

# FIRE ENGINE MAINTENANCE PROCEDURE AND RECORD



License: \_\_\_\_\_

Duty Station: \_\_\_\_\_

Engine Identification Number: \_\_\_\_\_



# **FIRE ENGINE MAINTENANCE PROCEDURE AND RECORD PREFACE**

The Fire Engine Maintenance Procedure and Record (FEMPR) was revised by a development group with direction from the National Interagency Fire Center (NIFC), BLM Fire Training. The primary BLM developers in this effort were:

|                 |          |                  |         |
|-----------------|----------|------------------|---------|
| Jason Adkins    | Wyoming  | Paul Peterson    | Nevada  |
| Keith Hackbarth | Idaho    | Randy Turrill    | Utah    |
| Tommy Hayes     | Colorado | Terry Tilford    | Utah    |
| Pam McDonald    | NIFC     | Glen Uhlig       | Nevada  |
| Al Olson        | NIFC     | Russell Wilstead | Montana |

BLM Fire Training appreciates the efforts of all contributors to the design and development of this product.

Please consider this edition as a dynamic document and make recommendations accordingly. Suggestions for improvements or changes are welcome via the e-mail address below.

Additional copies of this document are available on the BLM Fire Training Web site:  
[http://www.blm.gov/nifc/st/en/prog/fire/training/fire\\_training.html/](http://www.blm.gov/nifc/st/en/prog/fire/training/fire_training.html/)

Please forward questions, comments, or corrections to:

Al Olson, ENOP Project Leader  
3833 South Development Way  
Boise, ID 83705  
E-mail: [Al\\_Olson@nifc.blm.gov](mailto:Al_Olson@nifc.blm.gov)

When submitting comments for the FEMPR, include the following:

- Name/Office
- Page number/section that comments relate to
- Subject
- Comments



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### APPENDIX – Master Documents

1520-35, Annual Motor Vehicle Maintenance/Safety Checklist



## ***FIRE ENGINE MAINTENANCE PROCEDURE AND RECORD***

The Fire Engine Maintenance Procedure and Record (FEMPR) was designed as an engine operator's guide for performing routine maintenance on a wildland fire engine. This maintenance is performed in addition to requirements found in the vehicle owner's manual. Duties described as "daily" or "as needed" are recommendations; however, local protocol may dictate that some tasks be performed more/less often. This document is to be used for all types of engines and tenders; however, some instructions are engine-type specific. Skip the task if it does not pertain to your engine.

BLM wildland fire equipment operators and repair personnel are requested to submit Wildland Fire Equipment Report of Improvement/Deficiencies when they encounter problems, perform repairs, or make improvements to equipment. See the BLM Fire Equipment Development Web site at [http://web.blm.gov/internal/fire/EquipDev/def\\_form.php](http://web.blm.gov/internal/fire/EquipDev/def_form.php) for online submission. Information will be used to help track deficiencies and make improvements to BLM equipment.

The Vehicle Data and Pump Package Data sections on pages 2 and 3 need to be filled out and kept current for the life of the engine. This information is used by mechanics and engine module members when repairing or servicing the engine.

Additional copies of forms used within the FEMPR can be obtained at the BLM Training Web page ([http://www.blm.gov/nifc/st/en/prog/fire/training/fire\\_training/projects/engine\\_training/enop.html](http://www.blm.gov/nifc/st/en/prog/fire/training/fire_training/projects/engine_training/enop.html)) or make copies of the ones provided prior to use. The Annual Motor Vehicle Maintenance/Safety Checklist (Form 1520-35) is included in the Appendix and electronically through the Fleet Management Web site at ([http://nbcweb.blm.gov/bc653/fleet/fleet\\_index.html](http://nbcweb.blm.gov/bc653/fleet/fleet_index.html)).

## ***FIRE APPARATUS WARRANTY REPAIRS***

If you have a fire apparatus that needs repaired and you believe the work should be covered under the manufacturer's warranty, call the Fire and Aviation's Equipment Development Unit before taking to a repair facility for repairs.

They can assist with the warranty work and the manufacturer may have a preferred repair facility authorized to do warranty work.

If you authorize repair work without first checking with them or the manufacturer, you may be liable for the repair bill and your vehicle may not be released until the payment is finalized.

Equipment Development Unit phone numbers:

(208) 387-5422, 5423, 5424, 5425, and 5445

## **VEHICLE DATA**

| <b>Vehicle</b>              |                                      |                         |                                       |              |
|-----------------------------|--------------------------------------|-------------------------|---------------------------------------|--------------|
| Fire Engine Type            | License Plate #                      | Fire Engine #           |                                       |              |
| Make                        |                                      | Model                   |                                       |              |
| Year                        | Vehicle Identification Number (VIN)  |                         |                                       |              |
| Buildup Manufacturer        |                                      | Date Placed In Service  |                                       |              |
| Length                      | Width                                | Height                  | Wheel Base                            |              |
| NOTES                       |                                      |                         |                                       |              |
| <b>Vehicle Engine</b>       |                                      |                         |                                       |              |
| Manufacturer Make           | Manufacturer Model                   | Manufacture Year        |                                       |              |
| Crankcase Capacity (Quarts) |                                      | Oil Filter Type         |                                       |              |
| Coolant Capacity (Quarts)   |                                      | Coolant Filter Type     |                                       |              |
| Air Filter (Primary)        |                                      | Air Filter (Secondary)  |                                       |              |
| Fuel Filter (Primary)       |                                      | Fuel Filter (Secondary) |                                       |              |
| Tire Size                   | Ply Rating                           | Highway Pressure        | Off-Road Pressure                     | Speed Rating |
| Power Steering Belt         | Alternator Belt                      | Air Compressor Belt     | Battery Group                         | Other        |
| NOTES                       |                                      |                         |                                       |              |
| <b>Vehicle Transmission</b> |                                      |                         |                                       |              |
| Manufacturer Make           | Manufacturer Model                   |                         | Manufacture Year                      |              |
| Serial Number               | Filter Number                        |                         | Fluid Capacity (Quarts)               |              |
| Differential Type & Ratio   | Differential Fluid Capacity (Quarts) |                         | Transfer Case Fluid Capacity (Quarts) |              |
| NOTES                       |                                      |                         |                                       |              |

