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INTRODUCTION

Thank you for selecting the Blue Bird TC. Your TC is the result of developments in mass transportation which have been ongoing since 1927. The design and construction of the TC reflects Blue Bird’s concern for efficiency and—above all—safe operation.

This manual has been prepared to acquaint you with various aspects of service, maintenance, and operation. It explains the various features and controls which should be familiar to the operator before he or she attempts to drive the unit, and it will help keep your Blue Bird TC in top operating condition and help extend its service life.

Your Blue Bird TC may have some or all of the equipment described in this manual. Therefore, you may find maintenance data for equipment not installed on your bus. Please note that some sections of the manual are written for more than one product offered by Blue Bird, so some illustrations may differ slightly from what you find on your own bus. Text, illustrations, and specifications in this manual are based on information available at the time of printing. We reserve the right to make changes at any time without notice. To obtain maintenance and parts information, refer to Blue Bird Chassis Maintenance Manual and Parts Catalog. You are encouraged to contact your Blue Bird distributor if additional maintenance information or assistance is needed.

The complete line of Blue Bird Service Parts is available from your Blue Bird distributor. The use of original Blue Bird replacement parts and components will help ensure that your TC remains true to its original design, best preserving our high standards of performance, efficiency, and safety.

Proper operation, service, and maintenance are important to the safety and reliability of all motor vehicles. The information contained herein is provided as a reference for systems and components that require periodic service. The intervals given are manufacturer’s recommendations and should be considered maximum intervals. Actual operating conditions must be considered and maintenance intervals adjusted accordingly. Any time a system does not perform satisfactorily, corrective service should be performed at once.

Familiarity with automobile operation and controls is not a prerequisite, but is assumed to be common knowledge to all who will be operating this coach. Basically, control and operation are the same for both, but the driver must recognize some distinct differences before attempting to operate the coach.

Remember: The bus is eight feet wide without outside mirrors and is 25 to 40 feet long. Therefore, it is two feet wider and two to three times as long as the average automobile. Acceleration will very likely be slower than that of an automobile. The new operator may find that steering, brakes, and other systems feel different from what is familiar. This makes it very important, from a safety standpoint, for him or her to become completely familiar with bus operation through experience before attempting passenger transit. The operator will observe other differences, but after basic familiarization and some practical experience, he or she will find the operation quickly becomes quite natural, comfortable, and far from difficult.

CAUTION: No one should attempt to operate this coach without: (1) thorough knowledge of all instruments and controls; (2) supervision, or actual driving experience in this or a similar vehicle under supervision; and (3) an appropriate license or permit to operate. Do not drive the coach until the space in front, on the sides, and in the rear is unobstructed. Most accidents occur because the operator did not ensure a clear path before driving.

The operator should read this manual before attempting to drive the unit.

This manual provides you with the most current maintenance and operation information available. We welcome your comments and suggestions regarding this manual. Please direct all correspondence to:

Blue Bird Body Company
Attn: TECHNICAL PUBLICATIONS
P.O. Box 937
Fort Valley, GA 31030
FOREWORD

This Operator’s Manual provides some general and specific information regarding safe operation and maintenance of your Blue Bird bus. It does not address all items or situations that may arise, and it is not a substitute for proper driver and mechanic training. Exercise of care, common sense, and good driving and working practices are required for safe operation.

If this manual does not adequately address your specific questions or concerns, please contact your Blue Bird distributor. The distributor will answer your questions or put you in contact with the proper factory personnel.

Throughout this guide you will find CAUTIONS and WARNINGS. CAUTIONS are given to prevent you from making an error which could damage the vehicle and possibly cause personal injury. WARNINGS remind you to be especially careful to avoid personal injury.

Blue Bird Corporation offers many items as standard and optional equipment to meet Federal, state, and local specifications and individual customer requirements. Properly selected equipment can help ensure reliable and safe transportation of passengers.

Examples of this safety equipment include: stop arms, crossing guards, warning lights, warning light monitors, mirrors, first aid kits, fire extinguishers, warning reflectors, fusees, directional and brake lights, warning buzzers, security locks, emergency exits, and seat belts.

It is the driver’s responsibility to ensure that the safety items are in proper order. Equipment relating to safety should be checked for operation on a daily basis. Safety equipment may vary due to Federal and state specifications, and individual customer requirements.

In addition, the driver/operator must ensure that the loading area around the bus is clear of pedestrians before stopping, and that all unloaded passengers are a safe distance away from the bus before moving.

REPORTING SAFETY DEFECTS

If you believe your vehicle has a safety defect which could cause a crash or could otherwise result in injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) as well as Blue Bird Corporation.

If NHTSA receives similar complaints, it may open an investigation and, if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, and/or Blue Bird Corporation.

To report safety defects, or to obtain information about motor vehicle safety, you may call NHTSA’s Auto Safety Hotline toll-free at (800) 424-9393, or (202) 366-0123 in the Washington, DC area. You may access their website at http://www.nhtsa.dot.gov/. Their mailing address is:

NHTSA
U.S. Department of Transportation
Washington, DC 20590
COACH IDENTIFICATION

The Vehicle Certification Plate certifies that the vehicle conforms to all applicable Federal Motor Vehicle Safety Standards in effect at the date of manufacture. Do not remove or deface this plate.

MANUFACTURED BY
BLUE BIRD BODY COMPANY
DATE OF MFR. ____________
INC. VEH. MFG. BY _________ DATE _________
SUITABLE TIRE - RIM CHOICE
GVWR _______________
GVWR : FRONT __________ WITH __________ TIRES
GVWR : REAR __________ WITH __________ TIRES
RIMS, AT __________ PSI COLD SINGLE
RIMS, AT __________ PSI COLD DUAL
THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT IN V.I.N. __________ CLASSIFICATION __________

The Body Serial and Service Number Plate is located on the front upper inner panel above the windshield. Refer to the data on this plate for registration purposes or for replacement part information.

BLUE BIRD BODY CO.
FORT VALLEY, GEORGIA
BODY NO. __________
CAPACITY __________
MODEL YEAR __________
BODY SERVICE NO. __________

The Axle Record and Chassis Service Number Plate is located on the front upper inner panel above the windshield. Refer to the data on these plates for registration purposes or for replacement part information.

FURNISH INFORMATION BELOW WHEN ORDERING AXLE PARTS
CHASSIS SERIAL __________
ENGINE SERIAL __________
FRONT AXLE BRAKE LINING FMSI NO. & FRICTION CODE
BRAKE DRUM __________
REAR AXLE BRAKE LINING FMSI NO. & FRICTION CODE
BRAKE DRUM __________
REAR AXLE RATIO __________
CHASSIS SERVICE NO. __________
INSPECTION

PRIOR TO PLACING THE NEW BUS IN SERVICE, PERFORM THE FOLLOWING:

- Check suspension U-bolt torque.
- Check Neway suspension torque.
- Check brake adjustment.
- Check body tie-down bolts torque.

DAILY INSPECTION

To keep your bus in the best operating condition in terms of safety, convenience, service, and operating expense, follow these recommended inspection procedures on a daily basis. Any malfunctions or defects should be corrected before the next trip. Report needed services to responsible maintenance personnel.

- Check fuel level.
- Drain air tanks (cold weather).
- Check engine oil level.
- Check coolant level.
- Check automatic transmission fluid level.

Outside the bus:

- Wipe clean the windshield, mirrors, front windows, headlights, taillights, directional lights, and stop lights.
- Is the tailpipe clear?
- Does the rear emergency door open and close? Check warning buzzer operation.
- Check tire pressure and treads. Are the lug nuts in place?
- Drain the air brake tank.
- Is the area under the bus all clear?
- How is the general outside appearance? Is it clean? Is there a clear view of identifying features (license plate, school name, bus number, etc.)?
- Are the mirrors clean and adjusted?

Inside the bus:

- Are the seats and floor clean? Are the steps and aisle clear?
- Verify that the emergency exits, rear door, and windows can all open and close.
- Check emergency equipment and first aid kit.
- Is fire extinguisher in place?
- Are the windshield and windows around the driver’s area clean?
- Are the mirrors clean and adjusted?
- Are emergency doors/windows unlocked and operating freely?
- Do buzzers activate when exits are not fully latched?

Starting the engine:

- Be sure parking brakes are on.
- Put in Neutral.
- With key on, check fuel gauge. Check brake warning buzzer or light, neutral safety switch.
- Start engine. Look and listen for trouble signs; check gauges.

