

PREVENTIVE MAINTENANCE AND VEHICLE REPLACEMENT MANUAL

**NORTH CAROLINA DEPARTMENT OF PUBLIC INSTRUCTION
SCHOOL SUPPORT DIVISION
TRANSPORTATION SERVICES
(919) 715-1950**

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A. INTRODUCTION

North Carolina school children deserve the safest transportation possible. This is provided through the work and dedication of thousands of employees of local education agencies (LEAs) in cooperation with the Department of Public Instruction (DPI), Transportation Services. DPI services include providing both consultation on school bus transportation and the resources to facilitate school bus operations.

The State Board of Education is given statutory authority to fund public school transportation operations and the replacement of vehicles. Specifically, it is the responsibility of the State Board of Education to periodically

"...adopt such rules and regulations with reference to the construction, equipment, color, and maintenance of school buses. No school bus shall be operated for the transportation of pupils unless such bus is constructed and maintained as presented in such regulations."

North Carolina General Statute 115C-240(c)

The statute assures that public school buses throughout the State are built to the same standards and are uniform in appearance. DPI Transportation Services annually submits to the Department of Administration the North Carolina School Bus Specifications. At any time, the latest version of this document standardizes the construction and equipment to be included on North Carolina school buses. This authority does not extend to private contractors that may provide bus transportation to a local LEA but school buses operated by private contractors should meet all requirements outlined in the federal regulations for school buses.

The Preventive Maintenance Program is a result of this public school law also. It assures a uniform standard of maintenance necessary to provide a safe transportation environment for the students in the Public Schools of North Carolina. Therefore, it is each LEAs responsibility to maintain their school buses as described in the PM Manual.

Because of the State's responsibility to replace school buses, no school bus is to be altered in appearance, color, lettering, or equipment unless authorized by the Department of Public Instruction, Transportation Services Section. Additional equipment may be added to school buses as described in Section 15 of this manual. In order to provide the best information to all school districts regarding school bus equipment, it is important that the installation of new equipment or alteration of appearance be coordinated through and approved by DPI Transportation Services.

This manual is used in conjunction with the State Vehicle Fleet Management System (SVFMS). The SVFMS is an online data system whereby all one hundred garages are connected to the State Computer Center. The software was developed by the Department of Transportation and the bus

garages share the system with the DOT and Highway Patrol. Data entered by the users is updated either real time or overnight in a batch format. The principal areas addressed by the SVFMS are as follows:

- Preventive maintenance schedule and vehicle status
- Inventory management for repair parts and tires
- Vehicle maintenance and repair costs histories

The program presented in this manual represents the minimum requirements for all school buses and service vehicles in the Public Schools of North Carolina. However, **MORE FREQUENT SERVICE** may be warranted in your county. The purpose of this maintenance program is to promote repair consistency and cost efficiency, and assure that school buses and service vehicles are in safe operating condition.

Although this document provides a thorough explanation of the required preventive maintenance program, supplements will be forthcoming from the Division of School Support/Transportation Services. Technical training and workshops will be conducted to support local efforts to pursue this maintenance program.

Success of this maintenance program will be assured through the cooperation of all local transportation staffs. Assignment of personnel to the prescribed duties listed in this manual is essential in order for the preventive maintenance program to function properly and to be cost efficient. The prescribed school bus garage operational procedures are to be followed as closely as possible, depending upon staff, facilities, and available shop equipment.

Questions regarding the contents of this manual should be directed to DPI Transportation Services (919) 715-1950.

B. VEHICLE REPLACEMENT POLICIES

Each local board of education is authorized to own and operate a school bus fleet under Statute 115C-239. These fleets include school buses for basic to-and-from-school transportation and the service vehicles required for bus maintenance and fuel delivery. The local boards originally purchased these vehicles over a period of many years. The state assumed the responsibility of replacing these vehicles in the 1930's under Statute 115C-240(e)(f). The rate at which vehicles are replaced depends on the age and mileage of the vehicles, subject to appropriations from the General Assembly. The State Board of Education has the responsibility of purchasing the vehicles and allocating those vehicles to the local boards fairly and equitably on an annual basis.

1. Capital Outlay Purchases

A LEA may purchase vehicles and increase the size of the fleet that provides school transportation. The need for this action is generally the result of growth, opening/closing of schools or redistricting. A LEA is given this authority under Statute 115C-249(a) and the request for such additions are reviewed by Transportation Services.

A. School Bus

When needs exceed resources, a local board may request that a school bus be added to the state replacement schedule. The state will pay for the operation of a temporary bus (Status L, loaner) as long as the local board commits to the purchase of a new bus by submitting a letter requesting such use and drafting a purchase order within eighteen months to purchase a new bus. The new bus will be added to the state replacement schedule upon delivery to the local board. Under certain circumstances, a LEA may purchase a used bus from another LEA for the purpose of capital outlay. As long as the model year of the used bus is within 8 years of the current model year, the used bus will be placed on the replacement schedule upon request. The model years will coincide with fiscal years (i.e. 1997-98 equates with 1998 model year).

B. Service Truck

These service vehicles are used by the garage mechanics to access the fleet for maintenance and service. The buses are typically staged at schools or other parking facilities mid-day and are available for routine inspections and minor servicing. The service trucks are also used to respond to road calls in the event a bus becomes disabled. A local board may add a service truck (pickup/cargo van) to the state replacement schedule if the ratio of buses operated per service truck inventory exceeds 25. The general rule for service trucks is one truck per 20 to 25 buses. The truck purchased must be new and comparable to the truck that is on state contract. At such time that the truck purchased by the local board is replaced by the state, the replacement will be of the same type trucks currently being offered by the DPI. Four-wheel drive may be added to a service truck but the local board must bear the cost of this option.

C. Fuel Truck

Fuel trucks are the primary source for distributing fuel to the bus fleet. With the buses typically staged away from the garage, a remote system of fueling is essential. A local board may request that

the DPI review the need for an additional fuel truck. Several factors will be considered in granting the request including growth and current logistics for fueling the buses (i.e., school locations and staging areas). If the DPI agrees that the changing environment warrants an additional fuel truck, the local board may proceed with purchase and the state will add the fuel truck to the replacement schedule.

D. Wreckers

Wreckers are used to tow disabled buses to the garage or another site for repairs. If a county currently without at least one wrecker chooses to invest in a wrecker, the DPI would place the vehicle on the replacement schedule and replace the wrecker chassis when appropriate. The body, which includes the wrecker boom, could be transferred to the replacement chassis (upon approval by Transportation Services) or the local board would need to purchase a new body.

2. Vehicle Replacement

The Transportation Services Section is charged with allocating resources designated by the North Carolina General Assembly for school bus replacement among all local education agencies (LEAs) in the state in an equitable manner, for the replacement of school buses and service vehicles. Once vehicles are replaced, they remain titled to the LEAs; however, their authorized use is at the discretion of the state.

A. School Buses

In keeping with this charge, school buses are classified in one of several categories as indicated below:

Status 2 — a bus titled to the LEA, authorized for use as a regular route bus, subject to replacement by the state as the need arises and as funds are available.

Status S — a bus titled to the LEA, having already been replaced by the state with a new bus, authorized for use as a spare bus when a regular route bus is not available due to mechanical failure or maintenance.

Status 4 — a bus titled to the LEA, having already been replaced by the state with a new bus, not authorized for use as a regular or spare route bus. Eventually, most of these will be designated to be sold as surplus. Proceeds from sale of this bus will be forwarded through State Surplus Property to the DPI vehicle replacement fund.

Status L — a bus loaned to the LEA, having already been replaced by the state with a new bus, authorized for temporary operation from State funds as a regular route bus, above current inventory levels due to LEAs additional transportation needs. Authorization is contingent on a commitment by the LEA to purchase a capital outlay bus or eliminate the need for an additional bus route within one year.

Status 0XX — a bus titled to the LEA and was once authorized for use as a regular route bus, but because of current demands is not being utilized on a daily basis. At such time that the fleet is reviewed for bus replacements, these status 0 “parked” buses will not be included in the replacement pool.

1. School Bus Replacement Criteria

DPI Transportation Services will consider all of the following in determining which buses in the statewide fleet are to be replaced in a given year:

- Age of the bus
- Mileage of the bus
- Type of bus engine (e.g. gasoline or diesel)
- Condition of the bus
- Availability of funds
- Unique circumstances about a given bus
- Number of Status 2 buses operated by each LEA
- Buses destroyed by accident or vandalism (total loss)

A bus must have been operated by a LEA as authorized under General Statute 115C-242 to be considered for replacement. Any use of a replacement bus by an LEA or other entity for purposes other than “to-and-from-school” shall require reimbursement to the State for depreciation of capital equipment.

In general, a LEA will receive a bus of similar construction and size to the one being replaced. If a bus to be replaced has a capacity greater than is being currently offered as replacement, the State will use the largest capacity bus currently offered on contract as the replacement. If a LEA is not replacing a wheelchair lift bus, but desires a lift, the LEA must purchase the lift according to guidelines established for equipment replacement by Transportation Services. A LEA may be allowed to adjust capacities depending on bus offerings in a given year. For instance, a LEA may be allowed trade in front engine school buses for rear-engine buses based on a seating or cost exchange ratio that will be calculated each year. LEAs may also be afforded the opportunity to upgrade by paying the difference in cost from a similar model.

2. Parked Buses

From time to time, changes in a LEAs transportation pattern may enable that LEA to use fewer buses on a daily basis than its number of authorized Status 2 buses. As this continues, a LEA may have one or more buses which are retired from regular use, but are a part of its authorized (Status 2) inventory. These buses will be designated as Status 0XX – “Parked” buses. These buses, having been retired from regular service, will not be part of the eligible pool of buses to be replaced by the state - that pool consisting solely of Status 2 buses.

Upon designating a given vehicle as a Status 0XX (parked) bus, the LEA has several options available to it with regard to that vehicle.

- (a) Activity bus conversion — Simply by notifying Transportation Services, a LEA may convert a parked bus to an activity bus by making appropriate mechanical adjustments to the vehicle. This includes paint and the removal of lettering referring to “school bus” and North Carolina Public Schools. In this instance, the LEA relinquishes its right for another bus in its place in the future as the parked bus is removed from the State inventory. As long as the model year of a replacement bus is in excess of 8 years of the model year currently being replaced, the bus can be considered for conversion.
- (b) Turn in to the state — By mutual agreement the LEA would surrender the bus to the state for disposition. DPI Transportation Services may opt to sell the vehicle or use it in another capacity in North Carolina. In return, Transportation Services would issue a “credit” to the LEA for a bus in the future, should a need arise for additional vehicles. Note that it would not necessarily entitle the LEA to a new vehicle immediately, but it would guarantee a vehicle once a need is demonstrated. Any bus requested to be returned to Status 2 must have operated 91 days or more in a given academic year. No bus that has been designated as Status 0XX for more than 7 years, or is older than the current model year being replaced, will be accepted by the State for credit purposes.
- (c) Sale of vehicle — The vehicle may be sold outright and the proceeds would be returned to the LEA for use in any capacity, just as with the sale of other surplus LEA property. In this instance, the LEA relinquishes its right for another bus in its place in the future as the parked bus is removed from the State inventory as long as the model year of a replacement bus is in excess of 8 years of the model year currently being replaced the bus can be considered for sale by the LEA.
- (d) No action — A LEA may opt to retain a parked bus as a yellow school bus to be used as a spare vehicle. It may be reinstated to status 2 subject to approval by Transportation Services to guarantee an appropriate operating condition and age. If not reinstated, the LEA permanently relinquishes the right to have that bus replaced in the future.

Each year, each LEA will be asked to report statistics on its fleet usage by March 1. As part of this reporting, LEAs will designate additional specific buses which have been designated as parked since the last reporting period.

B. Service Vehicles

Service vehicles (pickups, cargo vans), fuel trucks, and wrecker's chassis are replaced by the State much in the same manner as school buses. The funds to purchase service vehicles come from three sources: (1) sale of surplus buses and service vehicles, (2) proceeds from the extra use of school buses (such as field trips) and, (3) appropriation from General Assembly.

DPI Transportation Services designates the service vehicles to be replaced, using similar criteria as for buses (i.e. mileage, age and condition) subject to the amount of funds available. Once service vehicles have been replaced, a small number are retained for spare status. These vehicles are available for transfer from one LEA to another in the event a service vehicle is destroyed by vandalism or accident.

3. Surplus Vehicles

The Transportation Services Section is charged with designating the old buses and service vehicles that are to be removed from active service and replaced with a new vehicle. The number of vehicles removed and replaced annually depends on the annual appropriation from the General Assembly. Funds realized from the disposal of old vehicles revert to the state vehicle replacement fund.

A. School Bus

Buses that have been replaced by the state are sold through State Surplus Property. The bus lettering will be removed per instructions in the Preventive Maintenance Manual. Proceeds from the sale of surplus buses are returned to the state vehicle replacement fund.

