

Florida Department of Transportation



Preventative Maintenance Standards MANUAL

Third Edition



THE FLORIDA STATE UNIVERSITY
COLLEGE OF BUSINESS
the Marketing Institute



Preventative Maintenance Standards Manual

**Sponsored by
The Florida Department of Transportation
Public Transit Office
(850) 414-4500**

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**Written by
The Preventative Maintenance Planning, Training and Technical Assistance
Program
The Marketing Institute
College of Business
Florida State University
(850) 644-2509
www.prmpt.org**

**For questions regarding maintenance standards,
please contact:
Laurie Revell, Program Coordinator
(850) 644-6956
lrevell@cob.fsu.edu**

**Julie Eck, Maintenance Review Specialist
(850) 644-6954
jeck@cob.fsu.edu**

**Steve Stopiak, Maintenance Technical Consultant
(863) 602-8515
sstopiak@aol.com**

Fleet Management

Managing a fleet of vehicles that are funded by the Florida Department of Transportation requires following a set of minimum requirements established by Chapter 14-90 of the Florida Administrative Code. These standards are created to ensure maximum vehicle life and passenger safety through regularly scheduled preventive maintenance. The Preventive Maintenance Standards Manual is a description of the minimum requirements regarding preventive maintenance inspections and includes basic maintenance oversight practices.

Pre-trip/Post-trip Daily Inspections

Vehicles should be inspected each day before they enter into service. Chapter 14-90 states that the following components must be checked during this inspection:

1. Service Brakes –
 - From the driver's seat pump the brake pedal three or four times, and then hold constant downward pressure on pedal for at least five seconds. The brake pedal should hold firm and not drift down.
 - If equipped with a hydraulic brake reserve system, with the key off, depress the brake pedal and listen for the sound of the reserve system electric motor.
 - If equipped with hydro boost system or vacuum assist system, with the key off, pump the brake at least five times and depress the brake pedal. It should feel firm. Remain holding the pedal and start the engine. The pedal should move slightly to the floor and then rise.
 - Check that the warning buzzer or light is off.
2. Parking Brakes –
 - Apply the parking brake and shift vehicle into low gear slightly pulling against the brakes. Vehicle should not move.
3. Tires and Wheels –
 - The minimum tire tread depth on steering axle is 4/32 inch in every major groove. No re-caps are allowed on the steering axle.
 - The minimum tread depth on all other tires is 2/32 inch in every major groove.
 - Check all tires for uneven tread wear and cuts or damage to tread and sidewalls.
 - Check for tire inflation by hitting the tires with a mallet or similar device to check for flats. To check for exact tire inflation a tire air gauge must be used.
 - Check rims for bends, damage, or welds. Rims must not have any welding repairs.
 - Check valve stems for damage and for missing valve caps.
 - Check that the wheels and hubs are free of oil or grease. Oil or grease present could indicate a leaking hub or axle seal.
 - Check that all lug nuts are present. Check for signs of rust streaks or shiny threads that could indicate loose lug nuts.

4. Steering –
 - With the engine running turn the wheel back and forth. Steering play should not exceed 2 inches (on a 20 inch wheel) until the front wheels barely move.
5. Horn –
 - Check that the horn works properly.
6. Lighting devices –
 - Turn on exterior lights. Turn on 4-way Flashers. Perform a complete walk around of the exterior of the vehicle and check all lights for proper operation and lens for cleanliness.
 - Turn off 4-way flashers and turn on left turn signal and check left signal lights for operation.
 - Turn on right turn signal and check right signal lights for operation.
 - Turn on hi-beam head lights and check for operation.
 - Checking brake lights and back-up lights may require assistance. With someone in the driver's seat instruct them to step on the brake pedal while observing the operation of the brake lights. At this time have the assistance place the vehicle in reverse. Check back-up light operation and back-up alarm if equipped.
 - Turn on all interior lights and check for operation.
7. Windshield wipers –
 - Check that the wipers operate smoothly and the arms and blades are secure.
 - Check that the windshield washer works correctly.
 - Windshield should be clean with no obstructions or damage to glass.
8. Rear vision mirrors –
 - Mirrors should be secure with no mirror bracket damage. Check for proper adjustment. Check mirror glass for cleanliness or fading.
9. Passenger doors –
 - Check doors for damage and that they operate smoothly. Hinges should be secure with seals intact.
 - Check door entry area for debris and any loose or extensively worn flooring.
10. Exhaust system –
 - Check tailpipe for placement and secure mounting.
 - Start engine and listen for exhaust leaks and check for exhaust fumes in areas other than the tailpipe end.
11. Equipment for transporting wheelchairs –
 - Check wheelchair lift doors for operation and damage.
 - Cycle lift from stow position to floor level and check outboard roll stop barrier for proper latching.

- Cycle lift to ground level and check for any leaking, damaged, missing parts, and for smooth operation.
Raise lift from ground level. With platform slightly off ground make sure outboard roll stop barrier raises and it is latched securely. This must be performed by visually inspecting the latching mechanism to ensure it is in the correct locked position and by physically attempting to pull/push barrier down with an adequate amount of force to make certain the barrier is securely latched.
- Continue to raise lift to floor level and check for any unusual noises or abnormal operation.
Check all warning lights and audible signals for proper operation. Due to varying lift configurations refer to your lifts Owner's Manual for a list of warning lights and audible alarms to ensure all of these safety warning devices are working properly.
- Stow lift.
- With lift door in the open position check shift interlock by trying to shift vehicle into gear. Bus should not shift out of park.
- Inspect retractors for damaged webbing and proper locking.
- Inspect shoulder belts.
- Inspect foldaway seats for operation.
- Inspect floor anchors.

12. Safety, security and emergency equipment-

- Inspect for three red reflective triangles.
- Check for properly charged and rated fire extinguisher.
- Check two-way communication equipment.

13. Additional items -

- Your agency may require additional items to be checked during the pre-trip/post-trip inspection, such as fluid checks, engine, hoses and belts under the hood. Check additional items as necessary using procedures set forth by your agency.

A Pre-trip/Post-trip Inspection checklist should be completed with each component either marked "Ok" or with a defect noted. These checklists should be reviewed by a manager prior to the vehicle entering service for the day. Vehicles with defects that pose a safety risk should be repaired immediately before the vehicle returns to service. Other defects can be scheduled for repair in the near future.

Post-trip Daily Inspections should also be conducted when a vehicle completes service for the day and should be performed similar to the Pre-trip inspection. Post-trip inspections are important because the driver can note defects that were observed while driving the vehicle as well as other defects noted during the inspection process. These checklists should be reviewed by a manager so adjustments to the fleet can be made in the case of a vehicle needing repair.

All Pre-trip/Post-trip inspection checklists should be kept on file for a minimum of two weeks, or up to one year depending on the preference of your FDOT District Representatives.