With the engine running, check (from driver’s seat):

- Mirrors, interior and stepwell lights, service door seal.
- Does the steering feel OK? Is there any unusual noise?
- Horn, defroster/heater blower, windshield wiper operation.
- Does brake pedal have right height and feel; is gauge reading OK? Parking brake release, reset.

Outside checks required before driving away:

- Check right- and left-turn signals in front and rear. Are they clean and flashing?
- Are flasher warning lights in front and rear clean and flashing?
- Is stop arm clean and working?
• Check hi-lo beams in headlights.
• Are stoplights and taillights clean and working?
• Is hazard flasher working?

**Final check while moving the bus:**
• Is seat belt fastened?
• Do brakes stop and hold?
• Does steering feel OK? Are there any unusual noises? Is bus under control... tracking straight?
• Brake to a stop. Are all gauges OK?

**Remember:** Safety on the road depends on you. Observe weather and road conditions and drive accordingly. Be physically and mentally alert. When backing up near pedestrians or in congested areas, use outside monitor or director. Look around before driving away from where you are parked and observe all traffic rules and regulations.

**WEEKLY INSPECTION**

- Adjust shoe-type brakes.
- Drain air tanks (warm weather).
- Check tires.
- Inspect seat cushion attachments for tightness.
- Inspect seat belts and buckles.
- Inspect outside lights for proper operation.

**OPERATOR’S COMPARTMENT**

1. Driver’s seat.
2. Switch panel.
3. Horn button—sounds electric horn.
4. Instrument panel.
5. Turn signal lever—operates turn signals.
6. Automatic transmission shift control (range selector or electronic push button pad) location.
7. Heater and defroster controls.
8. Brake pedal or air treadle—applies service brakes.
10. Dimmer switch—selects headlight high or low beam.
11. Tilt steering lever.
13. Ignition switch—controls ignition and starting circuits.
14. Parking brake—prevents unit from rolling when parked.
15. Throttle lock—for high idle or warm-up. **WARNING:** Do not use throttle lock as a means of cruise control. Always release throttle lock before putting vehicle into motion.
16. Driver’s fresh air vent control.
17. Hazard light flasher switch.

**NOT ILLUSTRATED**

- Door control.
- Wig-Wag—low air pressure warning.
- Warning light monitor—indicates whether warning lights are working.
- Inside mirror.
- Fusee canister.
- Reflector flares and flags
- High idle switch.
TILT AND TELESCOPING STEERING

To adjust steering wheel position, use the tilting lever located on the left side of steering mounting bracket. Press lever downward to unlock steering column. Move column to one of four positions and release lever. To raise or lower the steering wheel position, pull up on the tilting lever. This will enable you to raise or lower the steering wheel to one of its seven positions.

INSTRUMENT PANEL AND CONTROLS

Note: At the time of printing, Blue Bird TC instrument panels were in transition from an older to a newer design. Please see the addendum accompanying this manual for information on the newer design.

DASH AND INSTRUMENT PANEL

1. Ammeter (Optional)—Indicates battery charge and discharge.
3. Dash light rheostat switch—Dims and/or brightens dash lights.
4. Combustion air restriction gauge (Optional) or Sanders switch (Optional)—Combustion air restriction gauge measures air restriction through air intake and indicates service required for air filter. Sanders switch operates sanders function.
5. Cruise control on/off switch (Cummins ISB and ISC engines)—Activates or inactivates the cruise standby mode.
6. Cruise set/resume switch (Cummins ISB and ISC engines)—When vehicle reaches desired cruise speed depressing the set switch sets the speed. When the vehicle drops below 30 MPH or brake pedal is depressed the cruise returns to standby mode. To reactivate to preset speed depress the resume switch.
7. Transmission oil temperature gauge (Optional)—Indicates transmission oil temperature in transmission sump.
8. Multifunction Gauge Switch—Toggle/Scroll switch for multifunction gauge. (See CLUSTER INSTRUMENTATION)
9. Ignition switch—Controls ignition and starting circuits.
10. Parking brake valve—Prevents unit from rolling when parked.
11. High idle switch—Sets engine at high idle rpm.
12. Low idle adjustment (Cummins ISB and ISC engines)—Low engine idle speed can be adjusted between 700 and 875 rpm. This allows the operator to adjust the idle speed up or down in increments of 25 rpm. When adjusted, a new low engine idle speed is established and saved when the key switch is turned off.
13. Quick start aid (Optional)—Aids in quick start of engine by injecting a measured amount of ether.
14. Engine Maintenance Lamp (On Cummins ISB and ISC engines)—Amber lamp indicates need for engine maintenance.

**CLUSTER INSTRUMENTATION**

This unit has been delivered with the new Blue Bird instrument cluster. Reducing instrumentation by combining gauges and providing easily recognized and viewed indicators, the cluster is a system designed with several new features that emphasize enhanced vehicle safety and driver ergonomics.

The cluster is programmed at the factory for the specific application, based on information about the engine, transmission, axle, and tires. The multifunction gauge, indicator lights, and chassis alarm buzzers indicate when vital parameters exceed allowable limits. If any component is changed, the dash should be reprogrammed. Normally, the instrumentation shows speed, engine speed, fuel level, and odometer. See below for description of components.

1. Speedometer/Kilometer gauge is a precision electronic instrument, programmed for specific applications of engine, transmission, tire size, and drive axle ratio. Your Blue Bird distributor can easily program the cluster and the speedometer to maintain factory precision if you change tire sizes. To maintain speedometer accuracy, tires must be maintained at proper inflation. This gauge indicates vehicle speed MPH and kilometers per hour.
2. Multifunction gauge—See MULTIFUNCTION GAUGE.
3. Tachometer—The tachometer indicates engine speed in rpm x 1,000.
4. Indicator light panel—Panel of lights indicates conditions of individual operating systems. See INDICATOR LIGHT PANEL.
5. See LIQUID CRYSTAL DISPLAY.

**MULTIFUNCTION GAUGE**

One prominent new feature is the multifunction gauge, that combines several engine functions into one focal point. This allows the driver to concentrate more on driving conditions and safe passenger transportation without being distracted by multiple gauges.

The multifunction gauge in center of the instrumentation panel indicates 1) fuel level, 2) oil pressure, 3) battery voltage, and 4) coolant temperature, as shown.
Under standard operating conditions, when the bus is started, the multifunction gauge at start up will display each of these conditions in sequence, and then return to displaying fuel level. If oil pressure, battery voltage, or coolant temperature reaches alarm conditions, the gauge will switch to display that parameter, and the indicator light will illuminate. Additionally, an audible alarm will sound if oil pressure and/or coolant temperature exceeds alarm limits. The operator can scroll via the toggle switch to check other conditions of the multifunction gauge (see DASH AND INSTRUMENT PANEL section). A chirp sounds when the gauge is switched to another parameter, whether done manually or automatically. If the operator turns the gauge to a display setting other than fuel level, and leaves it for more than 30 seconds, it will change back automatically to display the fuel level. If there is a warning condition, the multifunction gauge will chirp and show the condition requiring attention; warning condition will continue until condition is serviced. If there is more than one warning condition, the gauge will chirp and scroll through the conditions requiring service. This non-distractive display keeps the driver informed of conditions which require prompt service, but allows him or her to concentrate on the primary task of transporting passengers safely.

**WARNING:** An engine buzzer will sound to indicate low oil pressure and/or high coolant temperature. Do not operate vehicle under these conditions. **NOTE:** Battery voltage alarm will beep if battery voltage is below 11.5 volts or above 14.5 volts. The battery voltage gauge will remain “ON” until condition is corrected.

**LIQUID CRYSTAL DISPLAY**

The liquid crystal display (LCD) air gauge, if so equipped, represents graphically the air pressure in the front and rear air brake systems. It displays relative pressure values in red and green color segments, with one set of segments for front brakes and one for rear brakes. Green segments indicate adequate air pressure. Dangerous air pressure conditions are indicated by red segments, as well as the LOW AIR indicator light, the brake warning indicator, and an audible alarm. The air compressor is set to maintain normal system pressure at 120±5 psi, which also is the point where the LCD changes from the fourth to the fifth green segment. Due to variance in air systems and in relative pressure measurements, the LCD air gauge may routinely display normal system pressure with four green segments in one brake system and the fifth green segment in the other brake system. Normal pressure is indicated with four or five green segments in each brake system.