## ***PUMP PACKAGE DATA***

| <b>Pump</b>                              |                          |
|--|--------------------------|
| Pump Make                                | Pump Model               |
| Rating _____ GPM@150 PSI                 |                          |
| NOTES                                    |                          |
| <b>Pump Engine</b>                       |                          |
| Make                                     | Model                    |
| Crankcase Capacity (Quarts)              | Oil Filter               |
| Coolant Capacity                         | Fan Belts                |
| Water Tank Capacity                      | Fuel Filter              |
| Pump Gear Box                            | Other                    |
| NOTES                                    |                          |
| <b>Foam System</b>                       |                          |
| Make                                     | Model                    |
| Foam Tank Capacity                       | Foam Filter/Wye Strainer |
| NOTES                                    |                          |
| <b>Compressed Air Foam System (CAFS)</b> |                          |
| Make                                     | Model                    |
| Compressor Oil Capacity                  | Compressor Oil Filter    |
| Compressor Air Filter                    | Compressor Belt Type     |
| NOTES                                    |                          |

## ***GROSS VEHICLE WEIGHT RATING (GVWR), GROSS AXLE WEIGHT RATING (GAWR) AND GROSS VEHICLE WEIGHT (GVW)***

The National Highway Safety Administration, U.S. Department of Transportation regulations (49 CFR, Part 567—Certification) require that the GVWR and GAWR of a vehicle must be posted in the vehicle on a permanently affixed label—usually on the driver side door.

GVWR is the chassis manufacturer’s specified maximum load carrying capacity of a vehicle. GAWR is the chassis manufacturer’s specified maximum load carrying capacity of an axle system, as measured at the tire/ground interface. The axle system includes, but is not limited to, the axle, tires, suspension, wheels, frame, brakes, and applied engine torque. GVW is the combined vehicle weight with all associated attachments, accessories, water, crew, and equipment.

### **For example:**

1. Weigh the front axle. Is the weight less than the manufacturer’s front axle GAWR?

If the answer is “**yes**,” then the front axle weight is OK.

If the answer is “**no**,” then the front axle weight is over-grossed and weight must be reduced (e.g., winch may need to be removed, brush guard may need to be removed, hose tray on bumper may need to be removed, etc.).

2. Weigh the rear axle. Is the weight less than the manufacturer’s rear axle GAWR?

If the answer is “**yes**,” then the rear axle weight is OK.

If the answer is “**no**,” then the rear axle weight is over-grossed and weight must be reduced (e.g., non-vital equipment may need to be removed, extra fuel containers may need to be removed, water load in tank may need to be reduced, etc.).

3. Add the front axle weight to the rear axle weight (this is the GVW). Is the GVW less than the manufacturer’s GVWR?

If the answer is “**yes**,” then the vehicles weight is OK.

If the answer is “**no**,” then the vehicle is over-grossed and weight must be reduced (e.g. removing non-vital equipment, removing crew members, removing non-essential accessories, etc.).

## ***FIRE ENGINE WEIGHT***

Complete this section and keep current for the life of the engine. This information is needed to keep engines at the proper GVWR. This information is generally found on a label on the inside driver’s door.

Manufacturer’s GVWR: \_\_\_\_\_

Manufacturer’s GAWR (front axle): \_\_\_\_\_

Manufacturer’s GAWR (rear axle): \_\_\_\_\_

Manufacturer’s GAWR (intermediate axle): \_\_\_\_\_



## ***FIRE ENGINE INSPECTION INSTRUCTIONS***

Engine crew should use the instructions below to perform daily or post-fire engine inspections. The inspection that is performed after a fire requires a more in-depth look at major engine components. Document inspection findings on the Fire Engine Inspection Checklist (pages 13-16).

Manufacturer's recommendations should be followed with regard to fluid specifications/levels and service intervals. Many of the statements below refer to "check" or "inspect." **When irregularities are found to items below (or those not listed), document the information in the "REMARKS" area of the inspection; ensure that the problem is corrected before putting the vehicle into service.**

### **CAB AND CHASSIS**

**As a safety precaution, remove keys from the ignition while working under or around the vehicle.**

1. **Approach** – Check the overall appearance of vehicle stance (not leaning). Check for signs of dripping fluids around major fire engine components.
2. **Hood** – Check the hood latches, springs, and hinges.
3. **Oil** – With the engine on level ground, check oil level; add if needed.
4. **Power Steering Fluid** – Check fluid level; add if needed.
5. **Fuel Filter** – Ensure there are no leaks.
6. **Fuel/Water Separator** – Ensure there are no leaks.
7. **Automatic Transmission Fluid** – With the engine on level ground, ensure that the transmission fluid level meets manufacturer's recommendations. Ensure fluid is the right consistency. Check the fluid's color and smell.  
*Manual Transmissions:* Occasionally check fluid level—pull plug and check with finger.  
*Transfer case:* Occasionally check fluid level—pull plug and check with finger.  
*Differential:* Occasionally check fluid level—pull plug and check with finger.
8. **Hydraulic Brake Fluid** – Check fluid level; add if needed.
9. **Fan and Fan Belts** – Ensure that the fan moves freely, has no cracks, and blades are tight. Check belts for wear, frays, tension, or cracks. Replace as necessary.
10. **Driver Side Front Tire, Rim, Hub and Suspension** – Check tread depth, wear patterns, tire damage and tire pressure. Ensure that tires are of same size, type, etc. Ensure lug nuts are present and tight. Inspect rims for damage and proper mounting. Check for leaks and proper operation of manual hubs. Check for missing leaf springs or cracks in leafs. Inspect shock and mounting hardware. Inspect tie rods for damage (bends or looseness).
11. **Front Bumper** – Ensure that brush guard, license plate, and skid plate are present and secured properly and engine number is displayed.
12. **Coolant** – Check fluid level; add if needed. Check coolant color.
13. **Radiators** – Check that radiator is clean and free of debris.
14. **Air Filters (including air conditioner, cabin, and ember separators)** – Carefully inspect filters, mounting brackets, inlet hose connections, and fittings. Inspect gasket and sealing surface areas. Replace service element, if needed. Ensure that ember separators are clear of particulates. Check air filter restriction gauge.
15. **Hoses** – Check for signs of wear, cracks or leaks; replace as necessary. Check hose clamps for tightness. Check for signs of dripping fluids around major engine components.
16. **Passenger Side Front Tire, Rim, Hub and Suspension** – *Refer to #10 above.*