Pre-trip/Post-trip Inspection Form

Unit ID # _____

Date _____

☐ Pre-trip Inspection

☐ Post-trip Inspection

Exterior	OK	Defect
Headlights		
Tail/Brake Lights		
Turn Signals		
Clearance Lights		
Windshield Wipers		
Fresh Body Damage		
Exhaust System		
Tires/Wheels		
Cleanliness		

Interior	OK	Defect
Gauges/Instruments		
Interior Lights		
Rear Vision Mirrors		
Windshield Wipers		
Blower Fans		
Brakes		
Steering		
Horn		
Passenger Doors		
Cleanliness		

Safety Equipment	OK	Defect
Flares/Triangles		
First Aid Kit		
Flashlight		
Back-up Alarm		
Fire Extinguisher		

Accessibility Equipment	OK	Defect
W/C Lift and Ramp		
Belts & Securement Devices - Proper Number & Condition		

Additional Items	OK	Defect

Comments

Driver's Name _____

Manager's Signature _____

Date _____

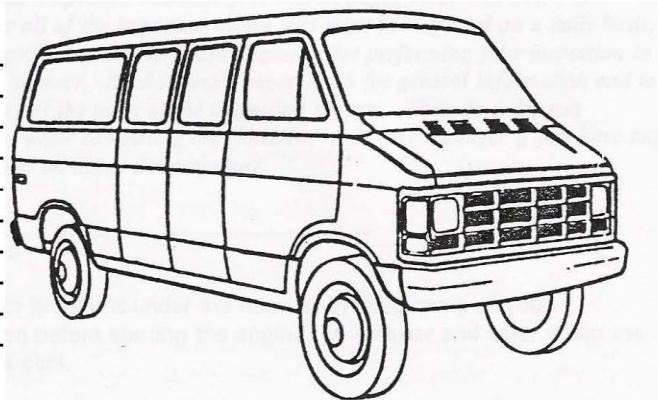
Carefully inspect the entire vehicle exterior.

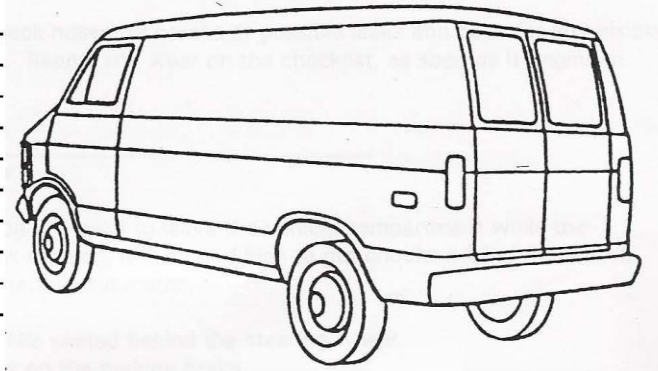
On the illustrations below, locate and note any damage or problems using the following code:

Dent: **X** Scratch: 

Indicate any other damage by circling the area and then describe the damage.

Description of damage





Scheduled Preventive Maintenance Inspections

According to Chapter 14-90 of the Florida Statutes, vehicles must be maintained using regular preventive maintenance inspections. The Florida Department of Transportation recommends conducting progressive inspections that meet or exceed OEM manufacturer recommendations. For a vehicle to remain under warranty its components must be inspected within the mileage projection noted in the vehicle's owners manual and these inspections must be documented in the vehicle history file.

FDOT recommends that preventive maintenance inspections be performed in ABC sequence. Mileage projections can be determined by the agency but must not exceed 6,000 miles. These mileage projections are determined by keeping several factors in mind: the age of the vehicle, the number of miles traveled by each vehicle, and the road conditions that the vehicle regularly travels.

The following is an example of a preventive maintenance schedule with vehicle inspections performed at 6,000 mile intervals:

A	6,000 miles
B	12,000 miles
A	18,000 miles
C	24,000 miles
A	30,000 miles
B	36,000 miles
A	42,000 miles
C	48,000 miles

Agency _____ Address _____ City _____ State _____ Zip _____ PREVENTIVE MAINTENANCE INSPECTION REPORT														
Bus ID #: _____				Date: _____				Miles _____						
Inspector's Signature _____				Printed Name _____				Employee # _____						
Inspection Type: ☐ A Inspection ☐ B Inspection ☐ C Inspection														
Condition Indicators: ☒ = Okay X = Item was repaired or adjusted O = Follow up required N/A = Not Applicable														
#	Interior	A	B	C	#	Exterior (cont.)	A	B	C	#	Chassis/Drive Line (cont.)	A	B	C
1	Passenger Door & Lift Door Interlock Operation				36	Check Operation of All Lights				71	Air Tank Mounting/Lines & Valves			
2	Standee Line & Warning				37	Fuel Cap and Door				72	Check Exhaust System for Mounting/Leaks/Restrictions			
3	Flooring/ Steps/All Interior Panels				38	All Access Doors/Engine Cover & Latch Operation				73	Underbody/Mounts & Frame			
4	Wheelchair Belts/Floor Anchors				39	Tire Damage & Wear				74	Fuel Tank Mounting & Fuel Leaks			
5	Passenger Seat Belts				40	Check Wheels/Lug Nuts/Valve Stems					Wheel Chair Lift Service May Vary Depending on Usage *Check Owners Manual			
6	Passenger Seat Condition/ Foldaway Seats Operation				41	Check Bumpers for Damage /Mounting/Rear Transition Panel				75	Lift Manufacturer Tag /Month & Year Manufactured /State of FL Certificate			
7	Stanchions & Hand Rails				42	Leveling				76	Check Wiring for Routing/ Chafing & Loose Conn.			
8	Roof Hatches/Operation					Engine Compartment				77	Check Lift for Damage/ Inspect Lift Anchor Bolts			
9	Emergency Window Operation				43	Clean Batteries Terminal Ends/ Check Electrolyte Level				78	Cycle Lift -Check all Safety Systems Including Barriers			
10	Fire Extinguisher/First Aid Kit Emergency Triangles				44	Check Battery Hold Downs/ Cables/Ground Straps				79	Check for Hydraulic Leaks/ Level			
11	Fire Suppression System				45	Record Voltage Output _____ V				80	Clean, Lubricate & Adjust Lift As Necessary			
12	Interior Lights				46	Check Belts/Tensioners & Hoses Air Compressor Mounting					Brake Inspection			
13	Vehicle Registration/Plates/Manual				47	Check All Fluids				81	Brake Foundation Lining/Rotors/Drums			
	Drivers Compartment				48	Inspect for Leaks				82	L/ Front % Worn:			
14	Brake & Accelerator Pedals				49	Test Anti-Freeze Protection				83	R/ Front % Worn:			
15	Drivers Seat & Belt				50	Check Radiator Core/Mounts				84	L/ Rear % Worn:			
16	Check Rear Door Alarm & No-Start Safety System				51	Check Wiring for Routing/Chafing & Loose Connections				85	R/ Rear % Worn:			
17	Service Brake Operation				52	Check Engine Mounts					Tire Tread Depth/Inflation			
18	Ignition System (Start Engine)				53	Replace Engine Oil & Filter				86	L/ Front /32			
19	Check All Gauges/Switches				54	Check/Replace Air Filter				87	R/ Front /32			
20	Check Fast Idle				55	Check/Replace Fuel Filter				88	R/R Inside /32			
21	Check Air System Pressures Perform Leak Down Test				56	Check/Clean A/C Filters & Cores/Lines for Routing/Chafing				89	R/R Outside /32			
22	Check Steering Wheel for Damage/Column Tilt Mechanism				57	A/C Compressor Mounting/Clutch				90	L/R Inside /32			
23	Parking Brake Operation				58	A/C Pressure Check				91	L/R Outside /32			
24	Back-Up Alarm & Horn					Chassis/Drive Line				92	L/ Front PSI			
25	Driver's & Panel Lamps				59	Shocks/Springs/MOR/ryde				93	R/ Front PSI			
26	Interior Mirrors/Sun visor				60	Torque Rods				94	R/R Inside PSI			
27	Windshield Wipers & Washers				61	Check Ball Joints				95	R/R Outside PSI			
28	Climate Control System/Fans				62	Steering Gear/Linkage & Arms				96	L/R Inside PSI			
29	Fare Collection System				63	Steering Shaft & Free Play				97	L/R Outside PSI			
30	Cleanliness				64	Lube Chassis					Test Drive			
	Exterior				65	Check Drive Shaft & U-Joints				98	Check Engine Performance			
31	Check for Exterior Paint/Damage/Decals				66	Check Differential Oil Level/Clean Breather/Check Axle Seals				99	Check Shift Points			
32	Condition of All Glass				67	Drain & Refill Differential				100	Steering			
33	Wiper Blades & Arms				68	Replace Transmission Fluid/Filter				101	Suspension			
34	Exterior Mirrors				69	Check Front Wheel Bearings				102	Brakes			
35	Check Light Lenses & Reflectors				70	Check Brakes (Pull Wheels)				103	Speedometer			