As an additional enhancement feature to the instrumentation the LCD is equipped with an engine hourmeter. The engine odometer/hourmeter can also be toggled by the operator without engine ignition. By turning on the headlight switch, the operator can scroll between odometer setting and hourmeter setting with the multifunction gauge toggle switch on dash. The odometer (1) records mileage on vehicle while the hourmeter records elapsed time of engine running.

1. Engine Odometer/Hourmeter.
2. Indicates air pressure in rear reservoir.
3. Indicates air pressure in front reservoir.

On air brake units, this instrument is also equipped with an air pressure liquid crystal bar graph gauge that indicates air pressure between 0 and 150 psi in increments of 15 psi. Pressures below 60 psi are indicated in red. Pressures above 60 psi are indicated in green. **NOTE:** Air pressure LCD will not display below -4°F (-20°C).

**WARNING:** Do not drive the vehicle until system air pressure has built up to adequate levels.
Another safety enhancement to the cluster is the programmable low fuel indicator. It can be programmed by your Blue Bird distributor to monitor fuel level and provide warning when level reaches programmed setting. The default setting is 1/8 of a tank.

Indicator lights depict all multifunction gauge functions, warning conditions, and system operations. The indicators are easily recognized and described below.

1. Engine Retard (Optional)—Red light indicates that the engine retarder is engaged.
2. Brake Warning—Red light with buzzer indicates that brake pressure is low.
3. Stop Light—Red light indicates that service brake is applied.
4. Anti-Lock (Optional)—Amber light indicates an anti-lock brake fault.
5. High Beams—Blue light indicates that headlights are in High Beam.
6. Low Coolant—Red light indicates that coolant is low.
7. Coolant Temperature—Red light indicates that coolant temperature is out of limits.
8. Oil pressure—Red light indicates that oil pressure is low.
9. Left Turn Directional—Green light indicates left turn.
10. Fuel—Amber light indicates low fuel at approximately 1/8 of a tank.
11. Low Air—Red light with buzzer indicates that air brake pressure is low.**
12. Parking brake—Red light indicates that parking brake is engaged.
13. Fuel Filter (Optional)—Red light indicates that fuel filter needs checking.
14. Sander Refill (Optional)—Red light indicates that sand quantity is low.
15. Engine Preheat (Optional)—Green light indicates diesel engine preheat. Wait until light goes out to start.
16. Service Engine Soon (Optional)—Amber light indicates that engine requires service soon.
17. Stop Engine (Optional)—Red light indicates that engine must be stopped immediately.
18. Engine Over-Speed (Optional)—Amber light indicates that engine is running over speed.
19. Right Turn Directional—Green light indicates right turn.

**WARNING: In the case of a brake system failure, a warning buzzer will sound and warning light illuminate, indicating trouble. The coach must not be operated under these conditions, but repaired before continuing operation.
SWITCH PANEL

![SWITCH PANEL Diagram]

1. Dome
2. Cluster Lamps
3. Pilot
4. Manuals
5. Master
6. Fan
7. Wipers/Washers

DESTINATION SIGNS

**Hinged Sign Front**—Mounted on outside of front roof cap with internal control for changing sign. Periodically lubricate hinges and lever assembly with lightweight lubricating oil.

**Hinged Sign Rear**—Mounted on outside of rear roof cap, manually changed from outside. Periodically lubricate hinges with lightweight lubricating oil.

**One Station Lighted Curtain**—Replace bulbs as needed. May occasionally loosen and cause slack in the curtain due to vibration. To tighten curtain, loosen bolts, pull curtain tight, retighten bolts.

**Roller Destination Sign with Lighted Curtain**—Replace bulbs as needed. May occasionally require same adjustment as One Station Sign. Periodically lubricate roller gears with light grease, such as “White Lube,” and hinges on access door with lightweight lubricating oil. To change sign, turn crank located on front upper inner panel above windshield to desired destination.

**Two Station Sign**—Front lighted, sign material masonite with lettering on both sides. Lubricate interior door hinge on front upper inner panel with lightweight lubricating oil.

**Lighted “School Bus” Sign**—Back lighted yellow plexiglass sign. Replace bulbs as needed. Lubricate interior door hinge on front upper inner panel with lightweight lubricating oil.

**NOTE:** All maintenance procedures to be done at six months or 6,000 mile intervals, whichever occurs first.
SEATS AND SEAT BELTS

DRIVER’S SEAT (Standard)

The driver’s seat may be adjusted fore and aft by pushing forward the release lever located beneath the seat at the center right side, adjusting the seat, and releasing the lever when the seat is in the desired position. To raise or lower the seat, release two height adjustment handles by turning counterclockwise. Raise the seat by lifting it to the desired position. Lower the seat by depressing the height adjustment pedal to release the latch mechanism. Retighten the adjustment handles after the seat is in the desired position.

WARNING: Do not attempt to adjust seat while vehicle is in motion. Do not adjust height adjustment while sitting in driver’s seat. Keep feet and other items away from height adjustment handles and pedals while vehicle is in motion.

BOSTROM DRIVER’S SEAT (Optional)

1. Weight and Height Adjustment—To adjust, push in valve knob to raise seat and pull out to lower. When adjusted properly, the seat should not be pushed against the top or bottom end limits of vertical motion under normal driving conditions. Adjustment position should also provide for driving visibility and vehicle control.
2. Fore and Aft Adjustment—Hold lever to the left to adjust seat position forward or backward.
3. Back Angle Adjustment—Lean forward slightly to remove pressure from seat back. Hold handle rearward to adjust to any position within range.
4. Cushion Tilt Adjustment—Rotate seat tilt knob to decrease or to increase seat tilt.
5. Lumbar Adjustment—Rotate knob forward to increase or rearward to decrease the support in the lumbar area.

WARNING: Do not attempt to adjust seat while vehicle is in motion. Do not adjust height adjustment while sitting in driver’s seat. Keep feet and other items away from height adjustment handles and pedals while vehicle is in motion.
DRIVER’S SEAT LUBRICATION

Moving parts of the driver’s seat require lubrication for ease of operation, as well as longevity and prevention of excessive wear.

Currently available is white lithium-based grease in an aerosol can. It gives excellent coverage when carefully directed into moving part joints. The very light coating of lubrication provided by aerosol-carried solvent-type solution works very well for penetrating into a joint and cleaning away dirt, but it should only be depended on for lubrication if it is applied frequently. A common 10W30 or 10W40 motor oil will provide good lubrication.

Remember that all moving part joints, tilt pivots, slide forward/back adjustment, and vertical motion pivots (four in all) require lubrication. This should be done every six months or 6,000 miles, whichever occurs first, with a lithium-based grease in aerosol form.

DRIVER’S SEAT BELT OPERATION

Driver’s seat belt should be worn at all times when the vehicle is being driven. Blue Bird driver’s seat belts have automatic locking retractors and are self-adjusting. They also have an anti-cinch device which prevents uncomfortable tightening of the belt as you drive. To use, withdraw an adequate length of belt from the retractor or retractors to allow the buckle halves to connect. After engaging the buckle halves, let the retractor withdraw the belt to a snug fit. Verify that the automatic locking mechanism is working properly by pulling the belt sharply against the retractor, which should resist. The buckle can be released by pushing the button in its center.

DRIVER’S SEAT BELT WITH SHOULDER HARNESS (IF SO EQUIPPED)

Driver’s seat belt shoulder harness is emergency locking; lap belt may be either emergency locking or automatic locking depending on the option chosen. The emergency locking retractor used for all shoulder harnesses and specified lap belts is dual sensitive. Emergency locking retractor engages when the vehicle tips 15° more, or if belt speed exceeds a preset rate. Automatic locking retractors for specified lap belts are self-adjusting. Adjust the shoulder belt bracket upward for taller drivers, downward for shorter drivers, or otherwise adjust to obtain maximum comfort.

To use, withdraw an adequate length of belt from the retractor or retractors to allow the buckle halves to connect. After engaging the buckle halves, let the retractor withdraw the belt to a snug fit. The buckle can be released by pushing the button in its center.

PASSENGER SEAT BELT OPERATION (IF SO EQUIPPED)

Individual lap belts for passengers are retractable or non-retractable depending on option ordered. Insert the catch into the buckle, test for assurance of latch fit, and pull loose end of strap until belt fits snugly across the lower hips. The buckle can be released by pushing the button in its center. The adjustable end can be moved outward on its strap by turning 90° to the strap and pulling.