17. **Fuel Tank and Brackets** – Ensure that the fuel tank is full and securely mounted. Look inside the tank to ensure that gauge is reading correctly (if applicable). Ensure that the fuel tank is not leaking.
18. **Passenger Side Door(s)** – Check the latch, lock, handhold, mirrors and hinges.
19. **Passenger Side General Condition** – Ensure that the fire engine is clean and orderly in appearance. Ensure that agency emblems, decals, equipment numbers are present and in good condition. Ensure that cabinet latches, hinges, and locks are in good working condition.
20. **Passenger Side Undercarriage** – Check for loose bolts, hanging wires, leaks, and broken parts. Ensure that the undercarriage is free of debris. Inspect steering components, drive train, body mounts, and cross members for functionality and damage. Check the package mounting brackets and bolts.
21. **Exhaust** – Check all brackets and look for signs of leaks.
22. **Passenger Side Rear Tire, Rim, Hub and Suspension** – *Refer to #10 on page 6.*
23. **Vehicle Rear** – Ensure that the bumper and license plate are securely fastened and cabinets are in working order. Check that the spare tire is present and properly inflated. Ensure that mud flaps are present and in good condition. Ensure engine number is displayed.
24. **Top Deck** – Ensure that the hose reel and boxes are in working order, bolts are tight on all hose reel components, and non-skid surface is in good condition.
25. **Rear Undercarriage (Plumbing)** – *Refer to #20 above.*
26. **Driver Side General Condition** – *Refer to #19 above.*
27. **Driver Side Rear Tire, Rim, Hub and Suspension** – *Refer to #10 on page 6.*
28. **Driver Side Undercarriage** – *Refer to #20 above.*
29. **Air Tanks** – Check for moisture and bleed. Inspect mounting brackets. Check for leaks in air lines.
30. **Batteries** – Ensure that batteries are secure, connections are tight, and cell caps are in place. Ensure that battery connections are not excessively corroded. Ensure that the battery box and cover are secure. Know locations of fuse boxes and electric junction boxes.
31. **Driver Side Door(s)** – *Refer to #18 above.*
32. **Wheel Chocks** – Ensure that wheel chocks are available and easily accessible.
33. **Hydraulic Oil (if applicable)** – Check fluid level; add if needed.

## **INSIDE CAB**

1. **Start Engine** – Start engine. Allow engine to reach operating temperature and leave running for electrical checks. Ensure that “water in fuel” light goes off after engine starts. If it doesn’t, drain water from fuel at the separator.
2. **Lights and Signals** – Check headlights, brake lights, running lights, emergency lights, turn signals, backup lights, work lights, panel lights, license plate lights, off-road lights, cabinet lights, dome and dash lights, and hazards. Replace bulbs as necessary.
3. **Mirrors and Glass** – Check for cleanliness, cracks, chips, and damaged brackets or mounts. Ensure that mirrors are properly adjusted.
4. **Gauges and Switches** – Ensure that all gauges are operational. Document any non-functioning gauges; ensure that the problem is fixed before putting the vehicle into service.
5. **2-Way Radio and P.A.** – Perform a radio check to ensure that the radio receives and transmits. Ensure that the radio is securely mounted and speakers are functional.
6. **Clutch and Gear Shifter** – Ensure gear shifter moves freely with clutch in. Ensure that the clutch has free play. If automatic transmission, ensure that shifter lever locks in place.

7. **Wipers and Washers** – Check condition, reservoir level, and operation. Replace wipers and fill reservoir as necessary.
8. **Horn and Backup Alarm** – Check electric horn. Check air horn mounting brackets. Ensure that air horn and backup alarm are operational.
9. **Seat Belts** – Ensure that seat belts are clean, secure, accessible, and operational—no signs of wear and tear. Ensure there are enough belts to accommodate all engine personnel.
10. **Heater and Air Conditioner** – Check fan, defroster, vents, and controls.
11. **Vehicle Use Book** – Ensure that the vehicle use book is current, neat and accessible. Check for credit card, receipts, proper charge codes, and weight ticket. Ensure that a copy of the self-insurance documentation is included in the log book.
12. **Accident Forms** – Ensure that the DI-135 contains the following forms: DI-134, SF-91, SF-91A, SF-94, CA-1, and OF-26.
13. **Fire Extinguisher** – Ensure that the fire extinguisher is securely mounted, pins are in place, inspection is current and tagged, reflective marker is attached, and unit is charged.
14. **First Aid Kit(s)** – Ensure that the first aid kit(s) is maintained, updated, and clearly marked.
15. **Reflector Set** – Ensure that the reflector set is available and operational.
16. **Jack and Lug Wrench** – Ensure that the properly-sized jack and lug wrench are present and compatible with the vehicle.
17. **Normal Unit Strength (NUS)** – The NUS should reflect the standards established in the Interagency Standards for Fire and Fire Aviation Operations, Appendix R. Check for missing or damaged items; replace if necessary. Ensure that the NUS is documented and kept current.

## **BRAKES**

1. **Parking Brake** – Check for proper operation. Ensure vehicle does not move when brake is set.
2. **Air Brakes** – Perform an air brake check in accordance with Department of Transportation (CDL) standards. Instructions for the Air Brake Check can be found on page 10.
3. **Slack Adjusters** – Inspect brake assembly for excessive play. Check for broken, loose, or missing parts.
4. **Brake Canister** – Ensure that the brake canister is properly mounted and free of dents and air leaks.
5. **Brake Lines** – Listen for air leaks. Inspect brake lines for rub marks.

## **PUMP PACKAGE**

1. **Water Tank, Foam Tank and Baffles** – Ensure that the water and foam tanks are full. Ensure that sight and electronic gauges are working properly.
2. **Valves** – Ensure that valves work smoothly and are not leaking. Check valves for loose handles and bolts. Ensure that valve caps are in place to prevent dirt from damaging the valve. Use dry lube to lubricate valve handles.
3. **Coolant** – Ensure that coolant is at a proper level and overflow container is in place.
4. **Oil** – Ensure that crankcase oil is at a proper level; if low, fill to manufacturer’s specifications.
5. **Fuel Filter** – Inspect fuel filter and bracket.
6. **Air Filter(s)** – Ensure that the air filter(s) is in place and clean; change as needed. If a pre-filter is being used, make sure it is clean. Inspect filter housing for damage. When reinstalling, check for proper seal between air intake and filter.
7. **Primer** – Ensure that the primer functions properly and all discharge valves are closed.
8. **Pump On/Off-Start Switch, Oil Pressure Override Switch, Glow Plugs, and Throttle** – Ensure that the pump on/off-start switch is secure and operational. Ensure that the push-to-start switch is secure and operational. Ensure that the glow plugs have cycled and the light goes off. Ensure that pump engine warms up to operating temperature (3-5 minutes).
9. **Gauges** – Ensure that all gauges are functioning properly; replace bad gauges. Ensure that panel lights are operational.
10. **Water Pressure Safety Shutdown Switch** – Ensure that the switch functions properly.
11. **Live Reels** – Ensure that live reels work properly. Grease hose reel swivels periodically. Operate the nozzle to ensure water flows. Check for leaks. Ensure that the hose reel rewind functions properly and that mounting hardware is secure.
12. **Foam Proportioner** – Ensure that foam proportioner is operational. Follow manufacturer’s guidelines for unit operation. Refill with foam if needed.
13. **Water Inlet Strainer** – Check for leaks. Clean out strainer weekly.
14. **Pump Mounting Bolts** – Check for loose or missing bolts.
15. **Pump Exhaust** – Check for signs of leaks.
16. **Gear Box** – Ensure that the gear case oil is at a proper level; if low, fill to manufacturer’s specifications.