B. Service Truck

A local board may purchase service trucks that have been replaced by the state. The local board agrees to pay the price that is set by DPI Transportation Services. If the local board does not wish to purchase the truck, it is sold at bid through State Surplus Property. The local board is responsible for painting the truck a color other than yellow before delivering it to the surplus office. DPI Transportation Services will determine which trucks are retained as spares. Proceeds from the sale of surplus trucks are returned to the state vehicle replacement fund.

C. PREVENTIVE MAINTENANCE

The following program must be documented by proper completion of all the required preventive maintenance forms listed in this manual. Documentation of maintenance is essential to conducting an effective, safe and cost-efficient maintenance program and in justifying budget needs and allocations.

The key operational factors upon which this PM program is based are vehicle mileage, fuel consumption, and elapsed time since the last recorded preventive maintenance service. Therefore, accurate speedometer operation and mileage recordings are essential as well as accurate record keeping of all routine daily records.

The performance of this maintenance program must be in accordance with all safety rules and regulations prescribed by the Occupational, Safety and Health Administration, the State Board of Education, and the local education agency.

All brake repairs shall be checked for operating safety and efficiency by using a Tapley Brake Meter or equivalent meter. The percent of brake efficiency shall be recorded for future reference.

Each mechanic should be provided a copy of the Preventive Maintenance Manual.

Service manuals are required to be available at each school bus garage for each year model vehicle. The manuals may be obtained from the bidding dealer.

1. New Vehicle Service — Repair Code 08

The success of any preventive maintenance program is determined by a number of factors. One of the initial factors, and possibly one of the most important, is the proper servicing of new vehicles prior to placing them into daily service. Without proper new vehicle servicing, the durability, service, and vehicle life will be adversely affected. The following section is devoted to explaining what is required in the proper service of new vehicles and how to correctly accomplish this required new vehicle preventive maintenance program. Refer to the New Vehicle Service Work Order in Section 13.

PRE-DELIVERY INSPECTION AND SERVICE FOR NEW BUSES

Front Axle

- Balance front tire and rim assembly. This balancing is done on a static truck tire balancer.
- Using a tire tread gauge that measures in 32nds of an inch, measure the amount of brake lining at the thickest point above the rivet head on each brake shoe. Record on the New Vehicle Service Work Order this measurement for each axle.
- Torque brake shoe backing plate or spider mounting bolts to specifications.
- Torque brake drum to hub bolts to specifications.
- Oil drain and refill with appropriate lube. Install hub and drum assembly and adjust wheel bearings to specified torque.
- Install tire and rim. Align and torque wheel nuts.
- Torque spring u-bolts to specifications.
- Torque spring shackles and eye bolts or spring pivot bolts.
- With a hammer and a punch the same size as the king bolt lock bolt head, (front wheels still raised from the floor) drive in king bolt lock pin and torque nut to specifications.
- Torque steering gear mounting bolts and steering gear case bolts to specifications.
- Torque steering pitman arm bolt and nut or sector nut to specifications.
- Adjust steering gear lash and sector end play.
- Inspect steering shaft u-joints for free movement and trunion bearing snap rings for proper seating. Torque steering shaft u-joint yoke to shaft bolts and nuts to specifications.

- Torque tie rod end nuts, drag link end nuts, third arm mounting nuts, and tie rod arm nuts to specifications.
- Check front-end alignment; and set toe-in with the equipment available at the garage.

Rear Axle

- Measure and record on the New Vehicle Service Work Order the brake lining thickness in the same manner as on the front axle. On air brake equipped buses having cam ground or tapered lining, the measurement should be made near the center of the brake shoe.
- Torque brake shoe backing plate or spider mounting bolts to specifications.
- Pack and install wheel bearings and seal; install hub and drum assembly and adjust wheel bearings to specifications.
- Install and align wheels; torque wheel nuts.

Note: Torque values for any bolt not specified in the vehicle service manual should be obtained from a bolt chart specifying torque.

Undercarriage

- Torque body to chassis mounting bolts to specifications.
- Torque drive line u-joints and center bearing support bracket bolts to specifications.
- Tighten hose clamps and pipe fittings for all vacuum tubing, air tubing, tanks, and air dryer.
- Inspect the routing and mounting of all hoses, tubing, pipes, battery cables, and wiring. Be observant for areas where any of the items may become worn by rubbing or damaged by vibration. Make appropriate corrections or repairs.
- Inspect air brake chamber push rod to slack adjuster angle to see that it is greater than 90 degrees (has not passed over center at the specified amount of travel). Angle should be approximately 93-94 degrees. If interior angle is less than a right angle, adjustment is needed. Refer to OEM Service Manual.

Brake Chamber Type No.	Maximum Stroke at Which Brake Should be Adjusted (inches)
12	Less than 1 1/2
16	Less than 1 3/4
24	Less than 1 3/4
30	Less than 2
36	Less than 2 1/2

Body

- Inspect all lights for proper operation.
- Inspect all seat belts and shoulder harnesses for proper mounting and operation.
- Adjust entrance door air regulator.
- Door control linkage should be adjusted for the rear leaf of entrance door to close just prior to front leaf. Weather seals should lap against, not butt against each other.
- Lubricate emergency door handle.
- Inspect for proper tightness all seat-mounting bolts, glass channel mounting screws, glass frame screws, turn signal lamp, mounting bolts and screws. Spray window track with silicone.
- Adjust all mirrors for proper visibility and tighten adjusting nuts and screws.
- Inspect all electrical connections in body electrical panel for proper assembly and tightness. Inspect routing of wires to avoid wear due to abrasion.
- Inspect ground wire from body electrical panel on which the warning light switch and body solenoid switches are mounted.
- Inspect brake pedal for "freeness" of pedal movement and adjust pedal "free travel" to specifications.
- Inspect alignment and mounting of accelerator pedal.
- Inspect alignment and mounting of wheelchair mounts (if equipped). Check wheelchair ground wire. If missing, install.
- Refer to 12,000-mile service instructions for wheelchair lift service. (Section 5).

Stop Arm and Walking Arm

- Inspect mounting screws for tightness.

- Align arm and tighten arm-mounting bolts.
- Check for proper operation.

Battery Compartment

- Remove battery and coat the battery tray and the inside of the compartment with a corrosive resistant metal seal.

Other Tests

- Check engine coolant DCA levels per manufacturer's specifications.
- Refer to the 12,000-mile service information for the following:
 - Engine: electrical system and road test.
 - Brake test using brake test meter.
 - After road test, bar test wheel bearings.

TD-15 — NEW VEHICLE SERVICE WORK ORDER (2 pages)

The mechanic shall complete this form (2 pages) during the new vehicle preventive maintenance service prior to the bus being placed in service. The information requested for each item shall be completed. After the inspection is finished, the form shall be reviewed by the shop foreman/transportation director and filed in the Individual Vehicle Maintenance History file and information transferred to a TD-8B (12,000/24,000/48,000 Service Sheet) along with mechanic's signature and entered in the computer. This will automatically set up the vehicle PM counter. A copy of the New Vehicle Service Work Order is presented in Section 13.

Note: The mechanic is required to initial each service he performs as well as record all test results indicated on the new vehicle service work order. After completion, the new vehicle service work order shall be filed in the individual vehicle maintenance history file.

2. Preventive Maintenance Scheduling

Preventive Maintenance Factors

The preventive maintenance program is supported by an automated scheduling system. The computer system schedules vehicles for preventive maintenance based on three (3) factors. The number one factor is mileage (M); number two is fuel consumption (F); and number three is time (T) (days since last PM). Vehicles may appear for preventive maintenance service by any one of these three factors.

Screen Use

The transportation director or his designated employee shall review the EQS1 "Due PM" screen **each workday morning**. The daily work schedule should be adjusted accordingly dependant upon what vehicles are displayed. One advantage of reviewing the screen daily is that it allows each county to service all vehicles before they exceed the preventive maintenance mileage maximum of 6,000 miles.

Early Display

All vehicles will appear for preventive maintenance 800 miles before they reach the maximum mileage allowed between preventive maintenance services. Vehicles due 30-day inspections will appear seven (7) days before they exceed the maximum days allowed between inspections. When school is in session, each school bus and activity bus must be inspected each thirty-calendar day period to meet state statutes. The one exception is when holiday periods are involved. Example: The computer will continue to count days over the Christmas and New Year holiday period. When you return from this extended holiday period, a large number of your fleet will be scheduled for 30-day inspections.

Preventive Maintenance Goals

One of your goals is to not exceed the mileage maximum interval of 6,000 miles for any vehicle on the preventive maintenance program. The purpose of the 5,200-mile scheduling is to allow each county to perform preventive maintenance service before the maximum interval of 6,000 miles has been reached. A second goal is to not exceed the 30-day limit on safety inspections on your fleet of vehicles (30 calendar days).

Vehicle Displayed

Only active vehicles that are being used should appear on the EQS1 Screen. If vehicles are no longer in service, they should be removed from the screen permanently. If you have spare vehicles or vehicles that are used only at rare intervals which have appeared on EQS1 for preventive maintenance service based on the time factor since the last preventive maintenance service, it is permissible to extend the time factor on screen EQMI. If you need assistance in this area please call the Transportation Services Office in Raleigh at (919) 715-1950.

Repair Code Scheduling

Vehicles will appear for preventive maintenance on screen EQS1 by one of nine different repair codes (RC).

MI	30-Day Inspection - (MO/DA/YR) - indicates date of last inspection.
	Mileage indicated on the screen for MI is not relevant because this service is scheduled by time only (days since last inspection).
05	Oil Change - (MO/DA/YR) - indicates date of last preventive maintenance - (meter) - indicates mileage since last preventive maintenance
*5	Oil Change & 30-Day Inspection
06	12,000-Mile Preventive Maintenance Service
*6	12,000-Mile Preventive Maintenance Service & 30-Day Inspection
07	24,000-Mile Preventive Maintenance Service
*7	24,000-Mile Preventive Maintenance Service & 30-Day Inspection
08	48,000-Mile Preventive Maintenance
*8	48,000 PM Service plus 30-day

All numeric repair codes show the date of the last preventive maintenance service and the miles since the last preventive maintenance service on the screen. **The asterisk repair codes** do not display the date of the last 30-day inspection.

Preventive Maintenance Counter

All vehicles on the preventive maintenance program have a preventive maintenance counter on screen EQMI. This counter monitors which preventive maintenance service is due next. The following is a listing of all possible preventive maintenance counter indicators:

08 - 0 - 1 mile MO/DA/YR new vehicle

08 - 1 - 6,000-mile MO/DA/YR 1st oil change (after new vehicle service) or
48,000-mile pm

06 - 0 - 12,000-mile MO/DA/YR

06 - 1 - 18,000-mile MO/DA/YR 1st oil change (after 12,000 pm)

07 - 0 - 24,000-mile MO/DA/YR

07 - 1 - 30,000-mile MO/DA/YR (after 24,000 pm)

06 - 0 - 36,000-mile MO/DA/YR (12,000 mile pm after 24,000-mile pm)

06 - 1 - 42,000-mile MO/DA/YR 1st oil change (after 36,000-mile pm)

08 - 0 - 48,000-mile MO/DA/YR

The counter recycles for the life of each vehicle once the 48,000-mile service is completed. All of your vehicles should appear within the above range of counter indicators. If your counter indicator's third digit exceeds one, you may have a problem properly scheduling your vehicle until you correctly reset the preventive maintenance counter indicator.

Screen Display

The EQS1 screen may be requested by keying any one of five options to view all the vehicles due preventive maintenance or a specific group of vehicles due preventive maintenance.

The following is a sample of the EQS1 screen display. If more information is needed, refer to the cost clerk computer manual.

P/N 6320 EQUIPMENT SHOP *DUE PM (IN PRIORITY)* 1/3/90 0939 Page1							
DURHAM		EST PM	LAST-PM	EXPIRED	ASSIGNED		
EQ/JO	LIC#	RC	HRS	S	MO/DA/YR	METER	CD DEPT CO LAST NAME
63200264	72049R	MI	1.2	T	04/30/96	2526	6320 00 GLENN
63202820	71345R	*8	4.7	M	08/01/96	6030	6320 00 BURTON
63200261	20090R	*5	1.2	M	06/10/96	5806	6320 00 GLENN
63200313	33837R	05	1.2	M	09/27/96	5870	6320 00 JORDAN
63200257	20094R	*7	3.4	M	08/21/96	5536	6320 00 WATTS
63200305	33826R	06	1.2	F	07/15/96	5032	6320 00 POWE
63200289	28554R	06	3.4	M	09/28/96	5526	6320 00 NEAL
63208032	92147P	05	.2	T	08/30/96	2652	6320 00 LITTLE RIVER

Work Source Codes

Incorrect coding on the TD-18A Equipment Repair and Parts Order form can have an adverse effect on preventive maintenance scheduling. The work source codes on the TD-18A Equipment Repair and Parts Order form are to be utilized in the following manner. It is essential for these instructions to be strictly followed in order to generate accurate computer records and accurate monthly reports.