SEAT BELT INSPECTION AND MAINTENANCE

Inspect seat belts and their attachments on a weekly basis. Check seat belt buckles and adjustability to ensure proper operation. If necessary, lubricate buckle with a graphite lubricant. When buckle is found to be inoperable, replace immediately. If there are any defects in the webbing (i.e., torn or frayed), the seat belt must be replaced immediately to ensure passenger safety. Hand-wash webbing with warm water and mild soap. Rinse thoroughly and dry in the shade. Do not bleach or redye, because such processing may severely weaken the assembly.

WARNING: Be sure the lap belt is fitted snugly around the hips, not the waist. Failure to do so may increase the chance of injury in the event of a collision. Do not bleach or redye, because such processing may severely weaken the assembly.
SEAT INSPECTION AND MAINTENANCE

Blue Bird seats are built to meet Federal Motor Vehicle Safety Standards. In order to provide even safer passenger transportation, follow these guidelines:

1. Inspect and retighten seat leg and wall side mounting bolts every 90 days.
2. Inspect and retighten cushion attachments with a Phillips-head screwdriver on a weekly basis.
3. Inspect upholstery for cuts and tears every 90 days. If upholstery is torn, remove it by taking out the staples at the bottom front of seat back or bottom of cushion and pulling the cover away. For installation of new cover, reverse this procedure.
4. School bus seats are equipped with a special foam back pad. If the pad becomes damaged, it should be replaced with an approved replacement part. Aftermarket suppliers should be checked for compliance with Federal standards.

SEAT CARE AND CLEANING

It is imperative that the interior of the bus be kept clean and seats are an important part of this maintenance. Regular cleaning and care will prolong the life of the seats and improve the general appearance of the entire bus.

Everyday dirt and soil—Most everyday soil and dirt may be removed with a soap and water solution. If the stain is persistent, a stiff bristle brush may be used. Fabric-covered seats should be rinsed with clean water after the stain is removed.

Paint, tar, and asphalt—Remove the stain immediately using a damp cloth and kerosene. Rub gently, using small strokes. Rinse thoroughly. NOTE: This type of stain may become permanent if not cleaned immediately.

Nail polish and lacquer-based stains—Soak up as much as possible with dry cloth immediately. Any remaining stain may be removed with a nonflammable cleaning fluid such as “Tuff Stuff” or “Armor All” cleanser. Rinse thoroughly with clean water.

Gum, grease, and shoe polish—Remove as much as possible immediately. If left for any length of time, shoe polish will stain permanently. Clean any remaining stain with “Tuff Stuff” or “Armor All” cleanser.

Ink—Remove stain immediately using a damp cloth and alcohol.

SEAT CUSHION REMOVAL AND INSTALLATION—DOT SEATS

WARNING: If seat cushions are removed for maintenance, they must be reinstalled using the following instructions. Failure to comply with these instructions could result in injury from unattached seat cushions in the event of an accident.

Removal

1. Loosen the two front swivel type clamps at the front underside of the cushion with a Phillips-head screwdriver. Caution: Do not remove clamps.
2. Rotate the swivel clamps so as to clear the front retaining channel frame.
3. Lift the forward edge of cushion two to three inches and pull cushion forward to remove.

Installation

1. Place the rear edge of cushion down on the base portion of the seat frame. Lifting the forward edge two to three inches, slide the cushion to the rear to engage the positive type clamp into the rear retaining channel.
2. Lower the forward edge to the frame, making sure the swivel clamps are inside the frame and the positive type clamps are secure on the rear retaining channel.
3. Rotate the swivel clamp to engage the forward retaining channel frame.
4. Tighten with Phillips-head screwdriver until clamps do not rotate.
**SEAT CUSHION REMOVAL AND INSTALLATION—DOT SEAT BELT SEATS**

**Removal**
1. Loosen the two front swivel-type clamps at the front underside of the cushion with a Phillips-head screwdriver. **Caution: Do not remove clamps.**
2. Rotate the swivel clamp located at the rear underside of seat cushion.
3. While lifting the rear edge of the cushion, pull the cushion to the rear and remove.

**Installation**
1. Place the forward edge of the cushion two inches to the rear of the front retaining channel. Slide the cushion forward, engaging the positive clamps onto the forward retaining channel.
2. Lower the rear edge to the frame and rotate the swivel clamps so they engage the square tube crossmember.
3. Tighten screws in front and rear clamps with Phillips-head screwdriver until clamps do not rotate.

**TRACK MOUNTED PASSENGER SEATS**
If your bus is equipped track mounted passenger seats and you relocate the seats or remove the seats to accommodate wheelchairs, you must follow rules of spacing and placement to comply with FMVSS 222 “School Bus Passenger Seating and Crash Protection” and FMVSS 217 “Bus Window Retention and Release”.

The decal (as shown) which gives these rules is installed on the interior body panel above the windshield.

All passenger seats must have a seat or barrier in front of it to provide compartmentalization required by Federal Motor Vehicle Safety Standards. As you reconfigure your bus, you may need additional barriers. Barriers are available from Blue Bird Body Company Part Sales.

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**FEDERAL STANDARD REQUIREMENTS FOR TRACK SEAT PLACEMENT**
ALL PASSENGER SEATS MUST HAVE A SEAT OR BARRIER THE SAME WIDTH AS THE SEAT IN FRONT OF IT

<table>
<thead>
<tr>
<th>Seat Spacing Measured at Aisle</th>
<th>Rear Seat Placement - Driver's Side</th>
<th>Side Emergency Door Clear Aisle</th>
<th>Emergency Exit Release Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.00 MIN. 31.00 MAX.</td>
<td>12.00</td>
<td>12.00</td>
<td>2.00</td>
</tr>
</tbody>
</table>
FLAT FLOOR UNITS

NOTE: This information is provided for units equipped with the flat floor option. Flat floor option 3515 is offered on TCFE model 2511 as a regular option and on other models as a temporary option. The following guidelines must be followed to meet Federal Motor Vehicle Safety Standards and for ultimate passenger safety.

SEAT AND RESTRAINING BARRIER INSTALLATION

WARNING: This vehicle was manufactured in conformance with all Federal Motor Vehicle Safety Standards in effect on the date of manufacture. Two of the important Federal Motor Vehicle Safety Standards applicable to large school buses are FMVSS 217, “Emergency Exits”, and FMVSS 222, “School Bus Passenger Seating and Crash Protection”. Anyone who adds, removes, or rearranges seats and restraining barriers in this vehicle should be familiar with the requirements of FMVSS 217 and 222 and exercise care to ensure that the vehicle’s seat and seating arrangement remains in conformance with those requirements.

The following list of items are some of the common requirements that must be followed to ensure compliance to Federal Motor Vehicle Safety Standards 217 and 222.

- All seats and restraining barriers must be original OEM-designed, manufactured, and certified for school bus use with track mounted seating system.
- School bus seats must be forward-facing.
- School bus seats must have another school bus seat or a restraining barrier of the same width in front of them with the proper seat spacing.
- Seat-to-seat spacing must be 27 inches minimum to 31 inches maximum, as measured from common points on the seats. NOTE: State or local regulations may be more restrictive.
- Seat-to-restraining barrier spacing must be 11 inches minimum to 15 inches maximum measured from the barriers front mounting hole on the aisle side leg to the front mounting hole on the seat’s front aisle side leg.
- All seat mounting bolts, washers and track hardware must be of the same grade, size, and type as those originally installed in the vehicle. All 1/4-inch seat-to-seat mounting bracket fasteners must be torqued to between 11 and 12 foot-pounds. All 3/8-inch track-to-seat mounting bracket fasteners must be torqued to between 45 and 50 foot-pounds.
- Seats with seat belts must be attached to the track system in the vehicle using a total of five fasteners: three in the wall side mounting bracket and two in the aisle side mounting bracket. Special OEM track-to-seat mounting brackets must be used with seat belt seats to ensure proper fastener spacing attaching the seat to the track system.
- Location of seats and restraining barriers installed in vehicles with lift doors is critical. Minimum clearance dimension from centerline of front bow of lift to restraining barrier varies with lift size. Contact Blue Bird Engineering for appropriate seat and barrier location.
- Seats and restraining barriers must be located such that they do not obstruct or interfere with any emergency exit label, instruction, actuation device, or zone of access.