* Lift Must be Serviced Annually at a Minimum to Ensure Compliance With Annual Safety Inspection FAC 14.90.006

The following components must be checked during an “A” inspection:

Interior Inspection:

1. Fire Extinguisher (s)/ First Aid Kit / Safety Triangles

Inspect the above mentioned safety equipment to ensure it is in proper working order, securely mounted, and easily accessible. Fire extinguisher must be fully charged with a dry chemical or carbon dioxide, having at least a 1A:BC rating and bearing the label Underwriters Laboratory Inc.

If equipped with fire suppression system check “System OK” LED is illuminated. Check that system is properly charged and that all instruction labels are intact, clean, and legible.

Check maintenance tag for expiration date and condition of all components for damage or conditions that may prevent operation. Nozzle outlets must be unobstructed and properly aimed.

2. All Seats / Seat Belts

Seat covering for the driver and passenger seats should be inspected for rips, tears, gouges, exposed springs, and security of floor mounting. Seat belts should be inspected for proper retraction mechanisms. Arm rest(s) should be inspected for proper attachment to seat(s). Check folding seats for proper operation of adjustment controls. Check the driver’s seat for proper fore and aft movement and tracks should be lubricated as necessary.

3. Doors / Hinges / Latches/Emergency Exits

Lubricate door hinges and latches, check operation of windows, doors, and the condition of the glass.

Check condition of all exit signs to ensure location and operation decals are in place and legible. Check emergency exits to insure all exits function properly and stay shut after opening.

4. Interlock System

Check to ensure interlock system is working properly. Vehicle should not come out of park with either the front door or lift door open.

If the rear emergency exit door is open or closed and locked the vehicle should not start. Check for audible alarm and warning light if rear door is open with vehicle running.

5. Flooring /Headliner / Side Panels /Grab Rails

Inspect floor covering for tears, rips, or gouges. Inspect headliner for damage, sag, or dirt. Inspect the condition of side panels.

On vehicles designed to allow standees check the condition of the standee line and sign. The line must be of contrasting color at least two inches wide and the sign, prohibiting anyone from occupying a space forward of the line, must be posted at or near the front of the vehicle. Check steps for yellow edge or nosing to pronounce presence of steps.

Inspect condition of the grab rails and stanchions for the standee passengers. Tighten grab rails as necessary. Note if extensive repairs are necessary.

6. Mirrors

Check inside rear view mirror(s) for proper mounting, adjustment, and condition of the glass. Also check the right and left exterior mirrors for adequate field of vision.

7. Interior Lights

Inspect the interior lights. Check step well lights if applicable for proper function by opening door. Check dome light switch/rheostat. Check turn signal and the hi-lo beam switches as well as the indicators on dash for proper function. Check all emergency exit lights at emergency windows and rear exit door.

8. Exterior Lights / Horn

Outside assistance may be required when making this check. Check parking, low and hi beam headlights, turn signal operation front and rear, and hazard flashers. Turn on all outside clearance lights and check operation. At this time also check license plate lights, back-up lights, and brake lights. All lighting must comply with the minimum requirements set for the in Florida Statutes 316.220, 316.221, 316.224, 316.225, 316.226, 316.234, and 316.235. Check horn. The horn must be capable of emitting a sound audible under normal conditions from a distance of not less than 200 feet.

9. Warning system

Activate ignition switch and check all warning indicator lights (oil, battery, engine, etc.) for proper operation. If the vehicle is equipped with gauges check proper readings after the engine has been started. Check all switches, levers, and knobs for proper function.

10. Starter System / Back-up Alarm

When starting engine listen for starter drag or grind, belt squeal, and any other unusual noises. As engine warms monitor all gauges. Check shift selector for smooth operation and can be shifted into all ranges. While depressing the brakes shift the vehicle into reverse and check the audible back-up alarm. Check fast idle system for proper operation.

11. Air System Check

Build air system to maximum air pressure and observe governor cut out (100-125 psi). Shut off engine and chock wheels if necessary. Release emergency brake and make a full brake application and hold for one minute. Check air gauge to see if pressure drops more than three pounds in one minute. Next rapidly pump the foot brake. Buzzer should activate before air pressure drops below 60 psi. Continue to pump brakes until emergency brake pops up. This should occur at approximately 40 psi. Drain all air tanks and check operation of system drier.

12. Windshield / Windshield Wipers / Washers / Blades

Inspect windshield for cracks, scratches, and any visible damage. Operate windshield wipers through all ranges on wet glass. Inspect condition of windshield wiper blades and arms. Replace if needed. Check washer fluid level.

13. Windows

Inspect side and rear windows for cracks, scratches, and proper function of opening mechanisms.

14. Comfort System

Operate and check heater and air conditioning controls through all selector ranges and check varying fan speed for proper function. Check rear unit output as applicable.

Exterior Inspection

15. Exterior Body and Components

Inspect exterior of vehicle for signs of body damage, missing trim, decals, paint condition, and any signs of developing rust. Inspect the outside of all windows for cracks, blemishes, or other damage. Inspect mirror brackets for secure mounting or rusting. Check mirrors for broken/fading glass.

16. Tires and Wheels

Inspect all tires for signs of uneven wear due to imbalance or improper front end alignment, check for exposed cord or steel belts, inspect valve cores, and check sidewalls for scrubbing or damage. Determine tread depth using tread depth gauge. Tread group pattern depth shall not be any less than $\frac{4}{32}$ ($\frac{1}{8}$) inch, measured at any point on a major tread groove for tires on the steering axle and no less than $\frac{2}{32}$ ($\frac{1}{16}$) inch measured at any point on a major tread groove for all other tires. Check air pressure in all tires including spare using tire air gauge. Check condition of spare tire and mounting.

Check tires for cuts, nails, or other embedded foreign objects. Check wheel lugs for proper torque. Check all wheels, including spare, for any damage, welds, or improper bead seating of tire. Check for missing balance weights. Check hubcaps for secure mounting.

17. Access Doors

Inspect exterior access doors and lubricate hinges or spring latches as necessary. Check fuel cap for proper fit and any signs of damage to fuel servicing piping/hoses. Check hood latch and lubricate. Check hood retainer bar.

Service and Operation Inspection

18. Engine and Oil Filter

Change oil according to manufacturer's specifications either under the normal or severe duty operating conditions. The information listed below defines which schedule you need to follow for each vehicle.

1. Normal Operating Conditions:
 - Everyday driving conditions
2. Severe Operating Conditions:
 - Making frequent short trips (less than five miles)
 - Making frequent short trips (less than 10 miles) when temperatures are below freezing
 - Driving in hot weather stop-and-go traffic
 - Extensive idling and/or low speed driving for long periods of time (taxi, police, door-to-door delivery, etc.)
 - Driving at sustained high speeds during hot weather
 - Towing a trailer
 - Driving in areas with heavy dust (gravel roads, construction zones, etc.)