Work Source (A) Road Calls

All service calls and repairs to vehicles in route to school or in route home from school.

Work Source (B) Unscheduled Repairs

All unscheduled repairs to vehicles. DO NOT INCLUDE ANY PREVENTIVE MAINTENANCE, VANDALISM, ACCIDENT, OR WARRANTY REPAIRS.

Work Source (C) Paid Time Off

All leave time: sick leave, vacation, holidays, jury duty, military leave, etc. shall be indicated using work source (C). This code shall not be used for any other purpose. All leave time is to be charged to the Dummy Shop Vehicle (example: 6430 0000) and keyed in the same manner as work source (G) administrative & clerical time. The following repair codes are required to be used for leave time for ALL GARAGE PERSONNEL:

Type of Leave	Repair Code
Sick	G1
Vacation	G2
Holiday:	G3
Jury Duty or Military leave	G4

Work Source (D) Preventive Maintenance

All repairs or services performed to vehicles that are of a preventive nature. (Any item inspected, serviced, or repaired prior to that item, breaking or malfunctioning is preventive maintenance). All fuel truck driver route time will be work source D and keyed in the same manner as administrative and clerical time to the Dummy Shop Vehicle Number using repair code 00.

Work Source (G) Administrative & Clerical Time

All transportation directors, supervisor's, shop foremen, and cost clerk's time not charged to a vehicle should be accounted for using work source G. DO NOT USE THIS CODE TO RECORD ANY LEAVE TIME OR HOLIDAYS. All work source (G) data is to be charged to the Dummy Shop Vehicle Number using repair code - 00.

Work Source (I) All County Vehicles (type 7 & type 8)

ALL REPAIRS and all TD-18A Equipment Repair and Parts Order forms that involve working on county vehicles are to be work source (I). THERE ARE NO EXCEPTIONS. All inventory charged to type 7 and type 8 vehicles on TD-18A Equipment Repair and Parts Order forms are to be keyed using work source (I).

Work Source (K) Miscellaneous Shop Time

All miscellaneous time such as shop equipment repair, cleaning or repairing the garage, staff meetings and/or training sessions at the garage are to be indicated using work source (K) and charged to the Dummy Shop Vehicle Number using the appropriate repair code.

Work Source (J) Accident Repair

All wreck or storm damage repair to vehicles is to be indicated using work source (J).

Work Source (V) Vandalism Repair

All vandalism repairs to vehicles are to be indicated using work source (V). Any item damaged that is not normal wear shall be coded as vandalism.

Work Source (W) Warranty Repair

All repairs to vehicles that are a result of a defective product or product update and the replacements item is furnished at no charge by the vendor shall be coded as warranty repair.

Annual Goal - Work Source Percentage

- Work Source (A) Road Calls - Maximum 2%
- Work Source (D) Preventive Maintenance - Minimum 35%
- Work Source (K) Miscellaneous Shop Time - Maximum 5%

All paid hours are to be documented on a TD-18A Equipment Repair and Parts Order form for all garage personnel each workday. Each county shall have 100% accountability for all employee hours paid.

Preventive Maintenance and Vehicle Replacement Manual

Please utilize the Monthly Garage Labor Report and the Monthly Garage Work Source Report. These reports summarize monthly and year-to-date data on the utilization of the school bus garage staff and they provide the transportation director with usable management data.

Actual time to service or repair vehicles is to be recorded on the TD-18A Equipment Repair and Parts Order form and/or the TD-8A&B Preventive Maintenance Service sheets. Do not indicate time for repairs not performed.

3. 30-Day Inspection Program — Repair Code MI

The 30-day inspection is the backbone of our Preventive Maintenance Program. If transportation personnel will thoroughly pursue the following description of a 30-day inspection, the procedures in the remaining preventive maintenance sections of this manual will be easier to perform on the entire transportation fleet. Refer to Section 13 for more information on the 30-Day School Bus Inspection Work Sheet.

GENERAL STATUTE 115-C248(a) REQUIRES ALL SCHOOL AND ACTIVITY BUSES TO BE INSPECTED EACH 30 CALENDAR DAYS. The purpose of this inspection is to identify mechanical defects or other defects which may affect the safe operation of the bus. It is also recommended that all service pickups, fuel trucks, wreckers, and tire trucks are inspected each 30 days in the same manner as school buses.

Each mechanic assigned to a specific group of buses shall inspect each assigned school bus and school activity bus once each thirty-calendar days while buses are being operated. This inspection is for the purpose of detecting any and all items which have failed, or could be reasonably expected to fail, before the next regularly scheduled monthly inspection. The procedures for this inspection are as follows:

INSPECT BUSES AS THEY APPEAR ON THE EQS1 SCREEN “PM DUE” LIST. On any assigned day of any month that buses are operated (weather permitting), a mechanic(s) designated by the foreman or director, will inspect all lights, windshield wipers, stop signs, walking arms, brake operation (service and park), steering components, and rear door and window buzzers on all buses in the assigned area. On all buses equipped with air brakes, the travel of the air chamber push rods (front and rear) shall be checked at this time and adjusted if needed per manufacturer's specifications.

To complete the 30-day inspection, the mechanic will, on assigned days, go to a school in his designated area and completely inspect and road test each bus due a 30-day inspection. After inspecting a bus, he will repair all defective items as far as he possibly can with parts available on his service truck before he starts inspecting another bus.

The mechanic is responsible for maintaining a repair parts inventory on his service truck. The mechanic shall keep a copy of the inventory.

Parts shall be charged on a TD-18A Equipment Repair and Parts Order form when removed from the service truck. The TD-18A Equipment Repair and Parts Order form and the mechanic's 30-Day School Bus Inspection Work Sheet shall be completed before beginning the inspection of the next bus.

Defective items for which the mechanic does not have the necessary parts to repair, which do not constitute a hazard for operation, or will not cause a greater mechanical problem, will be left until the next day that the mechanic inspects in his territory. On the next day that he inspects, he will start by completing the repairs on any buses on which the defects were not repaired on his previous day's

inspection. After unfinished minor repairs on previously inspected buses have been repaired, he will move on to any remaining buses at the school which have not been inspected. When all buses at this school have been completed as far as possible with the parts available on his service truck that day, he will move on to the next school in his area and start the same inspection process at that school. This is repeated until all buses in the area have been inspected and repaired during the month.

Items found to be defective by the mechanic during the inspecting of buses which may create a safety hazard or a greater mechanical problem, shall be repaired prior to operating the bus or a spare bus will be put in service in place of the defective bus until proper repairs can be made. The decision shall be made by the foreman or director while considering the availability of parts and personnel as well as the amount of time necessary to make the needed repairs.

At the end of each day, the mechanic shall turn in the inspection sheets for all buses which he has inspected during the day. Any items, which are not repaired, shall be shown as such on the mechanic's 30-Day School Bus Inspection Work Sheet. The mechanic shall report to the shop foreman or director any defects which could not be reasonably repaired at the school and would necessitate bringing the bus to the garage. The mechanic shall make for his own use, a Defect List of all defective items which he can repair at the school.

A defect list is simply a list made by the mechanic to remind him to repair those defective items on his next visit to that school.

Items which had been reported as defective but listed as not repaired on a previous day's 30-Day School Bus Inspection Work Sheet, which are repaired during this day's work, shall be reported on a Defect List and turned in with the following form. There shall be a TD-18A Equipment Repair and Parts Order form completed for each bus with previously reported defects that were repaired during the day. Any remaining defects on any bus would be handled in the same manner at the time they are repaired. This procedure would insure that all defects are repaired.

All Defect Lists for items completed that day, along with the mechanic's 30-Day School Bus Inspection Work Sheets and the TD-18A Equipment Repair and Parts Order form, shall be turned in at the parts department or other designated location daily.

At this time the mechanic shall secure from parts personnel parts to replace any items used from his service truck inventory during the day. He shall also obtain from parts personnel any additional parts which are needed to make repairs to defective buses in his area. This procedure of securing parts on the afternoon of the day the bus was inspected will allow time to procure parts not in stock and have them ready for the mechanic on his next regularly scheduled day out.

Any defective item on a vehicle which cannot be repaired at the school and which would not be expected to cause a greater mechanical problem, or will not be considered as hazardous if the vehicle is continued in operation, will be noted as such on the 30-Day School Bus Inspection Work Sheet. For such items, the foreman and/or director will complete a TD-18A Equipment Repair and Parts Order form. On this form, he will give the vehicle number, make, and model, the date reported and description of the defect and also the name of the reporting mechanic. The TD-18A Equipment

Repair and Parts Order form will be placed in the proper folder of the work order file in order that these repairs may be made when the vehicle is in the shop or when such affected component part is removed from the vehicle. Examples of such repairs are:

- Transmission bearing noisy - repair when transmission is out.
- Flywheel ring gear bad - replace when transmission is out.
- Body damage - repair when bus is at the garage.

The foreman and/or director will check the mechanic's 30-Day School Bus Inspection Work Sheets, Defect List and TD-18A Equipment Repair and Parts Order forms daily near the end of the work day in which the inspections are made. A record indicating the buses, which have been inspected during the month, will be maintained. This record will indicate buses which have been inspected during the month, whether the inspection and repairs are complete, or if there are defects which have not been repaired. For any bus which had been previously reported as inspected and not repaired, a Defect Repair List must be turned in by the mechanic showing that he has completed any or all these defect repairs. The foreman and/or director shall indicate on the mechanic's 30-Day School Bus Inspection Work Sheet the defective item or items which have been corrected. He will record the date of such corrections and file this information in the individual vehicle maintenance history file folder.

If a 30-Day School Bus Inspection Work Sheet indicates a defect making it necessary to bring a bus to the garage for repairs, the foreman shall consider this in his planning of work for the coming day and in his discussion of the work schedule with the director.

If there are buses previously listed as inspected with defects not repaired, and the mechanic assigned to the buses has moved on to inspecting and repairing other buses, the foreman and/or director shall discuss with that mechanic why those defective buses were not repaired prior to inspecting other buses.

THE FOLLOWING ITEMS ARE TO BE INCLUDED IN THE 30-DAY INSPECTION:

Inside Body

- Tire chains - check and wire (check for original wire - 2 loops), if applicable (secure chains)
- Passenger seats - frames, covers, seat foam pads, seat cushions secured, cushion clips, mounting bolts, wear
- Windows - glass, glazing rubber, sash screws, filler strips, lock racks, latches, safety buzzer, emergency window latches
- Sheet metal - screws or rivets out, marking, modesty panel
- Emergency door - lock operation, hinge mounting bolts, weather seal, buzzer, lubricate, buzzer on lift door (with or without lift)

- Floor covering and metal strips
- Floor boards - screws, floor mats, boots, (parking brake lever, steering shaft boot)
- Driver's seat - covers, mounting bolts, slide rails, rollers, operation, lubricate, looseness, check seat belt/shoulder harness operation and condition
- Entrance doors - step, hinge, mounting bolts, weather seal, safety latch, control operation and adjustment, lubricate (if needed)
- Sunvisor – adjust
- Windshield wiper - blades, linkage, arm travel and parking
- Stop sign valve - operation, lubricate, adjust switch, pilot lights
- Heater and defroster - motors, foot warmer operation (R.H. heater - remove lint from filter as needed)
- Ground wire on electrical panel
- Gauges, All; oil, temperature, alternator, vacuum, brake warning light, vacuum buzzer, low air pressure buzzer and light, high beam indicator
- Turn signal - switch operation, indicator lights, cancellation
- Brakes - pedal operation, by-pass, booster test, free travel, pedal bushing, pedal stop, check low vacuum or air buzzer, linkage and bushing
- Parking brake - lever, pawl, ratchet, spring, operation, adjustment, check light and buzzer
- Air brakes - check operation of low air pressure light or buzzer, and air pressure gauges
- Mirror - frame screws, mounting bolts, adjust for proper visibility
- Wheelchair - mounts, lift operation
- Interior lights
- Power test engine mounts

Outside Body

- Reflectors - 4 red and 2 amber (4 amber on 54 and 60 passenger)
 - Emergency door - stop, lock, handle and nut, lubricate
-

- Mirrors - glass, frames, screws, attaching bolts, brackets, crossview brackets, vibration, adjust for proper visibility
- Lights - operation, brightness, lens, license light
- Turn signal - lens, mounting bolts, wiring, grommets
- Gas door - hinge, lubricate, filler pipe hose and clamps, locking gas cap (if equipped)
- Walking arm - operation and condition
- Stop arm - operation, condition of paint and lettering
- Sheet metal – damage