Please note that this is an incomplete list of the requirements set forth by FMVSS 217 and 222. It is your responsibility to be familiar with all aspects of these requirements before making changes to the arrangement or placement of seats and/or restraining barriers.
The following guidelines must be followed when doing any work on vehicle electrical components or wiring.

1. Before beginning any electrical work, disconnect all batteries. Always remove all battery ground straps first and replace last to prevent accidental arcing.
2. Use only proper gauge wiring with high-temperature insulation, such as chemically cross-linked polyethylene, which meets SAE J-1128 (150°C).
3. Be certain any added circuit is protected by a fuse or circuit breaker.
4. Any push-on terminal must be insulated.
5. When installing or replacing any wiring (other than ground straps), observe the following:
   A. Always use clamps to secure wires away from any sharp metal edges or moving components.
   B. Support wires at least every 30 inches with insulated clamps.
   C. Where wiring is connected to moving components such as the engine, provide an adequate slack loop to allow for motion in all directions. Clamp at both sides of loop.
   D. Be certain there is sufficient length in wires so they are not pulled in tension.
   E. Wires should be secured to remain four inches from exhaust pipes, manifolds, or turbochargers unless components are shielded.
   F. Use rubber grommets whenever wires must pass through holes.
   G. Cover all full-time hot or accessory and ignition hot wires with approved loom.
   H. Avoid routing wires in contact with fuel lines or plastic components.
6. Always be sure ground straps are replaced when any work is done on engine components. The alternator must have at least a six (6) gauge strap. The engine must have one strap, engine block, and transmission (use bolt that mounts transmission to rear face of engine block). Allow slack loop for engine motion. Use external star tooth washer between cable and frame.
7. Do not “splice” into existing wires. Instead, route wire full-length to appropriate source.
8. If accessories must be added, relays may be required; check installation instructions thoroughly. Use bank of circuit breakers in the electrical panel unless the accessory must be on during cranking, in which case the “hot bar” should be used.
9. Always use insulated rubber boots over hot six (6) gauge wiring on alternator, ammeter shunt, or junction blocks.

Quick Reference

<table>
<thead>
<tr>
<th>Wiring Circuit Color Code Major Circuits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FUNCTION</strong></td>
</tr>
<tr>
<td>Left Rear Directional Light</td>
</tr>
<tr>
<td>Right Rear Directional Light</td>
</tr>
<tr>
<td>Stop Lights</td>
</tr>
<tr>
<td>Back-up Lights</td>
</tr>
<tr>
<td>Taillights</td>
</tr>
<tr>
<td>Ground</td>
</tr>
<tr>
<td>Ignition Feed, Primary Feed</td>
</tr>
</tbody>
</table>

Refer to the master wiring diagram for wire colors for other circuits.
## LIGHT BULB DATA

<table>
<thead>
<tr>
<th>Lamp Description</th>
<th>Trade Name</th>
<th>Trade No.</th>
<th>Color</th>
<th>Bulb No.</th>
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<td><strong>INTERIOR LIGHTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dome</td>
<td>Weldon</td>
<td>8005</td>
<td>(Standard)</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>Weldon</td>
<td>8010</td>
<td>(Deluxe)</td>
<td>93</td>
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<tr>
<td>Stepwell</td>
<td>Arrow</td>
<td>35</td>
<td></td>
<td>67</td>
</tr>
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<td>Emerg. Door Light</td>
<td>Weldon</td>
<td>8025</td>
<td></td>
<td>67</td>
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<td>Switch Panel Pilots</td>
<td>Cole Hersee</td>
<td>PL19</td>
<td></td>
<td>53</td>
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<td></td>
<td>Dial</td>
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<td>68</td>
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<td>Switch Panel Illum.</td>
<td></td>
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<td><strong>EXTERIOR LIGHTS</strong></td>
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<tr>
<td>Directional</td>
<td>KD</td>
<td>772-9105</td>
<td></td>
<td>1156</td>
</tr>
<tr>
<td></td>
<td>Weldon</td>
<td>1010 Series</td>
<td>Red and Amber</td>
<td>1156</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Plain and w/Arrow</td>
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<tr>
<td></td>
<td>Signal Stat</td>
<td>1604</td>
<td></td>
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<td>Warning Light</td>
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<td>B-776-A12</td>
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<td>Amber and Red</td>
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<td></td>
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<td>Amber and Red</td>
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<td>Non-replaceable</td>
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<td>Stop-Tail/Tag</td>
<td>Grote</td>
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<td>1157</td>
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<tr>
<td></td>
<td>Weldon</td>
<td>7-1010-1</td>
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</tr>
<tr>
<td>Stop</td>
<td>Weldon</td>
<td>1010</td>
<td>Red</td>
<td>1156</td>
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<td>Arrow</td>
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<td></td>
<td>Signal Stat</td>
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<tr>
<td></td>
<td>KD</td>
<td>772-9105</td>
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<td>1156</td>
</tr>
<tr>
<td>Destination Sign</td>
<td></td>
<td></td>
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<td>89</td>
</tr>
<tr>
<td>School Bus Sign</td>
<td></td>
<td></td>
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<td>TS93</td>
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</tbody>
</table>
Because warning lights are such an essential safety feature, it is important to know when they are not working properly. This is the function of the Doran monitor (Figure 1). Its display is a schematic of the lights as they appear outside the bus. It continuously monitors the current in each lamp. If current is flowing through a particular bus lamp circuit (i.e., the light is on), the monitor senses this and lights the corresponding monitor bulb. If the bus lamp burns out, current ceases and the corresponding monitor bulb goes out, indicating a fault. Once the defective lamp is replaced, and the warning lights are working normally again, this also should be shown by the monitor.

The Doran monitor is a reliable, long-life device, but as with most electrical instruments, it can be overheated and damaged if an overload occurs in a bus light. Such overloads can exist if a bus light circuit becomes shorted, forcing current through a coil in the monitor which exceeds the coil’s rated capacity. Short circuits can occur if improper connections are made during installations, bus repairs, etc. If the monitor has an optional thermistor overload protection, the tail light circuits are overload-protected (thermistors are located on the bottom of the component side of the printed circuit board).

If the Doran monitor is not working properly, check the troubleshooting chart below to find a possible cause and solution.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Possible Diagnosis</th>
<th>Possible Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>All lights on the monitor are inoperative, even though the exterior lights on the bus operate properly, and all connections to the monitor are intact.</td>
<td>Overloading or physical damage has burned or broken a path on the printed circuit board.</td>
<td>Field repair of printed circuit boards is generally not considered practical. A replacement monitor is recommended. Inoperative monitors under warranty should be returned to the Blue Bird Body Company for repair or replacement under the terms and conditions of warranty for electrical parts.</td>
</tr>
<tr>
<td>A particular light is inoperative, even though the corresponding exterior bus lamp operates properly, and all connections to the monitor are intact.</td>
<td>1. A burned-out coil or inoperative reed switch. 2. A loose connection in one or both leads of the light emitting diode (LED) on the monitor.</td>
<td>1. Burned-out coils can usually be detected by inspection upon removal from the bus. If a burned-out coil has not scorched the board and distorted a PC path, a replacement coil/reed switch kit (available from most electronics suppliers) can be installed. 2. LEDs seldom fail unless they are installed with incorrect polarity or have suffered physical damage. The LED recessed design of face plate protects against normal usage. (LEDs can be ruined by Ohm meters, and such devices must be avoided.)</td>
</tr>
<tr>
<td>A monitor light stays on even when the exterior light of the bus is turned off.</td>
<td>The reed switch located inside the monitor coil is not operating properly.</td>
<td>Replace the coil and reed switch.</td>
</tr>
<tr>
<td>The tail light monitor and exterior tail lights fail to operate.</td>
<td>1. Tail light bulbs may need to be replaced. 2. An overcurrent situation. The thermistor has protected the entire circuit.</td>
<td>1. Replace tail light bulbs. 2. Remove power from the circuit and monitor. Repair overcurrent, and reconnect. Some possible causes of overcurrent include: a dead short, use of the wrong taillight bulb, and parallel wiring of additional taillights.</td>
</tr>
</tbody>
</table>
TOOLS AND SUPPLIES REQUIRED FOR REPAIR

- Hand tools as required to remove mounting screws at bus panel.
- Tags suitable for use in marking connecting wires, and also for recording the monitor problem.
- A 30- or 40-watt soldering iron for electronic repair (do not use a 100-watt “shop” iron).
- Small wire clippers.
- Pointed tweezers (Claus #225, or equivalent).
- 60/40 resin core solder, .031 or .062 thick (Kester “44” or equivalent).
- Replacement coil/reed switch kits. Note that coils for bus warning lights are 10-turn coils; those for tail lamps are 50-turn coils, and those for back-up lights, turn signals, and stop lights are all 16-turn coils. The proper coil MUST be used in replacement.

