank vents and fuel-line connections.
    - Determine the amount of fuel needed.
    - Keep the hose nozzle in contact with the fuel tank opening that could create a spark.
    - Turn off gas flow; allow all fuel to drain from the line.
    - Close the fill opening and wipe or flush any spilled fuel with water.
    - Open all ports, doors, and hatches, and allow the boat to ventilate for 5 minutes. Turn on the explosion-proof bilge blowers, if the boat has them.
    - Check all compartments for any odor of gas before starting engines.

Operating Procedures

Each boat will handle differently. Operating a boat can be difficult because of wind, tides, currents, and other boat traffic. Boat characteristics, handling, piloting, and

other topics must be covered in training for operators. The potential operator must show the ability to handle these challenges during the field (hands-on) training and testing.

BOAT TRAILERING

1. The most critical item when picking a trailer for the boat is support of the hull. Using an incompatible trailer will probably damage the hull. The trailer must be rated to handle the total weight of the boat and equipment.

2. The trailer must be loaded so that 5 to 15 percent of the weight is on the tongue. When the tongue weight is too low, the trailer's weight will lighten the rear of the towing vehicle, which may lead to loss of control. When the tongue weight is too high, the trailer's weight will lighten the front of the towing vehicle, which may make it impossible to steer the vehicle.

   The combined weight of the boat loaded with equipment and the trailer shall not exceed 75 percent of the GVWR of the towing vehicle. If the combined weight of the boat and trailer exceed 75 percent of the GVWR of the towing vehicle, a larger vehicle must be used.

4. Safety chains ensure that the tongue will not contact the ground if the trailer comes loose. Make sure chains are crossed under the tongue and that the length is correct before attaching them to the vehicle frame.

5. Always be aware of extra length and weight of the trailer, which will require much more room when turning and greater distance when stopping. Plan far ahead of the turn or stop.

6. All trailers shall be equipped with lighting as required by Federal and State regulations. Trailer brakes controlled from the towing vehicle will be provided when the gross trailer weight exceeds the minimum 1,500 pounds requirement for installation of brakes.

Exhibit 1—
MINIMUM EQUIPMENT REQUIREMENTS
(Class A boat, shorter than 16 ft)
(Class 1 boat, 16 to 26 ft long)
(Class 2 boat, 26 to 40 ft long)
(Class 3 boat, 40 to 65 ft long)

Personal flotation devices (PFD, life jacket)

- **CLASS A BOAT:** One approved Type I, II, III, IV, or V PFD for each person onboard
- **CLASS 1, 2, and 3 BOATS:** One approved Type I, II, III, or V device for each person onboard. In addition, one throwable Type IV device. Type V recreational hybrid PFDs must be worn when the boat is being used.

Fire extinguisher*
(Must say *Coast Guard Approved*)

- **CLASS A and 1 BOATS:** At least one B-1-type* approved hand portable fire extinguisher. (Not required on outboard motorboats shorter than 26 feet and not carrying passengers for hire if the construction of such motorboats will not permit the entrapment of explosive or flammable gases or vapors and if fuel tanks are not permanently installed.)
- **CLASS 2 BOAT:** At least two B-1-type approved portable fire extinguishers; OR at least one B-11-type approved portable fire extinguisher.
- **CLASS 3 BOAT:** At least three B-1-type approved portable fire extinguishers; OR at least one B-1 type plus one B-11-type approved portable fire extinguisher.

Visual distress signals**
(Required on coastal waters only)

- **CLASS A BOAT:** Must carry approved visual distress signals for nighttime use.
- **CLASS 1, 2, and 3 BOATS:** Must carry visual distress signals approved for both daytime and nighttime use.

Exhibit 1
MINIMUM EQUIPMENT REQUIREMENTS
(Continued)

Bell, whistle

- **CLASS A and 1 BOATS:** Every vessel shorter than 12 meters (39.4 ft) must carry an efficient sound-producing device.
- **CLASS 2 and 3 BOATS:** Every vessel longer than 12 meters (39.4 ft) but shorter than 20 meters (65.6 ft) must carry a whistle and a bell. The whistle must be audible for $\frac{1}{2}$ nautical mile. The mouth of the bell must be at least 200 millimeters (7.87 in) in diameter.

Ventilation
(Boats built before August 1, 1980)

- **ALL CLASSES:** At least two ventilator ducts fitted with cowls or their equivalent for the purpose of properly and efficiently ventilating the bilges of every closed engine and fuel-tank compartment of boats constructed or decked over after April 25, 1940, using gasoline as fuel or other fuels having a flashpoint of less than 110° F.

Ventilation
(Boats built August 1, 1980 or after)

- **ALL CLASSES:** At least two ventilator ducts for the purpose of efficiently ventilating every closed compartment that contains a gasoline engine and every closed compartment containing a gasoline tank, except those having permanently installed tanks that vent outside the boat and which contain no unprotected electrical devices. Also, engine compartments containing a gasoline engine having a cranking motor must contain power-operated exhaust blowers that can be controlled from the instrument panel.

Backfire flame arrestor

- **ALL CLASSES:** One approved device on each carburetor of all gasoline engines installed after April 25, 1940, except outboard motors.

**When a fixed fire extinguishing system is installed in machinery space(s), it will replace one B-1-type portable fire extinguisher.*

***A pamphlet describing visual distress signals is available from the U.S. Coast Guard.*

Exhibit 1
MINIMUM EQUIPMENT REQUIREMENTS
(Continued)

Marine fire extinguisher classification

U.S. Coast Guard classes	Foam (gal)	CO_2 (lb)	Dry chemical (lb)	Halon (lb)
B-1	1.25	4	2	2.5
B-11	2.5	15	10	10
—	—	10	2.5	5

U.S. Coast Guard minimum equipment requirements vary with the size of the boat, type of propulsion, whether operated at night or in periods of reduced visibility, and, in some cases, the body of water on which it is used. For a more thorough discussion and complete details on how many and what types of equipment you must have aboard your boat, request a copy of the free pamphlet, *Federal Requirements for Recreational Boats*, from the U.S. Coast Guard. Many states have their own requirements that go beyond U.S. Coast Guard requirements. Contact your State boating office to learn what they are.

Exhibit 2
FEATURES OF U.S. COAST GUARD-APPROVED PERSONAL FLOTATION DEVICES

TYPE I—Offshore life jacket. These vests are geared for rough or remote waters where rescue may take awhile. They are excellent for flotation and will turn most unconscious persons face up in the water.

TYPE II—Near-shore vest. These vests are good for calm waters and fast rescues. Type II vests may lack the capacity to turn unconscious wearers face up.

TYPE III—Flotation aid. These vests or full-sleeved jackets are good for calm waters and fast rescues. They are not for rough waters since they will not turn a person face up.

Exhibit 2
FEATURES OF U.S. COAST GUARD-APPROVED PERSONAL FLOTATION DEVICES
(Continued)

TYPE IV—Throwable device. These cushions or ring buoys are designed to be thrown to someone in trouble. They are not for long hours in rough waters, nonswimmers, or the unconscious.

TYPE V—Special-use device. These wind-surfing vests, deck suits, hybrid PFDs, and others are designed for specific activities, such as kayaking or water skiing. ***To be acceptable, Type V PFDs must be used in accordance with their label.***

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Administrative Distribution

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