Chassis

- Body bolts and clamps - tighten if needed
- Springs - center bolts, hangers, shackle and eye bolts, u-bolts, tighten if needed
- Brakes - master cylinder booster, hose, lines (leaks, cracks, abrasions), kinks in hose, atmospheric filter and hose, check brake fluid level, adjust brakes
- Air Brakes - check air chamber and rod travel, (equal rod travel on both sides of an axle, front and rear, are required); adjust air brakes; adjust treadle valve; bleed air tanks completely
- Oil seal and fluid leaks - at compressor, front and rear wheels
- Shock absorbers - mounting, brackets, links, insulators
- Exhaust system - pipes, muffler, hangers, tail pipe extended beyond rear bumper
- Drive line - u-bolts, center bearings cushion supports, yokes and nuts, alignment of drive line sections, pinion flange, transmission flange
- Engine - mounts and brackets
- Engine belts - Check all belts for proper adjustment cracks, wear, etc.
- Wiring - loose, frayed, clips
- Oil leaks - at engine, transmission, differential, (check oil, fluid and lube levels)
- Antifreeze - check protection level and record degree (as needed)

- Steering - gear box mounting, sector seal, tie rod ends, drag link, third arm, idler arm shaft and bushing, shaft couplings, joints (snap rings), mast jacket bearings (upper and lower), check fluid level
- Cross members - cracked, loose bolts or rivets
- Tires - wear pattern, condition, check for proper inflation and record pressure readings: minimum 90 lbs.; maximum 110 lbs. pressure for radial tires
- If excessive tire wear indicates improper front-end alignment, it is to be noted on the 30-Day School Bus Inspection Work Sheet and scheduled for repairs
- Axle - studs and nuts
- Fuel - tank and lines
- Hood - hinges, latches, bumpers, adjust hood (4 point contract), lubricate
- Front End - fenders, skirts, radiator support

Fuel

- Visual inspection of linkage, lines, hose, fuel pump, injection pump
- Pump Throttle stops - adjust

Electrical

- Battery compartment - condition and cleanliness, terminals, electrolyte level
- Starter - ear test

Road Test

- Travel angle
- Steering gear operation (lock to lock), lost motion, shimmy
- Panic stop (not sliding) - brake action, engine idle
- Accelerate - knocks, pings, performance
- Rear axle and drive line - noise, vibration
- Transmission: automatic - observe operation and shift points
- Governor operation - MPH (high, low, variation) RECORD HIGH

- Instrument gauges - observe all
- Test operation of hydraulic brake warning light
- Test operation of low air pressure buzzer and light

The mechanic shall complete and sign the 30-Day School Bus Inspection Work Sheet and present completed forms to his supervisor (daily).

The following are maintenance record forms which are referred to in this section. They are required to document the preventive maintenance program. These forms are to be properly and thoroughly completed and filed in the appropriate assigned location. Transportation Services staff members will review these records periodically during the year.

TD-30 — 30-DAY SCHOOL BUS INSPECTION WORK SHEET (1 page)

The mechanic shall use this form to inspect each school bus. After completing the information on the top of the sheet, the defects are to be noted by placing an X in the Needs Repair column by the respective item. After repairs to each defective item have been completed, the mechanic shall place a check mark in the OK column for that item. If defects cannot be repaired the day of inspection, the mechanic for his own use shall complete a Defect List. The mechanic shall refer to the Defect List the next day he is at the school and repair these defective items, if parts are available, before inspecting another bus. The mechanic shall record his inspection time on the form and turn in daily the 30-Day School Bus Inspection Work Sheet to the designated person. The designated person shall file the 30-Day School Bus Inspection Work Sheet in the individual bus maintenance history file after keying inspection data and labor into the computer. A copy of the 30-Day School Bus Inspection Work Sheet is presented in Section 13.

TD-18A — EQUIPMENT REPAIR AND PARTS ORDER (1 page)

The mechanic shall record his service truck subshop number on the Shop location, the vehicle number, work source code, mileage, make, and model of the vehicle, and the correct date. A list of repairs completed shall be entered on the Repairs Performed Section. Labor shall be recorded (to the nearest tenth of an hour) for each type of repair. (Only one type of repair may be entered on a line). The mechanic shall enter his mechanic number beside all labor time entered on each line of the repair order. The mechanic, or designated person, shall record the remaining pertinent information needed: All inventory used; DOT - computer number, manufacturer's number, description, and cost for all non-inventory (direct charge) items, and/or sublet repairs.

When the job is completed, the mechanic shall sign the form and turn it over to the designated person for review and for all data to be entered into the computer. This form shall be filed in an individual vehicle cost record file **by a designated person**. A copy of the TD-18A Equipment Repair and Parts Order is presented in Section 13. All travel time from school to school or bus-to-bus etc. is to be charged on the TD-18A Equipment Repair and Parts Order by using repair code 00. Charge actual time of repair for each specific repair performed to a vehicle.

4. Preventive Maintenance 6,000-Mile Service — Repair Code 05

Proper servicing will increase vehicle life and help to deter high maintenance costs. To achieve the extended life and high mileage we are currently obtaining, school buses require consistent and thorough preventive maintenance. All filter maintenance (oil, fuel, air, etc.) is extremely critical to proper diesel engine servicing as well as gasoline engines. Adverse weather and road conditions may warrant more frequent lubrication. The 6,000-mile servicing frequency shall not be exceeded.

This is the first mileage-based service for school buses. For new buses only, this service will require the following:

- Drive in king pin bolt lock pins and torque lock nut (see new vehicle king pin bolt instructions in Section 1)
- Retorque all body mounting bolts
- Bar test wheel bearings
- Adjust tension on all engine accessory drive belts
- Use a magic marker to record oil change maximum quantity and computer oil filter numbers under the hood of each vehicle for future reference

Every 6,000 miles or 12 months from date of last oil change, all vehicles shall have the oil and filters changed as well as all grease fittings lubricated. Engine should be at normal operating temperature when the oil is drained. Also, all doors and hood hinges and latches are to be lubricated.

The above lubrication, oil, and oil filter change frequency shall be required for the entire service life of all vehicles.

Factors that affect oil contamination are as follows:

- Cold running engine (use at least 185 degree thermostat)
- Air cleaner
- Poor operating engine (rich fuel mixture)
- Weather conditions
- Road conditions

OIL REQUIREMENTS: 15W40, CD/SH, EOK-2 SHALL BE USED IN ALL STATE OPERATED VEHICLES (DIESEL AND GASOLINE) Oil packed in sealed containers is highly recommended to reduce engine contamination and to maintain chassis manufacturers warranty requirements.

TD-8A — PREVENTIVE MAINTENANCE OIL CHANGE SERVICE (1 page)

This vehicle service is to be recorded on a TD-8A Preventive Maintenance Oil Change Service form by the mechanic performing the service. This form is to be turned in daily to the appropriate person. The TD-8A Preventive Maintenance Oil Change Service form is to be processed in the same manner as a TD-18A Equipment Repair and Parts Order. A copy of the TD-8A Preventive Maintenance Oil Change Service form is presented in Section 13.

5. Preventive Maintenance 12,000- Mile Service — Repair Code 06

The 12,000-mile preventive maintenance service is a garage-performed activity. It is the first mileage-based scheduled preventive maintenance after the lubrication, oil, and filter change. The following procedures and instructions refer to the 12,000-mile service and the Preventive Maintenance 12,000/24,000/48,000 Service Work Order. These service procedures are to be followed every 12,000 miles for the entire service life of all vehicles. This service is similar to that described in the section on 30-day inspection and is performed even if the vehicle has been previously inspected during the month. The purpose of this preventive maintenance is to detect any defects in order that repairs can be made before returning the bus to service. The engine compartment shall be inspected before the engine is washed in order that oil leaks may be more easily detected. Refer to Section 13 for a sample copy of the Preventive Maintenance 12,000/24,000/48,000 Service Work Order.

Engine and battery compartments are to be washed at each 12,000-mile preventive maintenance service. This will maintain relatively clean engine compartments and allow oil leaks to be detected more easily on regular 30-day inspections. Also, battery compartment service will be much easier if a regular cleaning procedure is used.

Although 12,000 miles has been established as a maximum interval at which to perform this preventive maintenance service, you may want to use more frequent mileage intervals based upon factors such as terrain, road conditions, urban routes, etc. which may require more frequent servicing of your bus fleet.

Each mechanic is to record labor only for duties actually performed and the defect list/work order file is to be reviewed for the vehicle being serviced prior to performing the preventive maintenance due.

Road Test

During the road test, the mechanic must be observant for proper operation of all components of the vehicle. Any defect should be noted. Also, the results of the following items shall be noted on the work order.

Travel Angle

Observation, by using both side mirrors, should indicate the bus travel angle in relation to the road or centerline. A bus that appears to be running somewhat sideways (rear axle not tracking on a straight line with the front axle) could indicate either a misalignment of the axle to the springs or possibly a broken or bent spring center bolt.

Steering Gear Operation

While traveling very slowly in the bus garage parking area or some similar safe place, slowly turn the steering wheel to its extreme left, back to its extreme right, and then again to the straight ahead position. Observe any roughness, looseness, or other defect.

While driving along the road, ease bus to the right until right wheel leaves the pavement, then slowly to the left until bus returns to the pavement. Observe if any shimmy or lost motion can be detected.

Load Test

While traveling uphill, or simply slowing down to a point allowing for acceleration while still in high gear, accelerate the vehicle in a loaded condition and observe performance.

Brake Test

Each vehicle is required to have its brakes tested by using a Tapley brake test meter or equivalent test meter. This test is to be conducted on a dry paved road which is as level as possible for local terrain. The test is made by making a panic stop at 20 mph after having set the brake meter on test. The minimum score allowed is 60% for an unloaded vehicle. Any score less than 60% requires additional testing and proper brake system repair to enable the vehicle to be returned to service. You shall not operate any vehicle which does not pass the brake test. The test results are to be recorded on the TD-8B Preventive Maintenance 12,000/24,000/48,000 Service Work Order.

Panic Stop

While traveling in a safe area, make a panic brake application (without sliding wheels). Observe braking action and after vehicle has come to a stop, observe engine idle.

Acceleration

While traveling at a speed that would allow heavy acceleration in high gear, observe engine pings and knocks as well as engine performance.

Throttle Linkage

Adjust for wide open throttle.

Rear Axle and Drive Line Noise

Observe under varying operating conditions any abnormal noise in the drive train.

Governor Operation (if equipped)

Record governor cut off (high) and cut in (low) speeds. Also test for governor override allowing speed to increase beyond normal cut off (variation between cut-off and cut-in speeds).

Transmission—Automatic

Observe operation of transmission and record the up and down shift points on the 12,000-mile service form. Also note if gear changes are not normal.

After Road Test

Park vehicle in a clean dry area and observe five minutes later for leaks from any component.

Emission Control Devices

Are warranted to 50,000 miles as required by the federal government.

Tune Up

Perform the following and replace defective items as required. For all gasoline equipped vehicles, refer to OEM service manual for specifications and requirements.

Vehicle Service Manuals

May be obtained by ordering the desired manual from the dealer awarded the state bid for the respective vehicle model year. Contact the parts department of the bidding dealer for additional information.

Battery and Compartment

Clean compartment area and make any necessary repairs. Paint (brush) inside of compartment and tray with corrosion resistant metal seal. Lubricate tray slides. Clean battery and cable terminals. Install felt battery terminal protector rings and reconnect cables. Felt protector rings will be more effective if soaked in EP-90 lubricant prior to installation. If a battery terminal sealer is desired, use high heat paint. Do not use petroleum-based lubricant. Equipment required: a battery terminal puller and battery terminal spreader.

Fuel System Test

Air Filter

Conduct air filter restriction test.

Fuel Filters

If fuel filters have a replaceable element, fuel/water separator, drain, clean, and install new element, inspect flex hoses and tubing, replace if necessary.

Note: The installation date and mileage should be written on the fuel filters with a magic marker for future reference.

Electrical System

Starting and charging system tests are performed with a volt amp tester connected at the battery. With the engine cranking (but not starting), tester meter readings are observed for the number of amperes of current used and battery terminal voltage during starter operation. This test provides performance serviceability information for starter motor and battery.

Alternator Test

The alternator output test is performed with the engine running at a speed great enough to produce maximum output and the tester switch in output test position. The battery load is increased by decreasing the resistance in the tester carbon pile rheostat until the maximum ampere rate of current is observed on the tester amp meter.

Voltage Regulator

The voltage regulator test is performed with the engine running at the same speed and the tester switch in the voltage test position. This places a resistor in series with the battery, simulating a fully

charged battery. The regulated voltage is obtained by observing the maximum voltage on the tester volt meter.

Diode Stator

The diode stator test is performed with the engine running and the tester switch in the diode stator position. If the test indicates a defect, it will be necessary to disassemble the alternator to determine if the defect is a diode or the stator. Follow instructions of your test equipment.