REPAIR PROCEDURE

NOTE: Field repair is not intended for monitors covered by Blue Bird Body Company warranty. Inoperative monitors under warranty should be returned to Blue Bird Body Company for repair or replacement under the terms and conditions of warranty for electrical parts. These instructions should only be followed by qualified repair personnel.

1. MOST IMPORTANT! Carefully note and record exactly which monitor lamps are not operating properly. Include this information on a tag to be attached to the monitor after removal from the bus panel.
2. Disconnect bus battery.
3. Remove mounting screws, which attach the monitor to the bus panel, being careful not to pull loose any connecting wires.
4. Remove one connecting wire at a time from monitor terminals, tagging EACH WIRE with the terminal number shown on the monitor.
5. If installing a spare monitor, record the monitor serial number for future reference. The number is shown on both the protective fiberboard back plate and on the monitor printed circuit board.

Figure 1—Doran Warning Light Monitor.
6. With the monitor removed from the bus and to a repair bench, remove the four nuts to remove the monitor PC board from the face plate. Pull the protective fiberboard backing from the terminals, being careful not to bend or tear it; retain for later use.
7. Locate the components to be replaced by referring to Diagram of Coils and Reed Switches in Figure 3 on the following page. Locate the solder points for these components.
8. Replace the inoperative coil/reed switch assembly as follows:
   a. With wire clippers cut the reed switch leads (2) and the coil leads (2) as close to the board surface as possible. (If a tail lamp monitor is to be replaced, pull the protective shield loose and retain for reuse later).
   b. With soldering iron, CAREFULLY melt-out the remaining coil and reed switch leads from the solder side of the board, pulling gently on the leads with tweezers. With the lead stubs removed, touch the holds in the PC board with soldering iron to “clear” them for replacement lead insertion.
   c. Insert replacement coil and reed switch leads, guiding them into proper holes with thumb and forefinger. Hold coil snug to the board while leads are bent over the solder side of the board. It is recommended that excess leads not be clipped until after soldering is completed. This will help to minimize shock or vibration on the reed switch, when leads are later trimmed. (Reed switches are encased in a fragile envelope and should be handled carefully to avoid chipping of envelope or distortion of leads).
   d. Place a bead of solder on the remaining lead ends, being careful not to interfere with other nearby solder points or PC paths.
9. If a tail lamp has been replaced, clean the original sealant from the protective shields and reinstall with new Silicone rubber sealant as recommended.
10. Visually examine all other components, leads, PC paths, and LEDs for any remaining problems to correct. Reinstall monitor in bus, making sure battery is disconnected and that wires are reconnected to the monitor in the same order as shown in the chart on the following page.

If additional instructions are needed after following the above procedure, contact Blue Bird Body Company.

Figure 2—Doran Exterior Light Monitor. Diagram of coils and reed switches with indication of the LEDs they control.
Body circuits are protected by circuit breakers located in a side mounted electrical box below driver’s window. If a current overload or short should occur in any body circuit, it will trip the circuit breaker. If a short occurs and the circuit breaker breaks, the circuit breaker will reset itself when the element cools in about 15 seconds. A short may be indicated by blinking of lights or fluctuating gauges. The shorted circuit should be corrected immediately. Refer to body or chassis master wiring diagrams provided with vendor information.

For access to the electrical panel, locate release latch as shown at right. Push latch release downward to allow opening of the access door, located outside the bus below the driver’s window.

NOTE: Use of appropriate amperage circuit breaker required.
MIRRORS AND ADJUSTMENT

WARNING: The vehicle’s mirror system has been designed to comply with all field-of-view requirements, but it is the owner’s responsibility to adjust the mirrors properly before placing the vehicle in service and to maintain the adjustment during the service life of the vehicle. Mirrors provide additional driver visibility on buses. To be used effectively, mirrors must be properly adjusted for each driver and the driver must be aware of the limitations on viewing area that exist even when mirrors are properly used. Mirrors are not a substitute for proper driver training and care that should be exercised when operating the vehicle and loading or unloading passengers. Do not move the bus until you have accounted for each passenger that has disembarked and have confirmed that all passengers are clear of the bus. Failure to follow these procedures could cause serious injury or death.

Right front convex crossview and right and left front convex rearview mirrors are required equipment on all All American Forward Engine and Rear Engine Type (D) buses. Left front convex crossview mirrors are also available.

INTERIOR MIRRORS

Inside rearview mirrors (Figure 1) can be adjusted by loosening the bolts and nuts in slotted holes. Adjust the mirror to give the operator a clear view of the bus interior and the roadway to the rear.

WARNING: Many school bus passengers are energetic children who are small and playful and do not understand the hazards of buses. After unloading, some children could be outside the field of vision of your mirrors or could dart out of view quickly. After unloading passengers, do not move the bus until you have confirmed the location of each disembarked passenger, and know that all are completely clear of the bus. Failure to follow this procedure could cause serious injury or death.

8-INCH DIAMETER SUPPLEMENTAL EXTERIOR REARVIEW MIRROR

Some units may be equipped with two 8-inch elliptical mirrors, one on each side, which are designed to supplement the view provided by the outside rearview driving mirrors. The right-side 8-inch elliptical mirror is attached to the right outside rearview mirror mounting bracket as shown in Figure 2, and is viewed through the right-side windshield. The left-side 8-inch elliptical mirror is attached to the bus body and is located so as to be viewed through the left-side windshield.

Proper adjustment is necessary for any mirror system to perform as designed. Use the following adjustment to obtain the maximum viewing area with the mirror system.

Position the right-side 8-inch elliptical mirror in the location illustrated. Adjust the 8-inch elliptical mirrors on both sides to provide the seated driver a view of the ground directly below the outside rearview driving mirrors, and rearward to overlap the view provided by the outside rearview convex driving mirrors.

CAUTION: A convex mirror has a curved surface and is designed to provide a wide view with minimum distortion. However, persons or objects seen in a convex mirror will look smaller and appear farther away than when seen in a flat mirror or viewed directly. Therefore, use care when judging the size or distance of a person or object seen in a convex mirror. Wait until you can view the person or object directly or in a flat mirror to determine their size and distance.
Standard equipment on all school buses includes four outside rearview driving mirrors (two per side), and two elliptical crossview mirrors (one per side). The outside rearview driving mirrors include one flat and one convex on each side, both measuring 6.5 by 10 inches. The outside rearview driving mirrors are designed to provide the seated driver a view of the roadway to the rear and to the sides of the bus. The elliptical crossview mirrors are designed to allow a seated driver to view all areas around the front of the bus not directly visible. The elliptical crossview mirrors are designed to be used to view pedestrians while bus is stopped. **DO NOT USE THE ELLIPTICAL CROSSVIEW MIRRORS TO VIEW TRAFFIC WHILE BUS IS MOVING. IMAGES IN SUCH MIRRORS DO NOT ACCURATELY SHOW ANOTHER VEHICLE’S LOCATION.**

**CAUTION:** A convex mirror has a curved surface and is designed to provide a wide view with minimum distortion. However, persons or objects seen in a convex mirror will look smaller and appear farther away than when seen in a flat mirror or viewed directly. Therefore, use care when judging the size or distance of a person or object seen in a convex mirror. Wait until you can view the person or object directly or in a flat mirror to determine their size and distance.

Proper adjustment is necessary for any mirror system to perform as designed. The following adjustment sequence should be used to allow the driver to obtain the maximum viewing area with the mirror system.