Note: Fluid change interval mileages can be different from the 6,000 mile Preventive Maintenance Inspections.

19. Ball Joints / Steering / Drive Line (Lubricate)

Inspect all ball joints according to manufacturer's recommendations. Lubricate after inspection.

Due to the varying road conditions, vehicle type, age of vehicle, and type of joint, it is recommended to check the ball joints on every "A" inspection or if any of the symptoms listed below occur.

- * Front wheel shimmy at low speed
- * Steering wander
- * Clunking noises from the front suspension
- * Camber wear on the tires

Note: *Most original equipment ball joints today are designed to provide many miles of durability. Many never make it that far for a variety of reasons. One is wear. The constant friction created by turning and driving creates friction between the ball stud and bearing. The rougher the roads and the heavier the vehicle, the faster the rate of wear will occur. Wear can be further accelerated by contamination and/or lack of lubrication. With a greaseable joint, lubing the chassis periodically is necessary to maintain a layer of grease within the joint. Lubing the joint also helps flush out the old grease and contaminants, which*

extends the service life of the joint. Most OEM ball joints today as well as some aftermarket replacement joints are "sealed for life" and have no grease fittings. Load carrying ball joints do tend to wear at a faster rate than their unloaded counterparts because of the weight they carry. That's why the lower ball joints on an SLA (short long arm) suspension typically wear out before the upper joints.

Check steering column for any absence or looseness of U-bolts or positioning parts; worn, faulty, or any welded universal joints. Check steering wheel broken spokes or cracks and for securement.

Check steering box for any mounting bolts loose or missing, any cracks in gear box or mounting brackets. Check for any looseness of the pitman arm on the steering gear output shaft. Check for leaks.

Check for any motion, other than rotational, between any linkage member and its attachment point. Check for loose clamps or clamp bolt on tie rod or drag link. Check for linkage components that are not secured with proper pins or devices. Check for any looseness in any threaded joint.

Lubricate all steering zirk fittings.

Lubricate driveline u-joints and slip yoke.

20. Battery

Check battery mounting tray condition (corrosion and wear) and battery hold-down. Check battery case for cracking or damage. Check post and fasteners for corrosion – clean and cover with protectant. Check cables for fraying or signs of deterioration. If applicable check and service water levels. If it is maintenance free battery check “green” indicator. Record output voltage.

21. Cooling System

Visually check cooling system for leaks. Check the overflow tank for adequate coolant, and inspect the cleanliness and condition of the coolant. Inspect the condition of the upper and lower radiator hoses and check the security of the fasteners. Check butterfly drain for snugness. Inspect water pump and engine intake at the thermostat housing for signs of leaks.

Inspect radiator cap for signs of leaks or pressure loss. Before removing the cap allow the engine to cool down. Relieve any built-up pressure in the system.

Remove and inspect the radiator cap. At this time, the radiator cores and the interior of the radiator housing may be visually inspected for corrosion or clogging. Also, if circulation problems are suspected, operation of the water pump and circulation of the coolant may be verified with the engine running.

22. Air Cleaner / Filters

Remove air filter and inspect. Inspect air intake hoses and clamps. Visually inspect all vacuum hoses and connections. Inspect fuel lines for leaks or damage.

23. Belts / Hoses / Wiring

Inspect all belts for signs of wear, fraying, cracks, glazing, and proper tension. Inspect heater hoses and connections. Inspect wiring for signs of chafing, corrosion, loss of insulation and crimping. Ensure wiring does not come in contact with moving parts or heated surfaces.

24. Under Hood / Exhaust System

Check transmission fluid level with the fluid warm and the engine running. Check color of fluid for any signs of overheating. Visually inspect the transmission pan, front and rear seal, speedometer drive, and dipstick tube for signs of leakage. Visually check the transmission oil cooler, lines, and connections for signs of a leak. Check the exhaust system for mounting, routing, leaks and restrictions.

25. Service and Parking Brakes

From the driver's seat pump the brake pedal three or four times, and then hold constant downward pressure on pedal for at least five seconds. . The brake pedal should hold firm and not drift down. If equipped with a hydraulic brake reserve system, with the key off, depress the brake pedal and listen for the sound of the reserve system electric motor.

If equipped with hydro boost system or vacuum assist system, with the key off, pump the brake at least five times and depress the brake pedal. It should feel firm. Remain holding the pedal and start the engine. The pedal should move slightly to the floor and then rise.

Check that the warning buzzer or light is off.

Apply the parking brake and shift vehicle into low gear slightly pulling against the brakes. Vehicle should not move.

26. Accelerator/ Brake Pedal

Check pedals for sticking, binding, or failure to return to normal position. Check pedals for excessive pad wear.

The following components must be checked during a “B” inspection, in addition to the components that are checked during an “A” inspection:

27. Brakes

Remove wheels and inspect all brake pads/linings for wear. Check rotors/drums for wear, scoring, and warping. Check calipers/cylinders and brake lines for signs of wear or leaks. Check for any dirt or grease accumulation on the brake system.

28. Operational Check

Check for smoothness of acceleration, centering of steering wheel, and the proper tracking of the vehicle, smoothness of turns, balance of tires, and front end alignment. Also check for looseness in steering wheel. Check operation of speedometer.

29. Transmission

Check operation and position of shift lever and indicator. Check operation in each gear. Check shift points through all gear ranges in drive position.

The following components must be checked during a “C” inspection, in addition to the components that are checked during an “A” and “B” inspection:

30. Wheel Bearings / Driveshaft

Remove and inspect front wheel bearings, clean and lubricate or replace if necessary.

Check the driveshaft chock wheels if needed and place transmission in neutral. Grasp either side of the u-joint and rotate it back and forth while

watching/feeling for any play between the cross and the yoke. If the cross moves inside the yoke, replacement of the u-joint is warranted. Check slip joint for play.

Lubricate all zirk fittings.

31. Shocks / Springs

Inspect shock absorber cylinders for signs of leakage. Check bushings for signs of wear and the mounting brackets for secure mounting. Inspect coil and/or leaf springs for signs of damage or wear. Check MOR/ryde shear springs if equipped. If equipped with air springs check for leaks, cracks and dry rotting.

32. Rear Differential

Inspect rear axles and axle housing for signs of stress, wear, and leaks. Check differential level. (Note: Change differential fluid every other "C" inspection.

33. Fuel Tank

Check fuel tank for secure attachment to vehicle by inspecting for loose, broken or missing mounting bolts or brackets (some fuel tanks use springs or rubber bushings to permit movement).

Check fuel system for any visible leak at any point.

34. Engine Tune-Up

See vehicle service manual for details.

35. Cooling System

Test coolant with pH test strips. Change out coolant or add additive as necessary.

36. Change Transmission Fluid and Filter

Remove transmission pan and drain fluid. If the transmission torque converter is equipped with a drain plug, drain fluid from it as well. Inspect debris in the bottom of pan for signs of internal transmission damage. Check the color of fluid for signs of overheating. Remove and replace filter screen. Note any abnormalities on the check off sheet.

Note: Always check manufacturers recommended transmission change interval as some vehicles come from the factory equipped with synthetic oil and have an extended mileage change interval.