## ***AIR BRAKE CHECK***

**(Adapted from Department of Transportation CDL Manuals)**

1. **Check Air Compressor Drive Belt.** If the air compressor is belt-driven, check the condition and tightness of the belt. The belt should be in good condition.
2. **Check Manual Slack Adjusters on S-Cam Brakes.** Park on level ground and chock the wheels to prevent the vehicle from moving. Turn off the parking brakes so you can move the slack adjusters. Use gloves and pull hard on each slack adjuster. If a slack adjuster moves more than about one inch where the push rod attaches to it, it probably needs adjustment. Adjust it or have it adjusted. Vehicles with too much brake slack can be very hard to stop. Out-of-adjustment brakes are the most common defect found in roadside inspections. Be safe. Check the slack adjusters.
3. **Check Brake Drums (or Discs), Linings, and Hoses.** Brake drums (or discs) must not have cracks longer than one half the width of the friction area. Linings (friction material) must not be loose or soaked with oil or grease. They must not be dangerously thin. Mechanical parts must be in place, not broken or missing. Check the air hoses connected to the brake chambers to make sure they are not cut or worn due to rubbing.
4. **Test Low Pressure Warning Signal.** First, chock the wheels and release the brakes. Shut off the engine when you have enough air pressure so that the low pressure warning signal is not on. Turn on the electrical power and step on and off the brake pedal to reduce air tank pressure. The low air pressure warning signal must come on before the pressure drops to less than 60 PSI in the air tank (or tank with the lowest air pressure, in dual air systems).

If the warning signal does not work, you could lose air pressure and you would not know it. This could cause sudden emergency braking in a single circuit air system. In dual systems the stopping distance will be increased. Only limited braking can be done before the spring brakes engage.

5. **Check that the Spring Brakes Engage Automatically.** Chock the wheels, release the parking brakes when you have enough air pressure to do it, and shut off the engine. Step on and off the brake pedal to reduce the air tank pressure. The “parking brake” knob should pop out when the air pressure falls to the manufacturer’s specification (usually in a range between 20-45 PSI). This causes the spring brakes to come on.
6. **Check Rate of Air Pressure Buildup.** When the engine is at operating RPM, the pressure should build from 85 to 100 PSI within 45 seconds in dual air systems. (If the vehicle has larger than minimum air tanks, the buildup time can be longer and still be safe. Check the manufacturer’s specifications.) In single air systems (pre-1975), typical requirements are pressure buildup from 50 to 90 PSI within 3 minutes with the engine at an idle speed of 600-900 RPM.

If air pressure does not build up fast enough, your pressure may drop too low during driving, requiring an emergency stop. Do not drive until you get the problem fixed.

## 7. **Test Air Leakage Rate.**

- a. **Engine off, all brakes off.** With a fully-charged air system (typically 125 PSI) and wheels chocked, turn off the engine, release all brakes, and time the air pressure drop. The loss rate should be less than 2 PSI in one minute for single vehicles and less than 3 PSI in one minute for combination vehicles.
- b. **Engine off, service brakes applied.** Apply 90 PSI or more with the brake pedal. After the initial pressure drop, the loss rate should be less than 3 PSI in one minute for single vehicles and less than 4 PSI in one minute for combination vehicles. Check for air leaks and fix them before driving the vehicle. Otherwise, you could lose your brakes while driving.

8. **Check Air Compressor Governor Cut-in and Cut-out Pressures.** Pumping by the air compressor should start at about 100 PSI and stop at about 125 PSI. (Check manufacturer's specifications.) Run the engine at a fast idle. The air governor should cut-out the air compressor at about the manufacturer's specified pressure. The air pressure shown by your gauge(s) will stop rising. With the engine idling, step on and off the brake to reduce the air tank pressure. The compressor should cut-in at about the manufacturer's specified cut-in pressure. The pressure should begin to rise.

If the air governor does not work as described above, it may need to be fixed. A governor that does not work properly may not keep enough air pressure for safe driving.

9. **Test Parking Brake.** Stop the vehicle, put on the parking brake, and gently pull against it in a low gear to test that the parking brake will hold. If the vehicle moves significantly, have a mechanic inspect the brake system.
10. **Test Service Brakes.** Wait for normal air pressure, release the parking brake, move the vehicle forward slowly (about 5 mph), and apply the brakes firmly using the brake pedal. Note any vehicle "pulling" to one side, unusual feel, or delayed stopping action. This is not normal; a mechanic inspect the brake system.

*These tests may identify problems which you otherwise wouldn't know about until you needed the brakes on the road.*

## ***HYDRAULIC BRAKE CHECK***

1. **Test for hydraulic leaks.** Pump the brake pedal three times. Then apply firm pressure to the pedal and hold for five seconds. The pedal should not move. If it does, there may be a leak or other problems. Have a mechanic inspect.
2. **Test service brake stopping action.** Move the vehicle forward slowly (about 5 mph), apply the brakes firmly using the brake pedal. Note any "pulling" to one side, unusual feel, or delayed stopping action. This is not normal; a mechanic inspect the brake system.
3. **Test Parking Brake.** Stop the vehicle, put on the parking brake, and gently pull against it in a low gear to test that the parking brake will hold. If the vehicle moves significantly, have a mechanic inspect the brake system.