1. Adjust the driver’s seat to the desired position.
2. Adjust the right-side flat driving mirror so that the tops of the side windows are visible in the upper edge of the mirror, and so that the right side of the bus body is visible in the inside edge of the right-side flat mirror.
3. Adjust the right-side convex driving mirror so that the view in the top of the convex mirror overlaps the view provided by the right-side flat driving mirror, and so that the right side of the bus body is visible in the inside edge of the right-side convex mirror.
4. Adjust the left-side flat driving mirror and the left-side convex driving mirror following the same procedures described for the right-side mirrors. Refer to Steps 2 and 3 above.
5. Adjust the elliptical crossview mirrors by positioning each mirror head so that the center of its field of view is pointed directly at the eyes of the seated driver.
6. Make a final adjustment to the mirror system so that the seated driver can view the areas required by Federal Motor Vehicle Safety Standard 111, including the entire top surface of cylinders M and N when located as illustrated and rearward a minimum of 200 feet (measured from the mirror surface) using the outside rearview driving mirrors. The elliptical crossview mirrors should be adjusted to provide the seated driver a view of the entire surface of any cylinder A thru P (when located as illustrated) not visible by direct view of the driver. The view provided by the elliptical crossview mirrors must overlap the view provided by the outside rearview driving mirror system.

**Maintenance:** All mirrors should be cleaned once a week (or more if needed), preferably with an ammonia solution. Keep the mounting fasteners tight so that mirrors will not vibrate. Check weekly and retighten, if necessary.
EMERGENCY EQUIPMENT

Each state or province has its own set of laws regarding emergency equipment. Your unit may have some or all of the items listed below. Because of variations in option packages, the placement of this equipment inside the bus may vary from one unit to another, but it is important for you to recognize and know the locations of all the emergency equipment on your bus. Furthermore, it is important for you to read all literature, labels, and any other written materials supplied by the equipment manufacturers. Be sure you familiarize yourself with all aspects of the emergency equipment before attempting to drive the bus.

**FIRE EXTINGUISHER**

The fire extinguisher is normally located right-hand sidewall between the grabrail and barrier. Your unit may be equipped with a 2.75, 4.5, 5, or 6 pound extinguisher. Inspect the pressure gauge every 30 days or as required by individual state fire laws to make sure the unit is fully charged. Inspect mounting fasteners periodically to be sure they are tight.

**FIRST AID KIT**

The first aid kit is mounted in the front of the bus body just above the right windshield. Size and contents of first aid kits may vary because of different state specifications. The contents of the kit should be inspected weekly or as required by local regulation to be sure that all contents comply with state specifications.

**BODY FLUID CLEANUP KIT**

The body fluid cleanup kit is designed to contain accidental spillage of biological matter, minimizing risk of exposure to potential health hazards. The contents of the kit should be inspected monthly or as required by local regulation to be sure that all contents comply with state specifications.

**FIRE AXE/CROWBAR**

The fire axe and crowbar are located on the electrical panel access cover to the left of the driver’s seat as close to the front as possible. Every 30 days, inspect installation mounting fasteners to ensure that they are tight. Check fire axe and crowbar monthly to be sure that they are easily accessible and unobstructed.

**FLARE KIT**

The flare kit is mounted on the left-hand side panel behind the driver’s seat. Ensure that the contents of the flare kit are in place every 30 days or as required by local regulations. Inspect mounting fasteners for flare kit box every 30 days to make sure they are tight.
TRIANGULAR WARNING DEVICES

For states requiring the triangular warning devices to be located in the driver’s compartment, this container is mounted above the windshield at the upper center near the roof line. For other states, it is located on the left-hand rear floor board under the rear seat. Inspect contents of the kit every 30 days or as required by local code to ensure proper operation.

Recommended warning device positioning

In units with an optional locking emergency equipment compartment in the front upper panel above the windshield, all emergency supplies are located behind a door which is labeled with a list of compartment contents. To meet state regulations, the door locking mechanism is connected to a buzzer system that sounds if the compartment door is locked when the ignition is turned on.

On the Rear Engine models, the first aid kit, triangular warning device, encased fusees, fire extinguisher, fire axe, and wrecking bar are located in the front of the bus body in the center compartment at the floor, depending on the options.
Emergency exits are clearly identified by the words “EMERGENCY EXIT.” Operating instructions are printed nearby each exit. Some units are equipped with an audible alarm device signifying an emergency exit is unlatched or open. If a buzzer sounds when turning on the ignition switch, check emergency exits to see that they are completely closed. All emergency exits meet Federal Motor Vehicle Safety Standard 217, “Bus Window Retention and Release.” These illustrations show various types of emergency exits.

All emergency exits should be inspected and operated daily to ensure they are labeled and operate properly per the instructions provided.

Also see Transpec Safety Vent, on the following page.
The roof hatch serves as an important emergency exit, and therefore it is crucial that it is always maintained properly and instruction labels are in place and clearly visible. All emergency exits should be inspected and operated daily to ensure that they are labeled and operate properly per the instructions provided.

MAINTENANCE CAUTIONS

Transpec Safety Vents are designed to provide years of reliable service with a minimum amount of maintenance. All components are rustproof with lifetime finishes, and moving parts are Teflon-coated to eliminate need for lubrication. Use of lubricants, paints, or other coatings—such as graffiti-deterring spray—is not recommended.

Suggested maintenance includes periodic inspection of attaching fasteners for evidence of loosening due to tampering, and regular cleaning with mild soap and water. Although there are more powerful cleaning solutions available, some of them contain solvents and other chemicals that can attack the high-strength materials used in the production of safety vents. It is the customer’s responsibility to ensure that cleaning solutions are compatible with the materials used on safety vents.

Graffiti-removing cleaners often contain acetone, ether, lacquer thinner, or other solvents known to destroy the high-strength properties of many engineering plastics, and use of these cleaners must be avoided. Graffiti-resisting coatings often leave a sticky residue that interferes with the smooth up/down movement of the ventilator mechanism. Avoid using these coatings.

SERVICE AND REPAIRS

All components used in the production of safety vents are available as service parts, except for a particular hinge that represents a possible hazard if it is improperly reattached after being damaged. The hinge attaches to a hidden tapping plate that is permanently laminated between the inner and outer cover assemblies, and this tapping plate can neither be inspected nor replaced. Therefore, when the hinge is damaged, it is necessary to replace the entire assembly.

CAUTION: This hinge assembly is critical and hinge should never be removed from cover assembly. Fasteners used in this assembly are specially designed, with critical torque requirements and tamper-resistant heads.
STOP ARMS

Stop arms are required on Blue Bird All-American, Conventional, and TC school buses per Federal Motor Vehicle Safety Standard 131. Stop arm assemblies are purchased as a kit; many different kits are available with blades to meet all state requirements. The stop arm is located on the left-hand side of the body under the driver’s window. Stop arms are most commonly operated by a manual switch on the switch panel.

For air stop arms, the manual switch activates an electric solenoid valve controlling the flow of air. Optionally, the solenoid valve may be activated by the warning lamp system. This system works in conjunction with the air system on the chassis. No preventive maintenance procedures are required with these systems.

With the electric stop arms, the manual switch activates the control relay of the stop arm. Optionally, the stop arm may be activated by the warning lamp system.

MAINTENANCE

The following preventive maintenance procedures should be followed for the electric stop arm:

Monthly
- Oil the dual-action breakaway hinge at its four pivot points with a high-performance, penetrating lubricant. Tri-Flow™ (DuPont) with Teflon is recommended.
- Check and make sure breakaway portion of hinge is free and movable.
- Check fasteners for tightness.

Quarterly
- Remove front and rear covers of base and check internal fasteners for tightness.

On units equipped with air stop arms, the air pressure may occasionally require adjustment to ensure proper opening and closing of the stop arm. Air regulator (Figure 1) is accessible by opening the electrical panel door outside under the driver’s window. To regulate the air pressure, remove the wire retaining clip below the regulator knob and pull out the red lock ring. Turn the knob counterclockwise to decrease the pressure, then slowly increase the pressure (turn knob clockwise) until the stop arm hinge is extended to approximately 90°. Relock knob by pushing in the red lock ring and reinstalling wire retaining clip.

The “STOP” sign must extend, and if equipped with lights, the lights must be operating any time the red lights of the warning light system are flashing. For those state-designed warning light/stop arm systems that allow the stop arm to withdraw while warning lights are operating, an audible alarm sounds to alert the driver of the condition.

Figure 1
STOP SIGNS AND CROSSING ARM TROUBLESHOOTING

Air Stop Signs and Crossing Arms

Problem:
Signs won’t open to 90°.