Residual Current Draw Test

With the engine and all electrical components turned off and the negative battery cable disconnected, place a milliamperes meter in series with the circuit and observe meter reading. Observing polarity, connect one lead to the negative battery terminal and the other to the negative cable. A meter reading greater than 100 milliamperes indicates current leakage through some component of the electrical system. The proper component is located by the process of elimination (dirty or wet battery will allow current to travel along the case to ground through the battery tray). Alternators with integrated (internal) voltage regulators will have a residual current draw of approximately 50 millamperes.

Engine Accessory Drive Belts

Inspect for condition and proper adjustment of belt tension.

Cooling System Test

Using a pump type pressure tester installed on radiator filler pipe, pressurize system and observe for leaks. Using the same tester, test operation of radiator pressure cap. Visually inspect radiator hoses, water pump, and other components (coolant recovery tank) for defects. Inspect radiator support and support mounting bolts and insulators.

Conditioner Test

TEST THE COOLANT SYSTEM DCA LEVEL WITH AN ENGINE COOLANT SYSTEM TEST KIT. If conditioner is needed, use a conditioner per OEM specifications. This test is extremely critical for proper diesel engine maintenance. The test shall be conducted utilizing a Fleetrite Coolant Test Kit or equivalent kit. The coolant conditioner controls the buildup of scale with the cooling system of diesel engines.

OTHER REQUIRED TESTS

Wheelchair Lift

Inspect wheelchair lift for defects, leaks, and smoothness of operation. Lubricate all lift wear points. Also, inspect the following items. Observe electric motor pump performance. Check the fluid level with the lift up. Adjust as needed per OEM specifications. Vented fluid cap will help reduce leakage. Check the chains for looseness. Lubricate all grease fittings. Check complete lift hydraulic system for leaks. Check all switch adjustments (pressure release switches, etc.). Check lift frame or cracks. Check cam brackets for proper adjustment. Check current draw on electric motor per EOM specifications. Fluid pressure psi up position per OEM specifications. By-pass pressure, if applicable, per OEM specifications.

Crankshaft End Play

Using a dial indicator placed against the flywheel on crankshaft harmonic balancer, move crankshaft forward and backward to measure the amount of end play. Compare with manufacturer's specifications. Excessive crankshaft end play indicates worn thrust bearings and can destroy an engine block. Crankshaft thrust bearing wear increases rapidly due to a defective torque converter.

Automatic Transmission/Auxiliary Filter

Replace Auxiliary filter (only).

Air Compressor Filter

Replace air compressor filter.

Front Brakes

After front of vehicle is raised from the floor and before the wheel and drum assemblies are removed, the steering knuckle king bolts or upper and lower ball joints shall be inspected for lost motion or other defects which might necessitate repairs being made while servicing front brakes and wheel bearings.

Place safety stands under axle and remove both wheel and drum assemblies. Inspect brake components for possible defects (leaking wheel cylinders, etc.).

Clean brake drum, shoes, and other components in a safe and acceptable manner.

Using a tire tread gauge that measures in 32nds of an inch, measure the amount of brake lining above the rivet head at the thickest point of each brake shoe. Record the measurement of the shoe for each wheel in the appropriate space on the Preventive Maintenance 12,000/24000/48,000 Work Order. Compare these measurements with the measurements from the vehicle history to determine if the lining is still serviceable or needs to be replaced.

If brake lining thickness is acceptable, inspect for possible lining cracks, loose rivets, defective brake shoe, etc.

Remove wheel bearing, clean and inspect bearings and cups. Repack wheel bearing with manufacturer's specified lubricant. Outboard drum equipped vehicles, bar test wheel bearing adjustment.

Note: Sodium base lubricant is not compatible with lithium base lubricant and should not be intermixed.

Install inner wheel bearing seal in hub.

If brake lining thickness is unacceptable, replace brake lining.

Replacement of Brake Lining

Rebuild hydraulic brake wheel cylinders at any time brake lining is replaced (if needed).

Brake drums shall be turned to a smooth surface each time brake lining is replaced (if needed).

Torque brake backing plate or spider mounting bolts to manufacturer's specifications.

Reinstall wheel and drum assembly. Install outer wheel bearing, washer, and nut (if applicable). Torque spindle nut to manufacturer's specifications. Install and lock cotter pin. Replace hub cover. Inspect S-cam bushings. Replace as needed.

Road Test

After all routine 12,000-mile service is completed, road test vehicle as described earlier to insure proper operation of all serviced or repaired items.

After Road Test

Park vehicle in clean dry area and observe five minutes later for leaks from any component.

The following are maintenance record forms which are referred to in this section. They are required to document the preventive maintenance program. These forms are to be properly and thoroughly completed and filed in the appropriate assigned location. Transportation Services staff members will review these records periodically during the year.

TD-8B — PREVENTIVE MAINTENANCE 12,000/24,000/48,000 MILE SERVICE (3 pages)

The mechanic shall complete this form at 12,000-mile intervals for the service life of the vehicle. After entering all requested information and completing the 12,000-mile service, the mechanic shall turn the form over to the shop foreman/transportation director for review. After keying the data into the computer, the form shall be filed in the Individual Vehicle Maintenance History file for future reference. A copy of this form is presented in Section 13.

Note: All labor performed as well as results shall be indicated on the Preventive Maintenance 12,000/24,000/48,000 Mile Service form. Record actual time for each respective repair performed.

6. Preventive Maintenance 24,000-Mile Service — Repair Code 07

The 24,000-mile preventive maintenance service is a garage-performed activity. After completing the 12,000-mile procedures, the following additional items shall be serviced every 24,000 miles.

Rear Brakes

If indicated by your operating conditions, this service may need to be performed at the 12,000-mile preventive maintenance interval.

After rear of vehicle is raised from the floor and before the wheel and drum assemblies are removed:

- Place safety stands under axle and remove both wheel and drum assemblies.
- Inspect brake components for possible defects (leaking wheel cylinders, etc.).
- Clean brake drum, shoes, and other components in a safe and acceptable manner.
- Using a tire tread gauge that measures in 32nds of an inch, measure the amount of brake lining above the rivet head, at the thickest point of each brake shoe. Record the measurement of the thickest shoe, for each wheel, in the appropriate space on the Preventive Maintenance 12,000/24,000/48,000 Work Order. On air brake equipped buses which have cam ground or tapered lining, the measurement should be made near the center of the brake shoe.
- Compare these measurements with the measurements from the vehicle history to determine if the lining is still serviceable or needs to be replaced.
- If brake lining thickness is acceptable, inspect for possible lining cracks, loose rivets, defective brake shoe, etc. If brake lining thickness is unacceptable, replace brake lining.

Replacement of Brake Lining

Rebuild hydraulic brake wheel cylinders at any time brake lining is replaced (if needed).

Brake drums shall be turned to a smooth surface each time brake lining is replaced (if needed).

Inspect S-cam bushings. Replace if needed.

If applicable, remove wheel bearings, clean and inspect bearings and cups. Repack wheel bearings with lubricant which meets vehicle manufacturer's specifications.

Install inner wheel bearing and seal in hub.

Install hub and drum assembly. Replace with new drums if worn beyond OEM specifications. Install outer wheel bearing washer and nut, and adjust wheel bearings to specifications.

Note: Do not mix silicone brake fluid and non-silicone brake fluid.

Alternator

Check tension belt pulley.

Starter Motor and Solenoid

Perform starter current draw test. Repair if needed to meet manufacturer's specifications.

Tune Up Diesel

Diesel engine shall be adjusted to meet manufacturer's specifications. Replace items as necessary.

Automatic Transmission Filters and Fluid

Replace filters (internal & external) and fluid in automatic transmission. Automatic transmission shift point test should be made with results recorded prior to removing fluid and filter. This will allow for necessary valve body adjustments to be made when transmission pan is removed. Fluid should be drained at normal operating temperature.

Remove transmission pan, fluid, and filters. Fluid that is in transmission pan should be poured through a wire mesh screen in order to detect metal particles which might be in it. Particles which are recovered should be analyzed to determine if additional repairs are needed. After any needed adjustments or repairs are made, install new filters and reinstall transmission pan. Replace transmission fluid following instructions outlined in transmission service manual.

Note: Automatic transmission fluid has a tendency to form an alga if used too long and condensation may build up in the transmission.

Road Test

Refer to 12,000-mile service for an explanation of a proper road test.

During the road rest, the mechanic should be observant for proper operation of all components of the vehicle. Any defect observed should be noted and repaired.

After Road Test

Park vehicle in a clean dry area and observe five minutes later for leaks from any component. Bar test rear wheels.

The following maintenance record form is referred to in this section. It is required to document the preventive maintenance program. This form is to be properly and thoroughly completed and filed in the appropriate assigned location. Transportation Services staff members will review these records periodically during the year.

TD-8B — PREVENTIVE MAINTENANCE 12,000/24,000/48,000 MILE SERVICE (3 pages)

The mechanic shall complete this form at 24,000-mile intervals for the service life of the vehicle. After entering all requested information and completing the service, the mechanic shall turn the form over to the shop foreman/transportation director for review. After all data is keyed into the computer, the form shall be filed in the Individual Vehicle Maintenance History file for future reference. A copy of the Preventive Maintenance 12,000/24,000/48,000 Mile Service form is presented in Section 13.

Note: All labor performed as well as all test results are to be recorded on the form in the proper location.

7. Preventive Maintenance 48,000-Mile Service — Repair Code 08

The 48,000-mile preventive maintenance service is a garage-performed activity. After completing the 24,000-mile procedure, the following additional items shall be serviced every 48,000 miles.

Air Dryer

Replace desiccant cartridge and inspect all connections (fittings, hoses, etc.).

Drain and Replace Brake Fluid

Master cylinder: clean, flush reservoir and cylinder. Refill reservoir.

Connect hydraulic brake pressure bleeder. Bleed and flush the entire brake hydraulic system according to bleeding procedures outlined in manufacturer's service manual. Before hydraulic brake pressure bleeder is activated (pressurized), remove the brake warning light switch and reinstall after the flush is completed. This switch must also be removed during any brake bleeding operation and reinstalled after bleeding is completed.

Engine Valve Adjustment Diesel

Engine valves adjustment not to exceed 48,000 miles or per manufacturer recommendations is required. Valve adjustment frequency varies for each engine manufacturer. Refer to the respective manufacturer for correct specifications and valve adjustment intervals.

Power Steering Filter and Fluid

Change the power steering filter and fluid in reservoir.

Differential

With differential at normal operating temperature, drain lubricant and strain through a wire mesh screen to detect any metal particles which might be in lubricant. If no repairs are needed, replace lubricant with proper type as specified by chassis manufacturer. Lubricant should have EP (extreme pressure qualities). Synthetic lube draining not required.

Coolant System

Drain and flush the coolant system. Refill system with a proper mixture of water and glycol based antifreeze solution and install the proper amount of coolant conditioner. Do not use a soluble oil based cooling system additive. After refilling the coolant system, test the coolant for the proper level of conditioner. If conditioner is needed, use an ethylene glycol based or OEM recommended conditioner. For more information on conditioner testing, refer to Section 5, page 28.

Wheel Bearings

If equipped with out-board drums, remove all wheel bearings; clean, repack and bar test wheel bearing.

Undercoat Bus

Clean and re-apply undercoat to areas needed.

TD-8B — PREVENTIVE MAINTENANCE 12,000/24,000/48,000 MILE SERVICE (3 pages)

The mechanic shall complete this form at 48,000-mile intervals for the service life of the vehicle. After entering all requested information and completing the service, the mechanic shall turn the form over to the shop foreman/transportation director for review. After all data is keyed into the computer, the form shall be filed in the Individual Vehicle Maintenance History file for future reference. A copy of the Preventive Maintenance 12,000/24,000/48,000 Mile Service form is presented in Section 13.

Note: All labor performed as well as all test results are to be recorded on the form in the proper location.

8. Personnel Utilization

An important factor in the effectiveness of a preventive maintenance program is the ability and willingness of all transportation personnel to work together with one goal in mind: a cost efficient and safe preventive maintenance program. The assignment of personnel to specific daily job duties is essential for the preventive maintenance program presented in this manual to be successful. The following section describes typical job assignments for transportation personnel.

Personnel Assignments

The fuel truck driver's daily service (duties) will consist of the following routine: fuel vehicles (fuel dispensed must be charged to the nearest tenth of a gallon on form TD-18B Fuel Issue Ticket); and check oil, water, tires; and under hood observation. In addition to the above routine, the fuel truck driver shall, if assigned, analyze and repair driver reported bus defects on the day he is at the school as well as assist with 30-day inspections. Example: minor repairs such as replacing fuses or light bulbs. The fuel truck driver shall also obtain speedometer readings for each vehicle fueled.

The mechanic's daily service (duties) will consist of the following routine: analyze and repair driver reported bus defects on the day he is at the school. The mechanic shall visit his assigned schools to repair driver reported defects on the days designated by the shop foreman/transportation director. After repairing reported defects, he will initiate his 30-day bus inspection, which is the basic foundation of the preventive maintenance program. (Refer to the detailed explanation in the 30-day inspection section.) On the days the mechanic is at the garage, he will be performing routine preventive maintenance or forced maintenance (unscheduled repairs) on vehicles assigned to him by the shop foreman or transportation director.