## ***JUMP STARTING PROCEDURES***

**When jump starting, ensure that battery voltage systems are compatible (12-volt to 12-volt or 24-volt to 24-volt). Never jump a lower volt battery system with a higher volt battery system.**

1. Make sure the vehicles are not touching since contact could provide an unwanted electrical path.
2. Turn off your engine.
3. Connect the red jumper cable from the positive (+) post or terminal on your low or dead battery to the positive post or terminal on the good battery in the other vehicle.
4. Connect the black jumper cable from the negative (-) post or terminal on your good battery to a solid ground on the other vehicle.
  - **CAUTION: Do not make the final jumper connection directly to the low or dead battery itself because the final jumper connection usually produces a spark.** Making the final connection away from the battery will minimize any danger of an explosion by keeping the spark well away from the battery.
5. Make sure the ground connection on the vehicle with the low or dead battery provides a good electrical contact. Use an unpainted metal surface like an engine bracket or a frame member.
6. Make sure the cables do not touch each other and that the cables are clear of the fan and pulleys on both vehicles.
7. Start the engine in the vehicle with a good battery. Run the engine at fast idle for several minutes before attempting to start the vehicle with the low or dead battery.
  - This will allow the charging system to build a charge into the low or dead battery, lessening the drain on the good battery and charging system.
8. As soon as the vehicle with the dead battery starts, disconnect the battery cables. The vehicle should then be run or driven at least 30 minutes to recharge the low or dead battery.
  - Additional charging time may be required depending on the battery's condition and state of charge.
  - If vehicle battery does not charge, check alternator.
9. If the vehicle does not crank, or cranks slowly, recheck the jumper connections.
  - If it still does not crank, the problem may be something other than the battery (such as a bad starter, solenoid, battery cable connection, or internal engine problem).
10. If the vehicle cranks normally, but refuses to start, it may have an ignition, fuel, or mechanical problem.
  - Do not crank the starter more than 30 seconds at a stretch. Allow the starter to cool for 2 minutes before cranking the engine again.
  - Continuous grinding of the starter can cause it to overheat and fail.
  - Continuous cranking can also drain a good battery and/or overload and possibly damage your charging system.









## ***DIESEL PARTICULATE FILTER (DPF)***

The diesel particulate filter (DPF) was added to all post-2007 diesel engines to meet EPA air quality standards. The DPF is designed to collect and incinerate diesel particulate matter or soot from the exhaust gas of a diesel engine. DPFs must be cleaned out intermittently or continuously to avoid plugging the filter. Excessive exhaust back pressure due to a plugged filter can damage the engine and the DPF. The process of cleaning the filter is known as “regeneration.”

Regeneration is generally done automatically by passive and active systems. Passive systems use only the exhaust gas stream to burn out the soot. Active systems use a fuel burner that heats the filter to soot combustion temperatures. If neither of these regeneration procedures work to clean-out the DPF, then the driver needs to perform a parked (also referred to as a manual stationary regeneration). Any time the driver performs a parked regeneration, complete the table below.

**Refer to your owner’s manual for regeneration procedures specific to your engine.**

### **Parked Regeneration**

|         |  |  |  |  |  |  |  |  |  |
|---------|--|--|--|--|--|--|--|--|--|
| Date    |  |  |  |  |  |  |  |  |  |
| Hours   |  |  |  |  |  |  |  |  |  |
| Mileage |  |  |  |  |  |  |  |  |  |
| Date    |  |  |  |  |  |  |  |  |  |
| Hours   |  |  |  |  |  |  |  |  |  |
| Mileage |  |  |  |  |  |  |  |  |  |
| Date    |  |  |  |  |  |  |  |  |  |
| Hours   |  |  |  |  |  |  |  |  |  |
| Mileage |  |  |  |  |  |  |  |  |  |
| Date    |  |  |  |  |  |  |  |  |  |
| Hours   |  |  |  |  |  |  |  |  |  |
| Mileage |  |  |  |  |  |  |  |  |  |
| Date    |  |  |  |  |  |  |  |  |  |
| Hours   |  |  |  |  |  |  |  |  |  |
| Mileage |  |  |  |  |  |  |  |  |  |
| Date    |  |  |  |  |  |  |  |  |  |
| Hours   |  |  |  |  |  |  |  |  |  |
| Mileage |  |  |  |  |  |  |  |  |  |

## ***3,000-MILE SERVICE***

Service intervals should be reduced as conditions or local policy warrant (post-fire, severe conditions, etc.) and as per manufacturer's recommendations. The following are covered in this service:

- **Oil Change** – Ensure that the oil change is completed.
- **Oil Filter** – Ensure that the oil filter is changed.
- **Lubrication** – Ensure that the entire chassis is lubricated.
- **Air Filter** – Ensure that the air filter has been replaced.
- **Fuel Filter/Water Separator** – Ensure that the fuel filter/water separator has been replaced.

## ***ANNUAL MOTOR VEHICLE MAINTENANCE/SAFETY SERVICE***

BLM policy requires that a vehicle be inspected annually. The Annual Motor Vehicle Maintenance/Safety Checklist, Form 1520-35, is where this information is reported and submitted to the fleet manager. (Refer to the Appendix.) Use the FEMPR to supplement the 1520-35 for specific fire engine maintenance procedures. In addition to completion of the following items, the 3,000-mile service items will be completed.

1. **Pre-Inspection Road Test** – This should include driving the vehicle and checking that the foot brake, parking brake, steering, starter, transmission, clutch, and gauges are in working order. During the test the mechanic should be listening for any unusual noises.
2. **Wheel Bearings and Hubs** – Clean, inspect, and re-pack wheel bearings and hubs. Check wheel seals for leaks or damage. Perform at intervals recommended by the manufacturer or more often under severe conditions.
3. **Axles and Differentials** – Drain and refill with correct lubricants to the proper level. Visually check ring gears, pinion gear, and differential side gears.
4. **Transfer Case and Transmission** – Drain and refill with correct lubricant to proper level. Inspect mounts and seals. Manual Transmission and Transfer Case – remove inspection plates; visually inspect gears and bearings. Inspect and adjust clutch as needed. Automatic Transmission – Remove pan, inspect transmission, and service all filters.
5. **Drive Lines and U-Joints** – Clean, inspect, lubricate, balance or replace as per manufacturer's recommendations or as severity of conditions dictate.
6. **Steering Components** – Inspect steering gear box, steering components, lubricate and replace seals as needed.
7. **Brakes** – Examine brake lining and drums, pads and rotors, wheel cylinders, master cylinder, brake booster, Accumulock (where applicable), examine brake compressor, mounts, air lines, parking brake cable, and parking brake lining. Inspect "S" cam, shaft, and bushings for wear, inspect wedge assemblies and air brake chambers and repair as required. Inspect all brake components and repair as required. Adjust all brakes.
8. **Engine Tune-Up** – Check emission control systems and repair as required to bring the vehicle into compliance. Major engine tune-up to be performed as severity of conditions dictate or as per the manufacturer's preventative maintenance recommendations. Check fuel delivery systems; clean, overhaul or adjust as required. Replace fuel filters and water separator filter annually or more often under severe conditions. Check turbo-charger.
9. **Cooling System** – Examine radiator, hose connections, coolant recovery tank and water pump for leaks. Check fan belt for wear and adjustment. Clean radiator core (external) if dirty. Examine radiator pressure cap. Check condition of coolant. Examine automatic transmission heat exchanger oil lines for leaks or damage. Change coolant filter, if applicable.  
**Coolant must be changed and flushed every two years. If engine is overhauled, radiator shall be removed and completely overhauled.**
10. **Frame and Suspension** – Visually inspect fire package mounting brackets, springs, mounts, shocks, hangers and replace as needed. Perform four-wheel alignment.
11. **Exhaust System** – Check and inspect exhaust system.
12. **Air Conditioning System** – Inspect and recharge as necessary.
13. **Post Off-Road Inspection** – (inside back cover)