Accessories

37. Wheel Chair Lift and Accessories

Cycle lift from stow position to floor level and check outboard roll stop barrier for proper latching. Continue to lower lift to ground level and check for any leaking, damaged, missing parts, and for smooth operation. Raise lift from ground level. With platform slightly off ground make certain the outboard roll stop barrier raises and it is latched securely. This must be performed by visually inspecting the latching mechanism to ensure it is in the correct locked position and by physically attempting to pull/push barrier down with an adequate amount of force to make certain the barrier is secured.

Continue to raise lift to floor level and check for any unusual noises or abnormal operation. Stand on lift platform or place at least 50 pounds of weight on platform and attempt to stow lift. Lift should not fold in. Remove weight and stow lift.

Due to varying lift configurations refer to your lifts Owner's Manual for a list of warning lights and audible alarms to ensure all of these safety warning devices are working properly.

Inspect tie down retractors for damaged webbing and proper locking. Inspect floor tie down anchors.

Check lift padding and labels. Check lift manual operation and instruction label. Lubricate appropriate lube points. (see illustrations at the end of this section) Refer to original owners manual for lift adjustments if necessary.

38. License Plates / Registration / Operators Manual

Check condition and currency of license plate and registration and appropriate manuals. Insure accident report forms and other appropriate documents are up to date and available in the vehicle. Check for operating manual for the wheelchair lift.

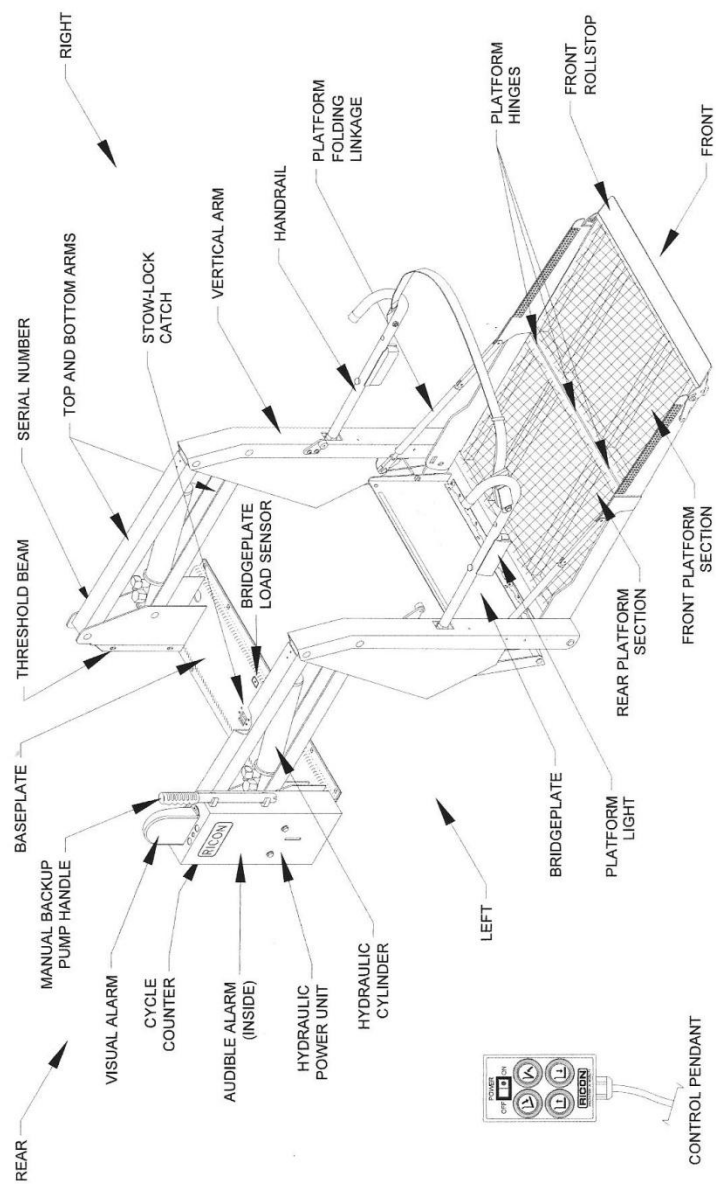
39. Air Conditioning Systems Check

Each spring, prior to the season for constant air conditioning use, the air conditioning system should be scheduled for a thorough operational check. The system should be checked with the appropriate air conditioning service equipment and gauges. Check the entire system for leaks.

Note: The Freon level should be checked and serviced as necessary.

If the system is to be serviced with the opening of a closed system, the complete system should be evacuated; the receiver dryer replaced and the system must be completely recharged, including refrigerant oil.

Note: All air conditioning work involving opening the system for repair and recharging must be performed by a licensed certified technician.



K-Series Ricon Lift Major Components

Regular maintenance of the Ricon KlearVue K-series Public Use wheelchair lift will optimize its performance and reduce the need for repairs. This chapter contains lubrication and cleaning instructions, a maintenance schedule, troubleshooting section, and maintenance diagrams.

CAUTION

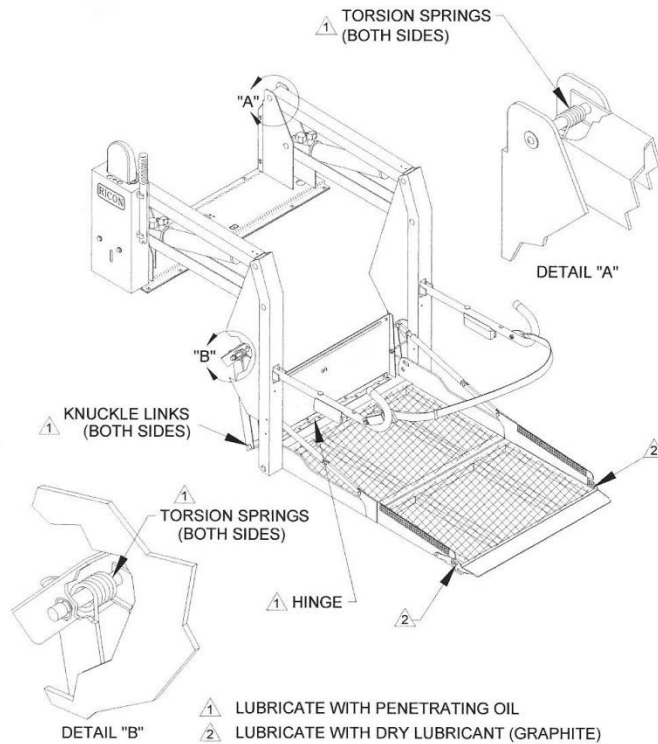
This Ricon product is highly specialized. Maintenance and repairs must be performed by an authorized Ricon service technician using Ricon replacement parts.