Note: The mechanic should observe automatic transmission equipped buses for the use of chock blocks at a wheel when the bus is parked (if required by the LEA). Any time a mechanic is working on a bus, chock blocks are to be used (if needed).

Reporting of defect by drivers and repairing such defects: bus drivers are required to sign in at each school where buses are terminated and indicate any defect detected on their bus on a Driver's Sign-In Sheet. A designated person shall call the bus garage upon arrival of all buses at the school, giving a report on all defects reported by their drivers or e-mail/fax (if available). The assigned person at the garage shall record on a Reported Bus Defect Log, the reported defects by school along with the time they were reported. The assignment of these defects to garage personnel will be as follows: the assigned person shall contact, by radio, the fuel truck operators and mechanics who are already working in their respective areas and give them a list, by bus number, of all reported defects in their area. If a mechanic assigned to an area not serviced by a fuel truck on that day is working in the garage, the foreman and/or transportation director shall give a list indicating the buses and their defects as reported by the drivers. The mechanic shall then proceed into his area and make such repairs and return to his assigned duties. The personnel, to whom such defects are assigned, shall inspect and repair these defects as far as they can, provided they have the necessary parts with them to do so.

All personnel to whom a defect has been assigned, who cannot repair said defect, shall report that information along with any additional information that would be helpful in repairing the defect to the garage by radio. The foreman or director will then decide the best course of action to take in the same manner he would with any other defective bus.

Personnel, to whom defects have been assigned from the reported Driver Reported Bus Defect Log, shall make a list of the defects by the bus number. This list of defects for each bus with notations of corrections made shall be turned in at the parts department or designated location, along with the TD-18A Equipment Repair and Parts Order forms by the person to whom they were assigned. The foreman and/or director shall check this Defect List against the reported Bus Defect Log daily. Any defects not repaired shall be assigned to a mechanic for repair, or the bus shall be scheduled to be brought to the garage for repairs.

The above procedures give specific guidelines for transportation personnel to pursue the field portion of the preventive maintenance program.

The shop foreman and or director shall plan a work schedule for the coming day. In planning this schedule, THE BUSES DUE PREVENTIVE MAINTENANCE SERVICE SHALL TAKE PRIORITY OVER OTHER REPAIRS. The shop foreman/transportation director shall consider any and all vehicles which are already at the garage awaiting repair, any defective vehicles which are still operating but need repair (both those which can be repaired at the school and those which will need to be brought to the garage), any other vehicles in the fleet which need repair or preventive maintenance service, and any other work (tire repairs, component parts, etc.) which needs to be done. Near the end of the workday, the foreman shall plan the next day's work and discuss this plan and work schedule with the director. The director shall make suggestions regarding the schedule. Together they shall arrive at a final plan for a work schedule for the following day. This schedule will be subject to change due to defects detected and road failures during the day.

The following are maintenance record forms which are referred to in this section. They are required to document the preventive maintenance program. These forms are to be properly and thoroughly completed and filed in the appropriate assigned location. Transportation Services staff members will review these records periodically during the year.

BUS DRIVER SIGN-IN SHEET

This form is utilized at the school each day for the drivers to record the bus number and time of arrival. Check the proper column if the bus is OK, record the number of students transported, note any bus defects or problems which the driver knows need to be checked by a mechanic, and sign the report. The designated person shall use this form as a record when notifying the school bus garage of driver reported bus defects. A copy of this report shall be picked up by the gas truck driver or mechanic (whoever is at the school that day) and turned over to the designated person at the school bus garage. After reviewing the form, it shall be filed in a School Bus Drivers Sign-In Sheet file.

DRIVER REPORTED BUS DEFECT LOG

A designated person at the school bus garage shall record daily on this form the defects called in from each school. The bus number, school, time of call, mechanical problem, and the assigned

mechanic shall be recorded for future reference. This form shall be used to double check the Bus Drivers Sign-In Sheet defects in order that no defects are overlooked. After comparing the two forms, this form shall be filed in a Reported Bus Defect Log file.

SERVICE CALL LOG

A designated person shall complete this form daily. The date, weather condition, bus number, time of call, phone number call received from, nature of problem, and location of vehicle shall be recorded at the time the service call is received. The time the mechanic calls in (that the bus is back in service and what the actual problem was) will be recorded in the proper columns. This form will be filed in a Bus Service Call Log file for future reference.

DEFECT LIST SHEET

For each bus involved, this sheet is to be turned in daily to the assigned person along with the TD-18A Equipment Repair and Parts Order form. This form shall be reviewed by the designated person and compared with the Reported Bus Defect Log.

Note: The defect list sheet may be a copy of the driver sign-in sheet or a list of defects the mechanic has been assigned to repair.

TD-18B — FUEL AND LUBRICANT ISSUE TICKET (1 page)

The fuel truck drivers shall complete the date, truck number, type fuel, bulk pump readings (both), truck meter readings (both), and gallons used for each. Also, he will record the bus number, quantity of gasoline/diesel fuel to the nearest tenth of a gallon and total quarts of oil for each vehicle, on the assigned days of the week. The fuel truck driver will record mileage for each vehicle fueled. The truck driver shall sign the form and turn it over to the cost clerk. After keying the data into the computer, the cost clerk shall file it in a designated file for future reference.

Note: All added oil is to be recorded on the TD-18B Fuel and Lubricant Issue Ticket. Do not record added oil on a TD-18A Equipment Repair and Parts Order form. Only oil change quantities are to be recorded on a TD-18A Equipment Repair and Parts Order form. Also, all added oil is to be keyed into the computer-using screen FISB. Do not use screen IVEI to enter added oil into the computer.

All of the above forms are presented in Section 13.

9. School Bus Garage Procedures

Proper garage operation is essential to a cost effective preventive maintenance program. The maintenance program presented in this manual requires that the operation of the school bus garage be conducted in the manner described below.

The garage shall be kept in a clean, workable, safe condition at all times. The following procedures should be utilized at the garage:

When a vehicle is brought to the garage, the foreman (or director if he sent after the vehicle), shall write a TD-18A Equipment Repair and Parts Order form giving information regarding the items to be repaired. Any defects detected by the mechanic who drove the vehicle to the garage, will also be listed on the repair order. If the vehicle is due preventive maintenance, the proper form (TD-8A or 8B) is also required to be completed. If the vehicle is not to be brought into the shop immediately, it shall be parked on the designated incoming area leading to the school bus garage. In such case, the TD-18A Equipment Repair and Parts Order form will be placed in the proper folder in the Work Order file. If the vehicle has not been inspected during the month, a 30-Day School Bus Inspection Work Sheet will be included with the TD-18A Equipment Repair and Parts Order form.

Mechanics driving a vehicle (at any time) should consider this as a road test. They should always be alert and observing for any defects. Any defects detected shall be repaired immediately if practical. If not repaired, they shall be reported to the foreman or director.

Any time a spare bus is returned to the garage and the mechanic who drives it detects any mechanical defect to be repaired, the bus shall be parked on the designated incoming area and the foreman or director notified of the defect. The foreman or director shall then write a TD-18A Equipment Repair and Parts Order form and place it in the proper folder of the work order file. It is required that a work order file be established to hold work orders until buses are brought into the garage for repair.

Note: It is essential for broken speedometers be repaired immediately whenever they are detected as malfunctioning. Correct vehicle mileage is essential for the proper scheduling of the preventive maintenance program by the computer.

If no defects are detected by the mechanic, the spare bus shall be fueled, the water and oil checked, the interior of the bus swept, if necessary, and then it shall be parked in the area designated for parking spare buses available for use.

The foreman or the supervisor shall maintain the information on the location of a spare bus when he sends for a bus to be brought to the garage. A means of detailing where spare buses are in use as replacements for regular vehicles is required.

When a vehicle is brought into the garage, the mechanic who is assigned to the vehicle will get the TD-18A Equipment Repair and Parts Order form along with the 30-Day School Bus Inspection Work Sheet, if applicable, and any Defect List for the vehicle, from the Work Order file or from the

foreman or supervisor. Unless it is impracticable due to some mechanical failure that must be repaired beforehand, the vehicle shall be inspected before any work is performed. Except for the checking of lights, steering, charging, and cranking systems, the remainder of the inspection shall be performed by one person. This inspection is for the purpose of detecting any and all items which have failed, or could reasonably be expected to fail, before the next regularly scheduled monthly inspection. This inspection shall include all the various parts of the vehicle. When inspecting a vehicle which is to have preventive maintenance brake service, the following shall be included as a part of the inspection: check for wear and lost motion in the steering knuckle king bolts, the upper and lower ball joints, and the upper and lower control arms.

Any defects detected during this inspection will be listed on the TD-18A Equipment Repair and Parts Order form. The inspecting mechanic shall sign the TD-18A Equipment Repair and Parts Order form and complete and sign the 30-Day School Bus Inspection Work Sheet, if applicable. He shall indicate on the 30-Day School Inspection Work Sheet those items which are acceptable with a check mark in the OK column, and those items which need repair with an X in the Needs Repair column.

Vehicles that are scheduled for a 12,000-mile service shall have the engine washed after the 30-Day inspection is completed.

After a defective item is corrected, the mechanic shall indicate this on the 30-Day School Bus Inspection Sheet by checking, initialing, and writing the date of repair in the column beside the repaired item. When performing preventive maintenance on brakes and wheel bearings, one man shall do both sides of an axle. On all vehicles when the brakes are relined, the brake drums shall be turned (if needed) and not to exceed manufacturers drum wear specifications and the wheel cylinders rebuilt (if needed). All S-cam shall be checked per OEM specifications. The repairing mechanic shall record the brake lining thickness at the thickest point above the rivet head, in the proper place on the TD-8B 12,000/24,000/48,000-Service Work Order. A tread depth gauge measured in thirty-seconds shall be used to measure rivet depth.

Rebuilding or repairing of transmission, differentials, cylinder heads, and engines that are out of the chassis shall be conducted in a designated area of garage.

Cleaning and storing of tools and equipment used, and the cleaning and sweeping of this area, shall be on the same basis as a stall. When the person who works in it finishes his job, he shall clean and replace the tools and sweep the floor. Scrubbing and hosing out of this area shall be on an as needed basis with assignment made by the foreman and/ or director.

Automatic transmissions, engines and differentials replaced by stock units and left to be rebuilt later, shall be stored in a designated area and tagged with the number of the bus from which removed and the apparent defects or symptoms.

Alternators, governors, starters, starter solenoid switches, brake cylinders, carburetors, etc., replaced by stock units shall be turned in at the parts department or other designated area for storage and future rebuilding. Those units will be rebuilt by the parts man or by that person designated by the

foreman and/or director. Before being turned in, those items shall be tagged with the number of the bus from which they were removed and the apparent defects or symptoms indicated.

Note: Rebuild all major components and sub-assemblies to the manufacturers recommended specifications.

The responsibility for maintaining safe tires on school buses (regular and spare) will be assigned by the foreman and/or supervisor. This does not relieve other employees of responsibility. Any employee who detects an unsafe tire (just as any other defect), on any vehicle maintained by the school bus garage, becomes responsible for changing the tire or repairing that defect, or informing the foreman or director that such action is needed. The determining factor of when to change a tire will be when it has worn to the point where the thinnest tread has only 4/32" on steering axle and 2/32" on rear axle of tread depth remaining (radial tires). Proper front-end alignment is essential to cost effective tire life. When installing tires on vehicles, new tires are required to be installed on the front axle. Rear duel tires shall be matched for size to within a maximum of 1/4" diameter of each other if possible. New tires are required on the front axle of all school buses.

The determination of who will make a service call to change a flat tire on a vehicle stopped along the road will be made by the foreman or director at the time of the call. The assignment of persons to demount, repair, and mount tires will be left to the foreman or director. This will be done while also considering the assignment of personnel to maintenance work in the shop and at the schools.

All tires and wheels to be repaired will be washed (weather permitting) before being taken to the tire shop.

All new tires and new recap tires should be balanced after mounting, if proper equipment is available, and before being placed on a vehicle or in the storage rack.

Used batteries shall be washed and cleaned properly prior to placing in the battery room (or designated area) for recharging or storage. A ventilated location is required to recharge batteries.

As needed, add antifreeze that meets OEM specifications to the cooling system of each bus. Antifreeze protection should be approximately 15 degrees below lowest expected temperature.

Note: Engine coolant DCA level test kits shall be used to determine if maintenance of the cooling system is needed.

Annually, perform the motor vehicle inspection required by G.S. 20-183.3(a) and attach the proper sticker to the assigned windshield location.

The following are maintenance record forms which are referred to in this section. They are required to document the preventive maintenance program. These forms are to be properly and thoroughly completed and filed in the appropriate assigned location. Transportation Services staff members will review these records periodically during the year.