*Additional services may be necessary according to the owner's manual.*















## ***PUMP PERFORMANCE TEST***

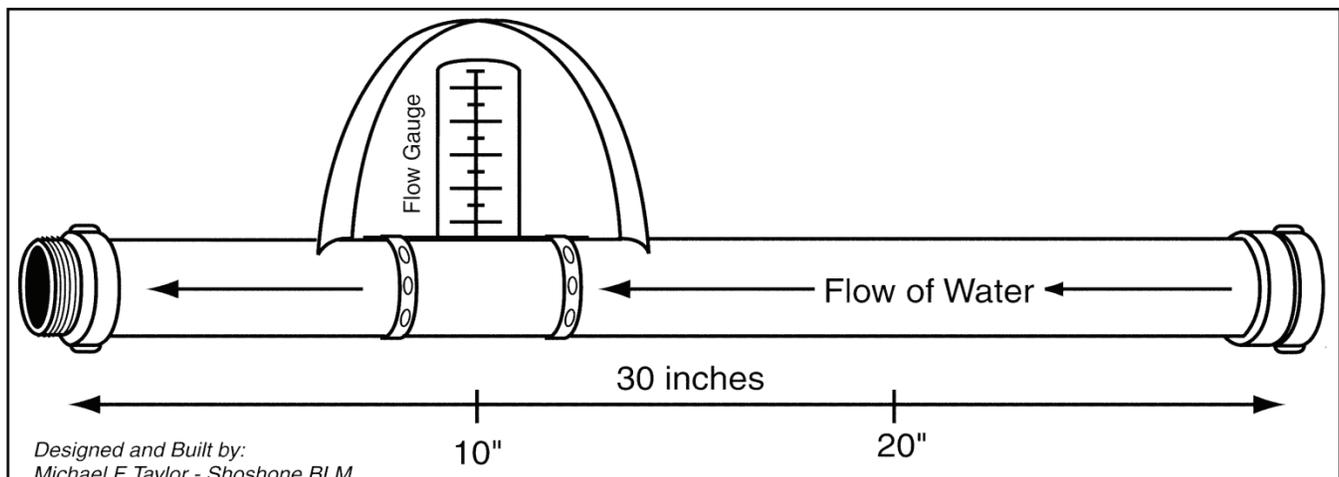
The Pump Performance Test Record on pages 24 and 25 provides an area to document pump performance and trend. Various methods can be used to test pump performance; using a consistent method on a routine basis (at a minimum, once per month) is essential for trend identification. Using commercial, certified flow meters will provide the most accurate flow readings. However, flow meters can be expensive and may not be practical to have at all field locations. See the non-commercial, non-certified flow meter at bottom of this page on how to build a non-certified flow meter. The BLM Equipment Development Shop at NIFC has several loaner commercial flow meters that are available to BLM districts or field offices. They are generally loaned out for a two-week period of time.

The pump performance test that the course development group recommends is based more on pounds per square inch (PSI) loss over the time of the pump's life. It is a trend analysis over time. If the test is done the same way every time and there is a PSI loss each time it is done, it alerts the operator of potential pump or pump motor problems and/or unacceptable gallons per minute (gpm) output. The pump performance test is done as follows:

- Using the 1½-inch overboard discharge nearest to the pump, assemble a 1-inch NPSH-F x 3/4-inch NH-M reducer (NFES 0733) to a 1-inch NH-F x 1-inch NPSH-M reducer (NFES 0010) and then secure onto the 1½-inch discharge port.
- With the valve to the 1½-inch discharge open, throttle the pump to maximum PSI output.
- Record the PSI gauge reading and also the engine RPM in the Pump Performance Test Record on pages 25 and 26. Compare each maximum PSI output and RPM readings to the ones previously done. If over time the maximum PSI or RPM goes down, then there is a problem with the pump or pump motor; the operator must find and correct the problem.
- Ensure that the pump-to-tank valve is fully closed each time.
- Ensure that the pressure relief is adjusted the same number of turns each time it is checked.
- Ensure that the strainer is clean.
- Ensure that all valves are fully closed except the tank-to-pump valve and the discharge valve being tested.

*Non-seating valves could be the cause of poor pump performance results.*

### ***NON-COMMERCIAL, NON-CERTIFIED FLOW METER***



*See page 27 for constructing a non-commercial, non-certified flow meter.*

## ***INSTRUCTIONS FOR BUILDING A FLOW METER***

### **Material Requirements:**

30" long of 2" pipe - threaded at both ends  
2 – reducers, 2" pipe female threads to 1½" hose male threads (NPSH)  
1 - 1½" x 1½" female hose thread swivel (NH)  
1 - Blue-White Model No. F-30200P GPM meter (for pool usage)  
2 - 4" hose clamps  
Approximately 2" of 1" x 1/16" flatbar metal

### **Construction Instructions:**

1. The 30" pipe needs to have a ½" diameter hole drilled 10" from the discharge end (the drawing will show the direction of flow by the arrows). This is where the flow meter will be installed.
2. Mount the flow meter onto the pipe (it will come with instructions and a gasket). It is mounted with two 4" hose clamps; the instructions will show this.
3. Bend and weld the flatbar metal over the top of the gauge to protect it (shown in drawing). Make sure you leave enough room to remove the gauge in the event of replacement or repair.
4. Install the 2" by 1½" reducer on the input side of the pipe.
5. Install the 1½" by 1½" female-to-female (NH) swivel to reducer on the input end of the pipe.
6. Installation of the other 2" by 1½" reducer on the discharge side is optional but it is recommended to pump the test flow away from the vehicle.

### **Flow Meter Use:**

The flow meter can be attached to the fire vehicle at any of the discharge points, providing they are 1½" (NH) outlets; or it can be adapted to a variety of sizes depending on the fittings on board the vehicle.