A. LUBRICATION

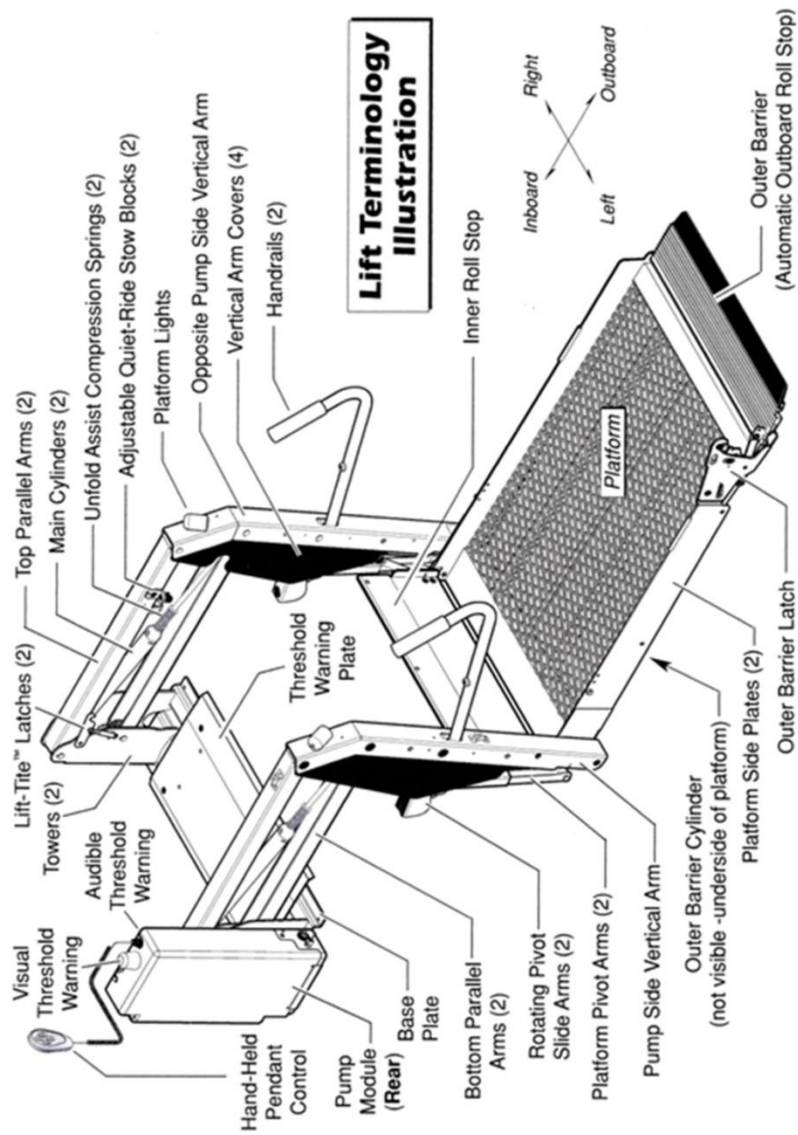
CAUTION

Do not lubricate motor or other electrical components. Lubrication of electrical components may collect dirt and debris, causing short circuits.

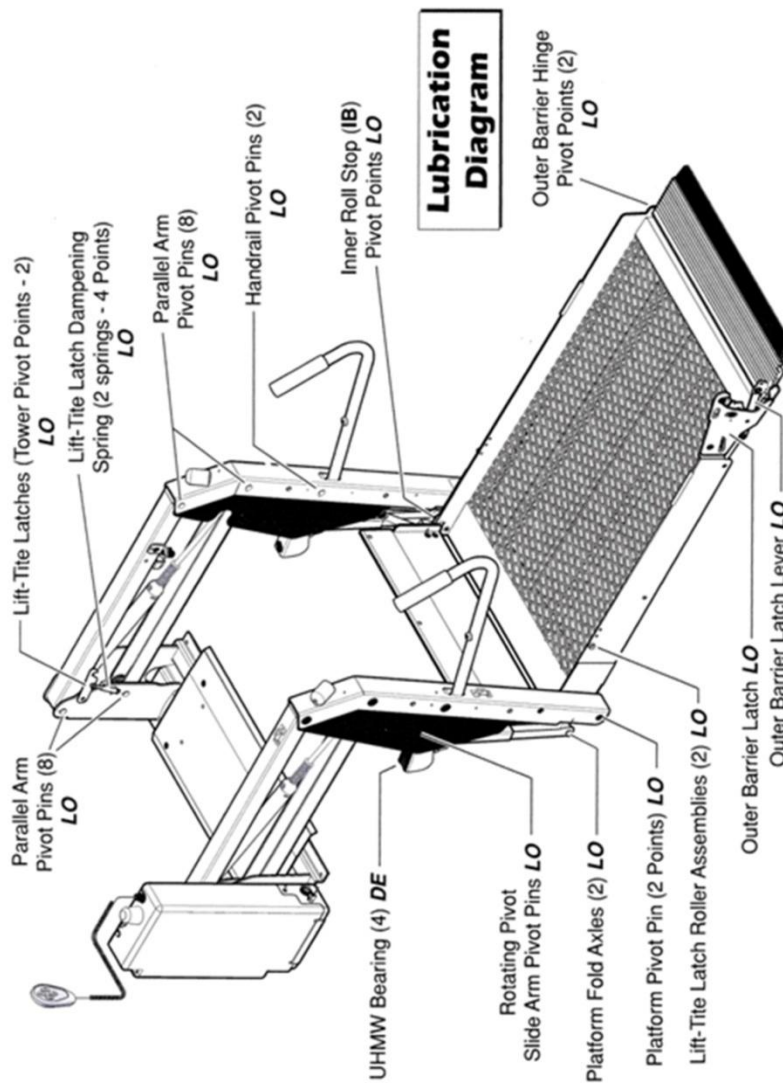
Lubrication should be performed at least every six months or sooner depending on usage.
Lubricate lift at points indicated with lubricants specified.



K-Series Ricon Lift Lubrication Points



Braun Millennium Series



LO=Light Penetrating Oil
(30 Weight or equivalent)
DE=Stainless Stick Style
tube Door-Ease

Braun Millennium Series

Annual Inspections

An Annual Safety Inspection is similar to an FDOT “C” level inspection. An agency may use a “C” level inspection for a vehicle to serve as the Annual Safety Inspection as long as the vehicle receives a “C” level inspection at least once annually. An agency may make a copy of the “C” level inspection and write “Annual Safety Inspection” across the top of the page to identify it and place the inspection in the vehicle’s history file, or a separate filing area for all Annual Safety Inspections.

All vehicle components for an Annual Safety Inspection must be checked at the same time, or within 48 hours if the inspection is being performed by utilizing partial inspections, for the inspection to be determined complete.

Chapter 14-90 requires that all agencies perform an Annual Safety Inspection on each public transit vehicle. These inspections must be performed once a year using a certified mechanic and proper lift equipment. Chapter 14-90 of the Florida Statutes states:

14-90.009 Bus Safety Inspections.

(1) Each bus transit system shall require that all buses operated by such bus transit system, and all buses operated by a private contract transit provider, be inspected at least annually in accordance with bus inspection procedures set forth in this rule.

(2) It shall be the bus transit system’s responsibility to ensure that each individual performing a bus safety inspection is qualified as follows:

(a) Understands the requirements set forth in this rule chapter and can identify defective components.

(b) Is knowledgeable of and has mastered the methods, procedures, tools, and equipment used when performing an inspection.

(c) Has at least one year of training and/or experience as a mechanic or inspector in a vehicle maintenance program, and has sufficient general knowledge of buses owned and operated by the bus transit system to recognize deficiencies or mechanical defects.

(3) Each bus receiving a safety inspection shall be checked for compliance with the requirements for safety devices and equipment, as referenced or specified herein. Specific operable equipment and devices as required by this rule chapter, include the following as applicable to Type I and II buses:

- (a) Horn.
- (b) Windshield wipers.
- (c) Mirrors.
- (d) Wiring and batteries.
- (e) Service and parking brakes.
- (f) Warning devices.
- (g) Directional signals.
- (h) Hazard warning signals.
- (i) Lighting systems and signaling devices.
- (j) Handrails and stanchions.