INDIVIDUAL VEHICLE MAINTENANCE HISTORY FILE

It is required that a separate folder be established to hold maintenance records for each vehicle in your fleet.

WORK ORDER FILE

It is required that a folder be established to hold TD-18A Equipment Repair and Parts Order forms written in advance of vehicles coming to the garage for repairs.

EXTRA BUS SCHEDULE (ASSIGNMENT)

This form is to be completed by a designated person to record when and where the spares are being operated. Not only does this form assist in recording use of spare buses, it also records "down time" of your regular buses. This form is to be filed in an Extra Bus Schedule file for future reference. A copy of the Extra Bus Schedule (Assignment) form is presented in Section 13.

SCHOOL BUS ACCIDENT REPORT

The transportation director shall record the county/city unit number, complete accident reports as needed and send one copy to the Attorney General's Office. The county school superintendent for future reference should also retain one copy. A copy of the School Bus Accident Report is available from the Attorney General's Office.

10. Service Vehicle Maintenance and Operation

Maintaining your service vehicle fleet is essential in order to provide proper preventive maintenance service to your bus fleet. The following procedures shall be followed for all service vehicles. The 6,000-mile oil change service shall not be exceeded.

All school garage service vehicles are to be maintained in good operating condition and in a safe state of repair.

Lubricate and change oil and filter every 6000 miles or 12 months from date of last oil change for all service vehicles. Engine should be at normal operating temperature when oil is drained.

Service wheel bearings and inspect brake lining and components at 24,000 miles for all service vehicles.

Inspect each vehicle once each year in accordance with the Division of Motor Vehicles regulation G. S. 20-183.3(a).

Clean all service vehicles inside and out a minimum of once a month.

Body repair and repainting of service vehicles should be conducted as needed according to the repainting procedures section.

For information regarding tire replacement, refer to the tire maintenance policy described in Section 9.

All service vehicles: pickups, fuel trucks, wreckers, and tire trucks are recommended to be inspected each 30 days in the same manner utilizing the same 30-day inspection form as school buses.

The transportation director is responsible for the supervision and assignment of care and maintenance of all school garage service vehicles. This includes pickup trucks, gasoline/diesel fuel dispensing trucks, tire trucks, and wreckers, etc.

The director shall permit only state funded school garage employees to operate service vehicles. All service vehicles are to be used only for official business. Tort Claims insurance only covers vehicles operated by employees paid from the State Public School Fund on official business.

Note: Follow vehicle manufacturer maintenance specifications for all items not listed.

11. Vehicle Body Repair and Repainting Procedures

The appearance of each county's bus and service vehicle fleet has more effect on your public relations than any other maintenance factor. While the appearance may or may not affect safety, it does affect the manner in which the public views the mechanical condition of your bus and service vehicle fleet. Driver attitudes and care of their assigned vehicles are influenced considerably by the appearance of those vehicles. Pride in the operation of your transportation fleet is very much dependent upon the appearance and condition of the vehicles. Vehicles shall be repaired and repainted as needed. The following preparation procedures are to be followed. These steps will greatly increase the durability and life expectancy of your paint jobs.

- Wash and clean vehicle with a cleaning agent.
- Wet sand vehicle.
- All lettering must be sanded to a smooth surface.
- Repair all exterior damage to vehicle.
- Mask and paint with a good quality unleaded polyurethane paint. Make sure bus is dry. Add a paint hardener catalyst into paint to increase paint life (if recommended by paint manufacturer).
- Use lettering screens or vinyl material to letter vehicles.
- Use reflective material front and rear for background to letter school bus.

12. Utilization of Surplus Equipment

With the approval of the regional area transportation consultant, parts may be used from school buses which have been identified for salvage. A number of complete buses may be identified for salvage, or salvage parts may be removed and stored in a designated location.

To obtain a listing of salvage buses, utilize screen EQSI. Key in status Z, type 6, and enter to view the salvage list.

Permission to use major components must be requested prior to installation on a regular bus. Contact your regional area transportation consultant for the procedures and record keeping required on salvage equipment.

Equipment (parts) removed from vehicles without proper authorization shall be reinstalled on the original vehicle by the school bus garage staff.

If salvage parts are stored for future use, items are to be tagged as salvage with the bus number and mileage noted.

Sale of Obsolete Vehicles

Prior to being priced, all buses shall have the lettering removed and the bus appearance altered in the following manner. The front and rear panel which formerly had "School Bus" indicated shall be painted from the flashing light on the left to the flashing light on the right, a color other than school bus yellow. Also, the area of the body which formerly indicated "NC Public Schools" shall be painted a color other than school bus yellow. The painted area is to be the full length of the bus.

Buses which are obsolete will be priced for sale or bid on a TD-13 Discarded Equipment Form by your regional area transportation consultant. Buses shall not be sold unless priced in writing on the proper form prior to sale or verbal permission is given by phone by the area transportation consultant.

Service vehicles, fuel trucks, tire trucks and wreckers shall have all lettering removed and shall be painted inside and outside a color other than school bus yellow prior to being placed on bid (unless sold to another school system).

Sale of All Other Surplus Items

Sale of all other surplus items is required to be placed on bid. Proper procedures must be followed.

***TD-13 — DISCARDED EQUIPMENT, SUPPLIES & MATERIAL* (1 page)**

The area transportation consultant shall complete this form identifying vehicles or other items for sale or bid.

DISCARDED EQUIPMENT, SUPPLIES & MATERIALS FILE

A file folder is required to hold authorizations of discarded equipment for future reference. Keep in office until of no further administrative value.

13. Required Maintenance Record Documentation

The following are maintenance record forms which are required to document the preventive maintenance program. These forms are to be properly and thoroughly completed and filed in the appropriate assigned location. The Transportation Services staff members will review periodically during the year.

Transportation Services will furnish upon request, a copy of the following forms to the county school bus staff:

- TD-8A — Preventive Maintenance — Oil Change Service Work Order
- TD-8B — Preventive Maintenance 12,000/24,000/48,000-Mile Service Work Order
- TD 13 — Discarded Equipment, Supplies & Material
- TD-15 — New Vehicle Service Work Order
- TD-18A — Equipment Repair and Parts Order
- TD-18B — Fuel and Lubricant Issue Ticket
- TD-30 — 30-Day School Bus Inspection Work Sheet

Note: These forms are presented on the following pages.

The following required forms or files ARE NOT FURNISHED by Transportation Services. Either the sample presented, or a similar form which fills your county's particular needs, is required to be used. All of the information requested on the samples presented must be included.

Sample Forms

- Bus Driver Sign-In Sheet
- Extra Bus Schedule (Assignment)
- Reported Bus Defect Log
- Service Call Log

Sample Files

- Discarded Equipment, Supplies & Materials File (*folder*)
- Extra Bus Schedule (Assignment) File (*folder*)
- Individual Vehicle Cost Record File (*folder*)
- Individual Vehicle Maintenance History File (*folder*)
- Work Order File (*folder*)

All of the forms and file folders listed in this section are essential for proper documentation of your preventive maintenance program. An explanation of each form listed above is presented in the appropriate section of this manual.

PREVENTIVE MAINTENANCE – OIL CHANGE SERVICE

PREVENTIVE MAINTENANCE - 12,000/24,000/48,000 MILE SERVICE

DATE	SHOP	VEHICLE	LICENSE	WS	MILEAGE	MAKE	MODEL	AGENCY		
MO	DAY	YR		D						
CHARGE ALL LABOR TO NEAREST TENTH HOUR										
All Mechanic Numbers 3 Digits										
Repair Order # - 1	SECTION 1 (06) 12,000 MILE SERVICE (Perform initial road test described in PM manual) REPAIRS PERFORMED					RC	ACT/HRS	MECH #	ACT/HRS	MECH #
TRANS. shift points 1-2	2-3	3-4			00					
TRANS. shift points down 4-2	2-1				00					
GOV. operation: HIGH	LOW	VAR.			MG					
WASH ENG. & BAT. Compartment area					04					
CHG OIL & OIL FILTERS (12000/24000/48,000) (Select either 06, 07, 08)										
SERVICE: lube fittings & check all fluid levels					09					
REP. FUEL FILTERS					75					
TEST & SER. AIR FILTER (If needed)					09					
LUBE DOORS & HOOD (hinges & latches)					77					
	TOTAL HOURS PG-1 >					TOTAL LABOR COST >				
Repair Order # - 2	SECTION 2 (06) 12,000 MILE SERVICE REPAIRS PERFORMED					RC	ACT/HRS	MECH #	ACT/HRS	MECH #
CRANKSHAFT END PLAY (measured in thousands)					14					
CLEAN HEATER FILTER					84					
ADJ. GOV. & THROTTLE (linkage) (check WOT)					77					
TEST COOLANT ADDITIVE (DCA Level)					81					
REP.COOLANT FILTER					09					
PRESSURE TEST COOLING SYS.					96					
SER. BATTERY (cables & compartment)					21					
INSPECT & ADJ. ENG BELTS					16					
	TOTAL HOURS PG-2 >					TOTAL LABOR COST >				
Repair Order # - 3	SECTION 3 (06) 12,000 MILE SERVICE REPAIRS PERFORMED					RC	ACT/HRS	MECH #	ACT/HRS	MECH #
TEST ALT. AMPS					22					
TEST REG. VOLTS					22					
SER. AIR COMP: (filter & moisture ejectors)					SA					
REP. AUXILIARY FILTER (automatic transmission)					50					
TEST STEER. GEAR OPER.					48					
TORQUE SPRING U-BOLTS (hangers, body clamps, etc.)					44					
SER. WHEEL CHAIR LIFT					MC					
FRONT END ALIGNMENT (set toe in)					40					
	TOTAL HOURS PG-3 >					TOTAL LABOR COST >				

Mechanic Signature

IVEI DATA ENTRY – INVENTORY USED

DATE		SHOP	VEHICLE	LICENSE	WS	MILEAGE	MAKE	MODEL	AGENCY	
MO	DAY	YR			D					
QNTY	UNIT	DOT NO.	MFG. NO.	DESCRIPTION			S	PRICE	CD	AMOUNT
		5900049		MOTOR OIL						
		8191600		CHASSIS GREASE						
		8191500		TRANS. DEXRON II FLUID						
		8191601		80/90 EP						
		5500500		ANTI FREEZE						
				OIL FILTER						
				FUEL FILTER						
				COOLANT FILTER						
				AIR FILTER						
				TRANS. FILTER						
				AIR COMPRESSOR FILTER						
		8191006		NALCOOL						
				AUX. TRANS. FILTER						
				FUEL FILTER						
		TOTAL QUANTITY				TOTAL INVENTORY COSTS				

INVENTORY USED

SUBLET REPAIRS:

QNTY	RC	STANDARD RC DESC.	ADDITIONAL DESC.	*	PRICE	CD	AMOUNT
MECHANICS SIGNATURE _____ * SOURCE I = INV/PARTS N = NON INV/PARTS S = SUBLET REPAIRS						GRAND TOTAL	

Preventive Maintenance and Vehicle Replacement Manual

TD-13
Rev. 6/2000

DISCARDED EQUIPMENT, SUPPLIES & MATERIAL

TO: Surplus Property Agent
Division of Purchase & Contract
Raleigh, NC

FROM: County

DATE:

We hereby recommend for sale surplus school transportation equipment, materials, and supplies as follows:

Miscellaneous*

The above is located and may be inspected at _____ County School Bus Garage,
_____, NC. Persons or firms interested in purchasing same should see
Mr. _____ for inspection of equipment.

*Includes batteries, tires, scrap iron, miscellaneous junk, etc.

Area Transportation Consultant

NEW VEHICLE SERVICE WORK ORDER

CHASSIS

Vehicle No. _____ Mileage _____ Date _____

Make _____ Year _____ Serial No. _____

Tire Size _____ Ignition Key No. _____

BODY

Make _____ Body No. _____ Cap. _____ Date Mfg. _____

FRONT AXLE

- _____ Adjust & Refill wheel bearings
- _____ Balance front tire and rim
- _____ Brake lining thickness: Left _____ /32; Right _____ /32
- _____ Torque backing plate or spider mounting bolts
- _____ Torque drum to hub bolts _____ ft. lbs.
- _____ Torque spring u-bolts ft. lbs.
- _____ Torque spring shackles & eye bolts or spring pivot bolts
- _____ Torque wheel bolts _____ ft. lbs.
- _____ Drive in and torque king pin lock bolt nuts
- _____ Torque steering gear mounting bolts and gear case bolts
- _____ Torque pitman arm nut _____ ft. lbs.
- _____ Adjust gear lash and sector end play
- _____ Check steering shaft u-joints for free movement and check trunion snap rings for seating.
- _____ Torque tie rod end nuts, drag link end nuts and 3rd arm mounting nut
- _____ Front End Alignment, set toe-in Adjustment
- _____ Set Axle Stops for Wheels

REAR AXLE

- _____ Adjust & Refill wheel bearings
- _____ Torque drum to hub bolts _____ ft. lbs.
- _____ Brake lining thickness: Left _____ /32; Right _____ /32
- _____ Torque backing plate or spider mounting bolts
- _____ Check brake shoe to backing plate clearance-adjust-key or lock adjusting bolts
- _____ Torque Spring u-bolts _____ ft. lbs.
- _____ Torque spring shackles, eye bolts, or spring pivot bolts
- _____ Torque differential to housing and inspection cover to housing bolts
- _____ Torque wheel bolts _____ ft. lbs.