The flow meter requires little to no maintenance—maybe an occasional rinsing to remove foam solution. There is also a plug on top of the gauge that can be removed to rinse. The range of this model is 40 to 150 GPM.

### **Approximate Cost:**

\$125 to \$150 depending upon the cost of supplies.





## ***WINTERIZATION INSTRUCTIONS***

Winterization of the fire engine and pump package is the process of preventing damage due to freezing temperatures.

A field or short-term winterization should be performed any time the fire engine plumbing is exposed to freezing temperatures. During short periods of exposure to freezing conditions, a full winterization need not be completed; however, some precautions need to be taken to prevent damage to the pump and plumbing.

A full winterization should be performed for periods of prolonged exposure or at the end of the fire season. This winterization process is performed in addition to what was done during the Annual Motor Vehicle Maintenance/Safety Service.

When doing a full winterization on the pump package, drain all pumps, valves, plumbing, foam unit and water tank. Blow out the system with compressed air and add a small amount of RV antifreeze to the pump head, foam unit, and low spots in the plumbing system.

**Copies of the Field or Short-Term Winterization Checklist can be found below and on page 31.**

**A copy of the Full Winterization Checklist can be found on page 32.**

### ***FIELD OR SHORT-TERM WINTERIZATION CHECKLIST***

| <b>PUMP PACKAGE</b>        | <b>Check Box</b>         | <b>HOSE REELS</b> | <b>Check Box</b>         | <b>OTHER</b> | <b>Check Box</b>         |
|----------------------------|--------------------------|-------------------|--------------------------|--------------|--------------------------|
| Close "Tank-to-Pump" Valve | <input type="checkbox"/> | Drain Hose        | <input type="checkbox"/> |              | <input type="checkbox"/> |
| Open All Other Valves      | <input type="checkbox"/> | Remove Nozzles    | <input type="checkbox"/> |              | <input type="checkbox"/> |
| Drain Pump                 | <input type="checkbox"/> | Drain Reels       | <input type="checkbox"/> |              | <input type="checkbox"/> |
| Drain and Remove Strainer  | <input type="checkbox"/> | Inspect Gaskets   | <input type="checkbox"/> |              | <input type="checkbox"/> |
| Drain Plumbing             | <input type="checkbox"/> |                   | <input type="checkbox"/> |              | <input type="checkbox"/> |
| Disconnect Pressure Gauge  | <input type="checkbox"/> |                   | <input type="checkbox"/> |              | <input type="checkbox"/> |
| Remove Caps                | <input type="checkbox"/> |                   | <input type="checkbox"/> |              | <input type="checkbox"/> |
|                            | <input type="checkbox"/> |                   | <input type="checkbox"/> |              | <input type="checkbox"/> |
| <b>DATE:</b>               | <b>COMPLETED BY:</b>     |                   |                          |              |                          |
|                            |                          |                   |                          |              |                          |
| <b>REMARKS:</b>            |                          |                   |                          |              |                          |
|                            |                          |                   |                          |              |                          |

***FIELD OR SHORT-TERM WINTERIZATION CHECKLIST***

| <b>PUMP PACKAGE</b>        | <b>Check Box</b>     | <b>HOSE REELS</b> | <b>Check Box</b> | <b>OTHER</b> | <b>Check Box</b> |
|----------------------------|----------------------|-------------------|------------------|--------------|------------------|
| Close "Tank-to-Pump" Valve |                      | Drain Hose        |                  |              |                  |
| Open All Other Valves      |                      | Remove Nozzles    |                  |              |                  |
| Drain Pump                 |                      | Drain Reels       |                  |              |                  |
| Drain and Remove Strainer  |                      | Inspect Gaskets   |                  |              |                  |
| Drain Plumbing             |                      |                   |                  |              |                  |
| Disconnect Pressure Gauge  |                      |                   |                  |              |                  |
| Remove Caps                |                      |                   |                  |              |                  |
|                            |                      |                   |                  |              |                  |
| <b>DATE:</b>               | <b>COMPLETED BY:</b> |                   |                  |              |                  |
|                            |                      |                   |                  |              |                  |
| <b>REMARKS:</b>            |                      |                   |                  |              |                  |
|                            |                      |                   |                  |              |                  |

***FIELD OR SHORT-TERM WINTERIZATION CHECKLIST***

| <b>PUMP PACKAGE</b>        | <b>Check Box</b>     | <b>HOSE REELS</b> | <b>Check Box</b> | <b>OTHER</b> | <b>Check Box</b> |
|----------------------------|----------------------|-------------------|------------------|--------------|------------------|
| Close "Tank-to-Pump" Valve |                      | Drain Hose        |                  |              |                  |
| Open All Other Valves      |                      | Remove Nozzles    |                  |              |                  |
| Drain Pump                 |                      | Drain Reels       |                  |              |                  |
| Drain and Remove Strainer  |                      | Inspect Gaskets   |                  |              |                  |
| Drain Plumbing             |                      |                   |                  |              |                  |
| Disconnect Pressure Gauge  |                      |                   |                  |              |                  |
| Remove Caps                |                      |                   |                  |              |                  |
|                            |                      |                   |                  |              |                  |
| <b>DATE:</b>               | <b>COMPLETED BY:</b> |                   |                  |              |                  |
|                            |                      |                   |                  |              |                  |
| <b>REMARKS:</b>            |                      |                   |                  |              |                  |
|                            |                      |                   |                  |              |                  |