- (k) Standee line and warning.
- (l) Doors and brake interlock devices.
- (m) Stepwells and flooring.
- (n) Emergency exits
- (o) Tires and wheels.
- (p) Suspension system.
- (q) Steering system.
- (r) Exhaust system.
- (s) Seat belts.
- (t) Safety equipment.
- (u) Equipment for transporting wheelchairs.
- (v) Working speedometer.

(4) A safety inspection report shall be prepared by the individual(s) performing the inspection and shall include the following:

- (a) Identification of the individual(s) performing the inspection.
- (b) Identification of the bus transit system operating the bus.
- (c) The date of the inspection.
- (d) Identification of the bus inspected.
- (e) Identification of the equipment and devices inspected including the identification of equipment and devices found deficient or defective.
- (f) Identification of corrective action(s) for any deficient or defective items found and date(s) of completion of corrective action(s).

(5) Records of annual safety inspections and documentation of any required corrective actions shall be retained a minimum of four years by the bus transit system for compliance review.

Rulemaking Authority 334.044(2), 341.041(3), 341.061(2)(a) FS. Law Implemented 341.061(2) FS. History—New 9-7-87, Amended 11-10-92, 8-7-05, 9-16-10.

Annual Safety Inspection

Date of Inspection	Odometer Reading	VIN Number	FDOT Number	Year/Make/Model

Inspection Agency	Inspector's Name (Print)	Inspector's Signature

Item Inspected	OK	Repairs Required	Comments
Horn			
Windshield Wipers			
Mirrors			
Batteries and Wiring			
Service and Parking Brakes			
Warning Devices			
Directional Signals			
Hazard Warning Signals			
Lighting System and Signaling Devices			
Handrails and Stanchions			
Standee and Warning			
Doors and Interlock Devices			
Stepwell and Flooring			
Emergency Exits			
Tires and Wheels			
Suspension System			
Steering System			
Exhaust System			
Seat Belts			
Safety Equipment			
Equipment for Transporting Wheelchairs			
Speedometer			

Note: Attach any repair order/invoice generated as a result of this inspection. Chapter 14-90.009 Bus Safety Inspections

Standards for Contractors

Preventive maintenance inspections can be performed using an in-house maintenance program, an outsourced maintenance facility, or a combination of in-house and outsourced maintenance.

If your agency wishes to use outsourced maintenance, standards must be provided to the contractor to follow when conducting preventive maintenance inspections on your vehicles. This can be accomplished by providing this handbook to the outsource facility or developing a service agreement that outlines expectations, price, and maintenance procedures that are agreed upon by both your agency and the outsource facility.

If your agency wishes to use an on-site mobile maintenance contractor to perform preventive maintenance inspections on your vehicles, the following requirements must be met by the contractor:

If the contractor is performing preventive maintenance inspections based on time projections rather than mileage projections, all vehicle components must be inspected within the mileage projections stated in the OEM recommendations for your vehicle while the vehicle is under warranty. When the vehicle is no longer under warranty, vehicle components must be inspected at least every 6,000 miles using the ABC inspection procedures previously mentioned. For example, all items listed for the “A” inspection must be inspected by the contractor before 6,000 miles, all of the items listed for the “B” inspection must be inspected by the contractor within 12,000 miles, etc.

The contractor must use proper equipment when performing preventive maintenance inspections on your vehicles. The following vehicle components must be inspected while your vehicle is suspended on a lift:

- Ball joints
- A-frames bushings
- Physical check of suspension parts
- Steering
- U-joints
- Front wheel bearings
- Rear wheel bearings

If a preventive maintenance inspection is going to be performed using a combination of an on-site inspection and maintenance garage inspection for components needing specialized vehicle equipment, both partial inspections should be performed within 48 hours of each other for the preventive maintenance inspection to be considered complete.

The maintenance contractor must provide a completed inspection checklist for the items that were examined during the preventive maintenance inspection. This checklist must be signed and dated by the contractor and filed in your vehicle history file. Your agency will need to monitor the maintenance contractor just as you would with an in-house

maintenance program or an outsourced maintenance facility. These practices are listed in the section Maintenance Oversight.

Maintenance Plans

The Federal Transit Administration requires all agencies with grant funded vehicles to develop and maintain a written maintenance plan. A maintenance plan is a “living” document that describes an agency’s maintenance procedures and practices in the following areas:

- Maintenance Goals
- Fleet Inventory
- Preventive Maintenance
- Standards for Contractors
- Annual Safety Inspections
- Pre-trip/Post-trip Inspections
- Road Calls
- Accidents
- Cleaning
- Warranty
- Parts Inventory, if applicable
- On-site Fueling, if applicable

Maintenance plans must be revised as maintenance procedures, practices or fleet inventory changes. Maintenance plans are used by FDOT representatives to evaluate your current maintenance department so it is important that these maintenance plans remain current and customized to your agency’s specific maintenance procedures and practices. Maintenance plans can also assist an agency with employee turnover by providing written instructions on how your agency’s maintenance department functions. If your agency needs assistance developing a maintenance plan, contact your FDOT District Representative to request this technical assistance.

Maintenance Oversight

It should be the goal of every transportation provider to be running an optimal maintenance program, one that is operating at the highest efficiency. No matter the size of the agency or the amount of transportation the agency offers, vehicle maintenance is the only area an agency can utilize to improve service and save money. Whether your agency utilizes in-house maintenance or outsourced maintenance, it is imperative that vehicle maintenance is being monitored. Your agency may have software designed to analyze vehicle inspection and repair data. If not, it is still possible to analyze this information manually. A successful maintenance manager will be consistently looking for ways to improve their maintenance program. The following are five ways to get the most out of your maintenance program:

Be Proactive

Maintenance activities must be scheduled to be considered preventive maintenance. Scheduled maintenance includes repairs that are scheduled ahead of time, and not as a result of failure or breakdown. Agencies with optimum maintenance programs perform virtually all of their maintenance as scheduled maintenance.

Some agencies perform preventive maintenance inspections and change fluids and filters at their regular inspection intervals without making other checks or adjustments and make repairs only when something fails. Unfortunately, these agencies are performing “reactive maintenance.” Responding to failures, instead of anticipating them, limits the ability of the agency to plan and schedule their maintenance. This creates a continual cycle of responding to chance failures and making emergency repairs to get vehicles back in service creating an unmanageable and costly situation. Take control of your maintenance by actively searching for defects and failures to repair them before a breakdown occurs. Below are some examples of how your agency will benefit from a proactive maintenance program:

Bus #	Type of Maintenance	Work Performed	Parts Replaced	Total Cost
Bus 1	Scheduled	Rear Brake Job	Pads only	\$253.40
Bus 2	Unscheduled	Rear Brake Job including tow service	Calipers, Pads, and Rotors	\$1,358.88

Bus #	Type of Maintenance	Work Performed	Parts Replaced	Total Cost
Bus 1	Scheduled	Repack front wheel bearings	Front Seals	\$150.00
Bus 2	Unscheduled	Bus towed; replace all front end parts on failed side	Spindle, Brake rotor, pads, caliper, bearings, seals, and new wheel	\$1,630.00

Some managers succumb to reactive maintenance because they would prefer to limit the breaks in service due to vehicle downtime. However, this line of thinking is harmful to your maintenance program. By scheduling your maintenance, you will be able to plan for a vehicle to be out of service, and make other arrangements. You do not receive this same opportunity when a vehicle is out of service due to failure or breakdown. Be proactive in your preventive maintenance inspections and repairs. This practice alone will save your agency money and valuable time.