OTHER MISCELLANEOUS TEST

- _____ Pressure test cooling system, visual inspection
- _____ Crankshaft end play _____ (record in thousands)
- _____ Check, adjust, and torque tie rod end, adjusting clamp bolts
- _____ Lubricate (check all fluid levels)
- _____ Adjust headlamps
- _____ Install tire chains (if needed)
- _____ NC Motor Vehicle Inspection, Install Inspection sticker to windshield
- _____ Test Engine DCA levels

UNDER CARRIAGE

- _____ Torque body mounting bolts
- _____ Torque u-joint nut and drive shaft center bearing bracket bolts
- _____ Tighten hose clamps and pipe fittings for air lines, air dryer, and tanks
- _____ Check routing and mounting of hose, pipes, battery cables, and wiring
- _____ Torque bolts in transmission case and transmission mounting bolts
- _____ Check and adjust (if needed) brake chambers push rod to slack adjuster angle

BODY

- _____ Check all lights
- _____ Adjust door controls a/r regulator
- _____ Adjust windshield wiper stroke and/or arms
- _____ Torque seat mounting bolts, all seat belt mounting and operation
- _____ Torque glass channel mounting screws
- _____ Torque turn signal bolts and screws, lens screws
- _____ Adjust mirrors and tighten
- _____ Check all electrical connections in body electrical panel
- _____ Torque body to cowl bolts
- _____ Check stop sign mounting screws; align and tighten blade mounting bolts
- _____ Modify battery box, coat inside of box with metal seal
- _____ Check and adjust brake pedal free travel
- _____ Lubricate glass channels & latches with silicone
- _____ Lubricate drivers seat tracts
- _____ Check for (install if necessary) a ground wire from body to the body electrical panel with warning light switch and solenoid.
- _____ Check wheelchair lift for ground wire (INSTALL IF NECESSARY)

ELECTRICAL SYSTEM

- _____ Test starter current draw _____ Amps _____ Volts (ground secondary coil wire)
- _____ Starting circuit resistance test (voltmeter from positive battery terminal to starter term) _____ volts
- _____ Alternator output test (regulated) _____ Amps
- _____ Voltage regular test _____ volts
- _____ Charging system resistance test (AT 20 AMPS): (use voltmeter)
- _____ Out put terminal of alternator to positive terminal of battery _____ volts
- _____ Frame of alternator to negative term of battery _____ volts
- _____ Diode-stator test
- _____ Residual current draw (negative terminal of battery to negative cable) _____ Milliamperes

ENGINE

- _____ Check routing of heater hose, install pipe and/or support brackets, tighten clamps
- _____ Check oil pan, valve cover and rocker arm cover bolts
- _____ Torque manifold and exhaust pipe bolts and nuts
- _____ Check all electrical connections
- _____ Check throttle linkage and adjust (on non electronic engine)
- _____ Adjust engine accessory drive belts
- _____ Check modulator and governor linkage

ROAD TEST

- _____ Check travel angle
- _____ Steering gear operation (lock to lock), lost motion, shimmy
- _____ Panic stop (not sliding); brake action, engine idle
- _____ Rear axle and drive line noise
- _____ Transmission: operation, noise
- _____ Automatic shift points up 1-2 ____ 2-3 ____ 3-4 ____ (WOT)
- _____ Automatic shift points down 4-2 ____ 2-1 ____
- _____ Test for maximum mph _____ top speed
- _____ Break meter test _____ % (Brake meter min. 60%)

AFTER ROAD TEST

- _____ Adjust lubricant level in transmission and differential
- _____ Park vehicle in a clean dry area, observe 5 min. later for leaks
- _____ Bar test wheel bearings
- _____ Property complete a TD-8B Preventive Mileage Service Form

REMARKS: _____

Mechanic Signature _____

EQUIPMENT REPAIR AND PARTS ORDER

FUEL AND LUBRICANT ISSUE TICKET

School System

Bulk Pump Reading

Ending _____
Beginning _____
Gal. Used _____

Truck Meter Reading

Ending _____
Beginning _____
Gal. Used _____

***Charge fuel to nearest tenth of a gallon**

Mechanic No.

Mechanic Signature

30 DAY SCHOOL BUS INSPECTION WORK SHEET

[NOTE: ALL ACTIVITY BUS INSPECTIONS REQUIRES USE OF WORK SOURCE (I)]

MILEAGE _____

BUS NO. _____ MAKE _____ MODEL _____ SCHOOL _____ DATE _____

OK	Items Inspected	Needs Repairs	OK	Items Inspected	Needs Repairs
(1) _____	Steering: Fluid Added _____	_____	(22) _____	Clean: Int. _____ Ext. _____	_____
(2) _____	Brake, Foot (Check & Adjust)	_____	(23) _____	Fire Ext. _____ First Aid Kit _____	_____
(3) _____	Clean Slacks w/wire brush	_____		Body Fluid Kit _____	_____
(4) _____	Drain Air Tanks Completely	_____	(24) _____	Seats: All covers, foam pads, frames (seat cushions secure)	_____
(5) _____	Brake: Fluid Added _____	_____	(25) _____	Seat Belts (All)	_____
(6) _____	Brake, Park (Check & Adjust)	_____	(26) _____	Exhaust System	_____
(7) _____	Stop Sign & Walking Arm	_____	(27) _____	Cooling System: Added _____	_____
(8) _____	Batteries & Cables	_____	(28) _____	A. Freeze Protection _____ °	_____
(9) _____	Tires: LF _____ RF _____ LRO _____ LRI _____ (Record Air Pressure) RRO _____ RRI _____	_____	(29) _____	Engine: Oil Added _____	_____
(10) _____	Tires: LF _____ RF _____ LRO _____ LRI _____ (Record Tread Depth) RRO _____ RRI _____	_____	(30) _____	Drain Fuel Water Separator	_____
(11) _____	Entrance Steps & Handrails	_____	(31) _____	Engine Belts (Adjust All)	_____
(12) _____	Door Controls (All)	_____	(32) _____	Transmission: Fluid Added _____	_____
(13) _____	Warning Buzzers (All)	_____	(33) _____	Drive Shaft	_____
(14) _____	Bus Body Glass (All)	_____	(34) _____	Differential: Lube Added _____	_____
(15) _____	Windshield Wipers (Arm Travel) Washer Fluid Added _____	_____	(35) _____	Springs and Hangers	_____
(16) _____	Sun Visor	_____	(36) _____	Lettering & Paint	_____
(17) _____	Horn	_____	(37) _____	Body & Sheet Metal Damage	_____
(18) _____	Lights (All)	_____	(38) _____	Wheel Chair Mounts (If equipped)	_____
(19) _____	Turn Signals & Cancellation	_____	(39) _____	Wheel Chair Lift (If equipped)	_____
(20) _____	Mirrors (All)	_____	(40) _____	Governor _____ MPH (maximum)	_____
(21) _____	Dash Instruments (All)	_____	(41) _____	Check Travel Angle	_____
			(42) _____	ROAD TEST COMPLETED	_____

Remarks: _____

Shop _____ Work Source D _____Repair Code # MI _____ Labor Hours _____ Mech. # _____Repair Code # MI _____ Labor Hours _____ Mech. # _____Repair Code # 32 _____ Labor Hours _____ Mech. # _____

(Record labor to nearest tenth hour)

Mechanic's Signature _____

(NOTE: KEY LABOR BY DATE ON INSPECTION SHEET)

BUS DRIVER SIGN IN SHEET

DATE _____

SCHOOL _____

PRINCIPAL _____

EXTRA BUS SCHEDULE (ASSIGNMENT)

REPORTED BUS DEFECT LOG

DATE: _____

LIST SCHOOL AND TIME OF CALL FOR EACH GROUP:

SERVICE CALL LOG

14. School Bus Garage Shop Equipment

It is recommended that all school bus garages be equipped with the following minimum equipment. Additional equipment may be required for your operation.

QUANTITY	TYPE OF EQUIPMENT
1	Headlight aligner, complete set
1	High pressure washer
1	Ignition tester, electronic
2	Impact wrenches 1/2" and 3/4 " or 1"
8	Jack safety stands, heavy duty
3	Jacks, hydraulic or air (minimum 10 ton)
1	Key machine
1	Kunrl machine (valve guide repair)
1	Masking paper dispenser
1	Metal cutting shears
1	Metal lathe (engine lathe)
1	Micrometers and calipers, inside and outside, complete set
1	Milliamperc meter (0-150)
1	Paint gun (5 gallon pot with agitator)
2	Paint respirators (OSHA) approved
1	Pin hole grinder
1	Power hacksaw
1	Press, 40 ton
2	Pressure gauges, 1 air and 1 hydraulic
1	Pressurized brake bleeder
1	Radiator temperature gauge
1	Radio system, two way (1 base station, 1 radio station, 1 radio on each service vehicle)
1	Rear axle nut sockets, complete set
1	Ridge reamer
1	Rivet gun, air operated
1	Sander, disc type, heavy duty
1	Sander, orbital
1	Socket set, heavy duty metric and standard
1	Steering wheel puller
1	Tap and die set
1	Timing light, electronic
1	Tire balancer
2	Tire changers, 1 truck and 1 car
1	Tire inflation cage
1	Tire matching gauge

QUANTITY	TYPE OF EQUIPMENT
3	Torque wrenches, 3/8" drive, 1/2" drive and 3/4" or 1" drive
1	Transmission gear lube gun
1	Transmission jack
1	Transmission stand
*	Tread depth gauge, 1 for each man
1	Tune up equipment, complete set (volt/amp tester, ohm meter, timing light, compression tester, rpm gauge, vacuum gauge, combustion analyzer) or preferably
1	Engine analyzer
1	Pro-link 9,000 or equal (electronic test unit)
1	Brake drum and rotor gauge
**	Minimum 20,000-gallon fuel storage, including 1 shop pump and 2 bulk pump with meter for each fuel type

* Each mechanic shall have a battery terminal puller and battery terminal spreader

15. Additional Equipment Installation

Because of the State's responsibility to replace school buses, no school bus is to be altered in appearance, color, lettering, or equipment unless authorized by the Department of Public Instruction, Transportation Services Section. It is permissible to update older model school buses to the current year school bus specifications. Any safety item included in the most recent issue of the North Carolina School Bus Specifications may be added. However, the items must be of the same model and type of material as described in the specifications and also installed in the manner described in the specifications. The following list includes safety items that may be added to update older school bus specifications without specific written approval:

- Reflective lettering
- Polyurethane paint
- Reflective stop sign material
- Air dryer
- Automatic slack adjusters
- Parking brake interlock
- Synthetic differential lube
- Driver fan
- Exhaust pipe extension turn down
- 11R22.5 radial tires
- Proform fire block seat material
- Strobe lights
- Rearview lens
- Double nickel mirrors
- Roof hatches
- Backup alarms
- Right side hand rails

Other safety or cost efficiency items not included in the school bus specifications may be installed on your school buses. However, Transportation Services must receive a written request and approval granted prior to actual installation on a bus(es). Any item added would be considered a pilot test and must be reviewed by a Transportation Services staff member prior to the bus being put in service.

The following are some examples of test pilots that have been conducted:

- Lomar crossover mirrors
- Transpec roof hatches
- Strobe stop signs
- Rear mounted strobe lights (adopted in 1996 School Bus Specifications)
- Backup alarms (adopted in 1996 School Bus Specifications)

D. PM MANUAL COMMITTEE MEMBERS

The members of this committee were selected as representatives from the three geographical areas of the state.

AREA #1 — Eastern North Carolina

Cato Devane	Area Transportation Consultant (NCDPI)
John Evans	Transportation Director (Johnston County)
Jeff Smith	Transportation Director (Onslow County)
Jerel Winslow	Transportation Director (Pasquotank County)

AREA #2 — Central North Carolina

Johnnie Hardee	Area Transportation Consultant (NCDPI)
Terry Smith	Shop Foreman (Guilford County)
Billy Smith	Shop Foreman (Randolph County)
Ronnie McDonald	Shop Foreman (Harnett County)
Ronnie Apple	Shop Foreman (Alamance County)

AREA #3 — Western North Carolina

David Sluder	Area Transportation Consultant (NCDPI)
Charles Ball	Shop Foreman (Forsyth County)
Alfred Schrum	Shop Foreman (Lincoln County)
Mike Ellis	Shop Foreman (Wilkes County)