## ***FULL WINTERIZATION CHECKLIST***

**(Lube, oil, and filter as per local policy and manufacturer's recommendation)**

| <b>PUMP PACKAGE</b>                       | <b>Check Box</b> | <b>FOAM UNIT</b>                                  | <b>Check Box</b> | <b>HOSE REELS</b>                      | <b>Check Box</b> |
|---|------------------|---|------------------|--|------------------|
| Open all valves                           |                  | Follow manufacturer's recommendation              |                  | Remove nozzles                         |                  |
| Disconnect pressure gauge                 |                  |   |                  | Drain hose                             |                  |
| Drain pump                                |                  | <b><i>AT THE MINIMUM:</i></b>                     |                  | Drain reels                            |                  |
| Drain and remove strainer                 |                  | Flush with water                                  |                  | Blow out lines                         |                  |
| Drain plumbing                            |                  | Run RV antifreeze through the lines               |                  |  |                  |
| Wash motor                                |                  |   |                  |  |                  |
| Check pump package mounting brackets      |                  |   |                  |  |                  |
| Remove Caps                               |                  |   |                  |  |                  |
|   |                  |   |                  |  |                  |
| <b>TANK</b>                               | <b>Check Box</b> | <b>FIRE ENGINE</b>                                | <b>Check Box</b> | <b>BOXES</b>                           | <b>Check Box</b> |
| Drain and flush                           |                  | Test anti-freeze (-40)                            |                  | Clean fuel cans and drip torches       |                  |
| Remove plugs                              |                  | Post anti-freeze degree reading on left headlight |                  | Lock boxes and cabinets                |                  |
|   |                  | Anti-freeze in wiper fluid                        |                  | Fire extinguisher serviced and stored  |                  |
|   |                  | Battery master off                                |                  | Remove perishables                     |                  |
| <b>OTHER</b>                              | <b>Check Box</b> | Add fuel additive                                 |                  | Winterize portable pumps and chainsaws |                  |
| Bag all parts and store on the front seat |                  |   |                  |  |                  |
|   |                  |   |                  |  |                  |
|   |                  |   |                  |  |                  |
| <b>DATE:</b>                              |                  | <b>COMPLETED BY:</b>                              |                  |  |                  |
|   |                  |   |                  |  |                  |
| <b>REMARKS:</b>                           |                  |   |                  |  |                  |
|   |                  |   |                  |  |                  |

**APPENDIX – MASTER DOCUMENTS**



UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

License Number

Odometer Reading

**ANNUAL MOTOR VEHICLE MAINTENANCE/SAFETY CHECKLIST**

|                     |                        |                          |                          |                        |                          |   |                        |                          |
|---------------------|------------------------|--------------------------|--------------------------|------------------------|--------------------------|---|------------------------|--------------------------|
| State               |                        | District/Field Office    |                          | Vehicle Manufacturer   |                          | Vehicle Model   |                        |                          |
|                     |                        |                          |                          |                        |                          |   |                        |                          |
| ITEM                | SATIS-<br>FAC-<br>TORY | UNSAT-<br>ISEAC-<br>TORY | ITEM                     | SATIS-<br>FAC-<br>TORY | UNSAT-<br>ISEAC-<br>TORY | ITEM  | SATIS-<br>FAC-<br>TORY | UNSAT-<br>ISEAC-<br>TORY |
| VEHICLE EXTERIOR    |                        |                          | ROAD TEST                |                        |                          | UNDER VEHICLE (CONT.)                                       |                        |                          |
| Paint               |                        |                          | Parking Brake            |                        |                          | U-Joints  |                        |                          |
| Winch               |                        |                          | Service Brake            |                        |                          | Differential(s)   |                        |                          |
| Bumper              |                        |                          | Steering                 |                        |                          | Exhaust System  |                        |                          |
| Fenders             |                        |                          | Starter                  |                        |                          | Mud Flaps   |                        |                          |
| Cab                 |                        |                          | Transmission             |                        |                          | Parking Brake Cables  |                        |                          |
| Body, Bed, or Rack  |                        |                          | Clutch                   |                        |                          | CV Joints, Boots  |                        |                          |
| Tire Carrier        |                        |                          | Gauges & Warning Lights  |                        |                          |   |                        |                          |
| Spare Tire          |                        |                          | Noises                   |                        |                          | UNDER HOOD  |                        |                          |
| Lights              |                        |                          |                          |                        |                          | Wiring  |                        |                          |
|                     |                        |                          |                          |                        |                          | Ignition  |                        |                          |
|                     |                        |                          |                          |                        |                          | Spark Plugs   |                        |                          |
|                     |                        |                          |                          |                        |                          | Fuel Lines  |                        |                          |
| VEHICLE INTERIOR    |                        |                          | UNDER VEHICLE            |                        |                          | Oil Lines   |                        |                          |
| Doors               |                        |                          | Steering Gear            |                        |                          | Fuel Pump   |                        |                          |
| Glass               |                        |                          | Ball Joints              |                        |                          | Fuel System   |                        |                          |
| Mirrors             |                        |                          | Turn Stops               |                        |                          | Motor Mounts  |                        |                          |
| Wipers              |                        |                          | Tie Rods                 |                        |                          | Compression Test <i>(Only for vehicles over 60,000 mi.)</i> |                        |                          |
| Washers             |                        |                          | Axle Joints (4x4)        |                        |                          | 1   | 2                      | 3                        |
| Heater              |                        |                          | Cab Mounts               |                        |                          | 4   | 5                      | 6                        |
| Defrosters          |                        |                          | Shock Absorbers          |                        |                          | 7   | 8                      | 9                        |
| Lights              |                        |                          | Suspension               |                        |                          | 10  |                        |                          |
| Turn Signals        |                        |                          | Tires                    |                        |                          | Oil Level   |                        |                          |
| Horn                |                        |                          | Wheels                   |                        |                          | Coolant Level   |                        |                          |
| Seat Cushions       |                        |                          | Brake Lining             |                        |                          | Power Steering Fluid Level                                  |                        |                          |
| Seat Belts          |                        |                          | Brake Cylinders/Calipers |                        |                          | Brake Fluid   |                        |                          |
| Extinguisher        |                        |                          | Brake Lines              |                        |                          | Transmission Fluid  |                        |                          |
| First Aid Kit       |                        |                          | Frame                    |                        |                          | Belts   |                        |                          |
| Jack & Lug Wrench   |                        |                          | Leaks                    |                        |                          | Battery & Cables  |                        |                          |
| Trim                |                        |                          | Axles                    |                        |                          | Hoses   |                        |                          |
| Air Conditioning    |                        |                          | Clutch                   |                        |                          | Air Filter  |                        |                          |
| Entertainment Radio |                        |                          | Transmission             |                        |                          | Fan   |                        |                          |
| Controls            |                        |                          | Transfer Case            |                        |                          |   |                        |                          |
|                     |                        |                          | Drive Shafts             |                        |                          |   |                        |                          |

Remarks (for additional remarks on reverse)

Inspected by

Date



## ***POST OFF-ROAD FIRE ENGINE INSPECTION***

After performing off-road driving operations, perform a post off-road fire engine inspection prior to driving onto a solid surface. This is a quick, visual safety inspection of the components. Additional inspection information regarding most items can be found in the Fire Engine Inspection Instructions on page 6.

- Tie rod and tie rod ends
- Steering stabilizers
- Rock in duals
- Tire condition and pressure
- Air brake canisters
- Drivelines and linkage
- Shock mounts
- Noxious weeds
- Disengage 4 X 4 and low-range

**When working in noxious weed infested areas, ensure that the vehicle is cleaned according to local policy.**