Cover Your Bases

Quality assurance is key with developing an optimal maintenance program. When a state-purchased vehicle is involved in a serious accident, FDOT may be called to perform an investigation. Your agency is liable for the vehicles in service and it is the job of the maintenance manager, or the person who oversees maintenance at your agency, to ensure that maintenance inspections and repairs are thoroughly performed and that all inspection and repair documentation is accurate.

A successful maintenance manager will set up a quality assurance system that will monitor inspections and repairs by randomly inspecting vehicles that have just been inspected or repaired, regardless of whether your agency uses in-house maintenance or outsourced maintenance.

Performing a quality assurance check on a recently inspected vehicle can be as easy as performing an identical preventive maintenance inspection on that vehicle and comparing your findings to those that were marked on the inspection checklist. For example, if you found a defect that was marked “OK” on the checklist, then you know that vehicle component was not properly inspected.

If your agency is not capable of performing these inspections, quality assurance can also be accomplished by manually reviewing vehicle repair files. This can be done in the same manner that was mentioned above. A maintenance manager can review unscheduled repairs that have been made between preventive maintenance inspections to determine whether the unscheduled repair could have been avoided. Unscheduled repairs can occur due to in-service failures or defects noted on pre-trip/post-trip inspections. For each unscheduled repair, the maintenance manager can review the previous preventive maintenance inspection and see whether the defective item was checked “ok” during the time of the inspection. The maintenance manager should then attempt to make a determination about whether the defect could have been identified at the time of the preventive maintenance inspection.

A maintenance manager needs to be informed on all maintenance repairs, scheduled or not. If your agency outsources your maintenance, you need to provide authorization on all repairs before they are made. By doing so, you can avoid a common error such as a repeat repair. Below is an example of an agency that did not practice quality assurance and that used outsourced maintenance without requiring authorization for repairs:

Unit #	Date	Miles	Complaint	Repairs	Cost
Bus 101	1/13/2009	99,029	Engine misfiring	Ignition coil replaced	\$254.09
Bus 101	4/23/2009	99,558	Jerking	Ignition coil replaced	\$269.57

Several questions needed to be asked after the second identical repair was made. Why did the coil have to be replaced a second time? Did this fix the root of the problem or is it another temporary repair? In slightly over 500 miles, why was the part not covered under warranty? Why is the cost of the part higher the second time? There could be a logical explanation for this repeat repair. If you are not monitoring your shop, mistakes can be made and if the invoice is paid the agency is at a loss.

Developing a good quality assurance program is all about staying informed. By analyzing inspections and repairs, you will be reassured that your maintenance inspections and repairs are being performed properly. Preventive maintenance checklists should not always come back with all items marked “OK.” That is a big clue that preventive maintenance inspections are not being performed thoroughly. Repairs due to preventive maintenance inspections should be made fairly regularly. It is your job to reinforce that the service your agency is paying for is expected to be completed correctly.

Start a Campaign

Once your agency begins to track maintenance activities, repair patterns will start to surface and maintenance becomes more predictable. You do not have to be a maintenance expert to oversee a maintenance program. The key to developing good preventive maintenance is being able to analyze failure trends and use this information to predict future failures.

Some examples are:

Alternators: You find that the alternators on a particular order of buses are failing at 65,000 miles. With each failure there was a road call involved resulting in a tow charge, the bus was down until parts were shipped and the emergency repair could be made. To avoid the unscheduled repair and added costs, the alternators can be scheduled to be replaced at 60,000 miles.

Brakes: Say your buses run an average of 20,000 miles until the rear brakes are re-lined. At close to this mileage you should expect the brakes to be re-lined at an upcoming inspection. Notify your shop of the anticipated brake lining replacement and ask for an estimated mileage of the life of the pads if they are not changed. As discussed earlier, the price of total failure can lead to over \$1,000 in unnecessary costs.

Transmissions: This is another component that has predictable failure patterns. Pay close attention to the failure mileages on transmissions to avoid tow charges, unscheduled down time, and possibly higher shipping charges for the emergency repair.

There are instances when new vehicles are placed into service and unforeseen problems occur that you may not have experienced on your existing fleet.

Example: you notice that you have a belt on the engine that seems to fail twice the rate than you can remember. This is when you need to notify the dealer and see if this is a known problem and if there is a fix for the premature failures. Until the solution is found, you should start a campaign on changing the belt at a predetermined mileage before it is noted to fail.

Reduce Your Costs

The task of beginning a preventive maintenance program with an existing fleet can be overwhelming at first, and many may be confused about how to begin this process. You should start with your next upcoming preventive maintenance inspections. If these inspections have not been thorough in the past, the amount of defects that are initially found will increase with the improved inspections, along with the cost of your maintenance. This is due to the extra labor hours and parts cost to repair mechanical problems that have escalated due to minimum maintenance performed in the past. This increase will depend on the size of your fleet, the age of your fleet and how many repairs need to be made. But this increase in maintenance costs is temporary! Once this period of adjustment is over, the unscheduled repairs decline increasing efficiency which results in a better control of costs.

By implementing a thorough preventive maintenance program, you will be avoiding several hidden costs that arise when dealing with unscheduled repairs. These costs are often found in administrative duties such as:

- Contacting wrecker services to arrange towing
- Rescheduling trips to cover routes
- Notifying clients of the delay
- Extra invoicing
- Opportunity cost

Scheduling your repairs will put an end to these hidden administrative costs and give you valuable time to plan for purchasing the parts needed for such replacement repairs, whereas when unscheduled repairs occur there is no time to plan for new parts. Having this unique opportunity to plan major purchases will help you control your maintenance budget. Also, being able to plan for scheduled repairs gives your operations team time to make other service arrangements while the vehicle is temporarily out of service. The amount of down time for the vehicle is reduced when the repairs are scheduled. All of these advantages to preparing for scheduled repairs will help reduce your overall maintenance costs by improving fleet efficiency.

Take Advantage

The last suggestion for optimizing your maintenance program is utilizing the tools and training opportunities that have been made available to you. The Florida Department of Transportation has contracts in place to help agencies with technical assistance concerning maintenance. These assistance programs are offered at no cost to your agency.

Each agency should also ensure that they are getting the most out of their state and federal financial assistance. Agencies are encouraged to be proactive about their search for financial aid. There may be financial opportunities available to you that you are unaware of.

If you have any questions about FDOT technical assistance programs or financial assistance, please contact your local FDOT District Representative to discuss these items further.

Work Order Invoice

Unit ID _____ Repair Facility _____
 Make/Model _____ Address _____
 VIN _____
 Odometer Reading _____ Date Vehicle In _____

Description of Problem:

Road Call	Y	N
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Description of Repair:

Repair Category

1	Brakes
2	Electrical
3	Air Conditioning
4	Tires
5	Drive train
6	Transmission
7	Suspension
8	Engine
9	Body
10	Lift

Materials/Parts Used:

Description	Unit Price	Total Price
	Total Labor	
	Subtotal	
	Taxes, fees	
	Job Total	

Mechanic

Print Name _____

Sign Name

Date _____

**Road Call Information Sheet
Dispatch Informtion**

1. Date:_____

2. Vehicle Number:_____

3. Time of Call:_____

4. Operator:_____

5. Route:_____

6. Received By:_____

Location of Vehicle:
(Street, Address, City, etc.)

Reported Problem

Technicians Report

1. Time of Call:_____

2. Time Arrived at Vehicle_____

3. Circle One: **In-Service Repair** **Vehicle Exchanged** **Towed**

4. Problem Found/ Action Taken

5. Time of Road Call Completion_____

Mechanics Signature

Fleet Managers Signature

Date