Areas to Check:
1. Faulty diaphragm.
2. Faulty solenoid valve.
3. Air pressure regulator—Air pressure regulator must precede the solenoid to prevent damage to the solenoid or to the diaphragm. Excessive pressure may cause damage to both the solenoid and the diaphragm. Pressure should not exceed 12 pounds.
4. System leak—Check to make sure that the air pressure supplied to the solenoid valve or the diaphragm is between 10 and 12 pounds. Again—CAUTION—it is very important not to exceed 12 pounds of pressure. Excessive pressure will cause damage to the diaphragm and the solenoid valve.
5. Loose fasteners.

NOTE: Solenoid valves must be checked under pressure while the electric solenoid is being activated.

Electric Stop Signs and Crossing Arms

To troubleshoot electric stop signs or crossing arms, it is important first to understand how to install them. There are two methods of installation:
1. Dark blue to a switched 12 V terminal. Red to a constant 12 V terminal. Green to a proper ground. By this method, the blue wire activates and deactivates the stop sign.
2. Dark blue and red to a constant 12 V terminal. Green to a grounded switched terminal. This method uses the green wire or the ground to activate and deactivate the stop signs and crossing arms.

Note that for the electric stop signs and crossing arms, all the works are in the base. You can troubleshoot the electric stop sign by these steps:
1. Determine if the sign is wired correctly (see Steps 1 and 2 above) and that 12 V and ground are available where required.
2. Remove the rear cover of the base.
3. Remove the red wire from the relay (wires lead to terminal on motor).
4. Remove red wire from the limit switch.
5. Replace the red wire on the limit switch with the red wire from the motor.
6. With a battery charger (or any other 12 V source), ground the motor terminal (black wire) and attach the positive 12 V to the red wire terminal on the motor. The motor should activate and run continuously until the red wire is removed.
7. With a probe attached to the 12 V positive side of the battery charger, identify the black and light blue leads on the limit switch at the motor base and attach the 12 V positive probe to one of the two leads. Either the motor will begin running or it will not. If the motor runs, it should proceed until the CAM circles and deactivates the limit switch, causing the motor to stop. At that time, change terminals with the limit switch to the other of the two leads, and again the motor should begin to run until the CAM positions itself to deactivate the limit switch. If both these points can operate the motor, then the limit switch, CAM, and motor assembly are functioning. If the motor still fails to run, and you have verified that you have the proper wiring installation as identified above, then the problem is with the relay. Once the relay is replaced, the sign should be operational.
Stop Sign Blade Failure

Problem:
Lights do not function.

Areas to Check:
1. Check that the light bulb is working.
2. Check that the ground strap is secure.
3. Check to see if 12 V is being supplied to the light bulb.

Please note that the following improvements have been made to the socket and pigtail:
A. Screws are now used instead of rivets. This makes replacement easier.
B. The braided wire ground strap, which failed on occasion, has been replaced with a two-wire socket and pigtail. This helps ensure an intact ground throughout the operation and life of the sign.
C. Lower temperature protection has been added to ensure a broader temperature range in warmer and cooler climates.

Problem:
Color fading of the blade surface.

Areas to Check:
1. The red paint used on steel blades contains a pigment that tends to bleach over time. If a blade surface fades, it may be repainted or replaced. Specialty recommends replacement due to the labor savings and cost efficiency.
2. Improvements in technology now allow aluminum reflective signs to last much longer than in the past. Decals are available for engineering grade, and the high-intensity sign costs somewhat more than the steel blade. All stop arms—air, vacuum, and electric—are available with a high-intensity face.
WHEELCHAIR LIFTS

For the TC, Blue Bird supplies lifts from Braun and from Collins. Each vendor provides its own publication for information on maintenance, lubrication, troubleshooting, and other important items that are imperative to the smooth operation and safety of wheelchair lifts. These publications are supplied with vendor maintenance documents per order.

Illustrated is the wiring diagram of the buzzer circuits for the wheelchair lift door. The buzzer indicates whether the door is unlatched, opened part of the way, or opened completely (at which time buzzer does not sound).

1. Pull out on top portion of release latch to disengage latch mechanism.
2. To open hood, lift handle. The hood is designed with a built-in prop. When hood is opened to its maximum and lowered, the prop locks in the open position.
   
   **NOTE:** A hole is provided in the prop as a safety device. When the hood is in the opened position, a pin should be placed in the hole to prevent the prop from unlatching accidentally.
3. To close the hood, remove the pin and lift as if to open further. This disengages the lock and allows the hood to close.

HOOD REMOVAL FOR MECHANIC’S ACCESS

1. Pull out on top portion of release latch to disengage latch mechanism and open hood completely.
2. Using a 1/2-inch socket wrench, remove the two flange nuts securing the prop bracket to the hood. Hold up the hood and allow prop to rest next to engine.
3. Let down the hood. Use two 7/16-inch wrenches to remove hinge pins from hinges located on top side of hood. This will allow hood to be completely removed.
4. To replace hood, reverse this procedure.
WINTERFRONT COVER

The winterfront cover design for charge-air-cooled TCFE engines beginning in 1991 is slightly different from previous designs. A minimum of 120 square inches of area must remain open at all times. Therefore, do not attempt to cover the air inlet holes in the headlight panel while the winterfront cover is on the top grille panel.

Monitor the engine coolant temperature gauge at all times when the winterfront is in place. If the engine temperature begins to rise above normal and/or the shutters begin to stay open, remove the cover.

FRONT ACCESS PANELS

To service components behind or underneath the dash area, gain access through the front access panels as follows:

Release press button latches on center panel and allow panel to open downward. This allows access to heater bleeding valve, radiator fill cap, and view to radiator sight glass.

Release press button latches on front access doors to the left and right of the center panel for access to windshield wiper motors, windshield wash reservoir (located behind the driver’s side headlight), power steering fluid reservoir and radiator overflow reservoir.

ACCESS DOORS

In order to prolong the life of access door latches, locks and hinges, periodic maintenance should be performed as follows. Once per week, clean and inspect the door hinges and latch mechanisms. Clean with a nonabrasive degreaser or cleanser as required. Every three months, lubricate with either a graphite-type lubricant or a spray-type lubricant such as LPS. The following is a list of access doors which require these maintenance procedures.

1. Battery Compartment Door
2. Luggage Compartment Door
3. Tire Compartment Door
4. Fuel Fill Door
5. Radiator Fill Door
6. Side Electrical Panel Door
7. Left and Right Hand Front Access Doors

Glove compartment and emergency equipment doors should be inspected on a daily basis. Open and close to ensure proper operation. If necessary, follow the same lubrication procedure as outlined above.
BODY TIE-DOWN

Tighten the tie-down clamp bolts and body shear bolts at 1,500 miles and quarterly thereafter to between 37 and 41 foot-pounds of torque.

There are eight shear bolt locations. One shear bolt is located on the right front outrigger under the body. Another is on the left corner post tie-down channel under the body. Two shear bolts are located just behind the front suspension, one on each frame rail tie-down angle. The last four are at the rear of the body floor in the chassis outriggers. The body is mounted with pads of high-durometer rubber between the floor and chassis frame rails. The rubber absorbs shock, deadens sound, and maintains tension on the tie-down clamps. Be sure pads are in place when tightening tie-down bolts.

WARNING: Failure to follow the procedures for tightening bolts, either by failure to tighten on schedule or by failure to conform to the torque poundages, could create a danger of separation of the body and chassis, thereby causing possible personal injury or death.

TOWING OR PUSHING

CAUTION: Never tow or push a vehicle equipped with Allison automatic transmission until the rear drive shaft has been removed, or unless the rear wheels have been raised off the ground. Do not tow by front axle. Bus may be towed using front or rear bumper brackets. Optional tow hooks are located at the front and/or rear of the vehicle under the bumper. Tow hooks are designed to tow or pull with both hooks simultaneously. Do not pull or tow with an individual hook. Bumpers provided on Blue Bird buses are designed to protect the vehicle and occupants from front and rear collisions. TC bumpers are designed for use with bumper jacks. Do not work under bus when supported by bumper jacks. Use only appropriate jack stands supporting frame rails when under bus.

WARNING: Exercise extreme caution when the drive shaft is removed on a unit equipped with hydraulic brakes. The parking brake becomes inoperative when the drive shaft is disconnected. Do not leave the bus unattended until taking appropriate measures to prevent vehicle movement. Do not work under bus when supported by bumper jacks. Use only appropriate jack stands supporting frame rails when under bus.
CONTINUING MAINTENANCE REQUIREMENTS

1. Keep working parts of control tightened.
2. Lubricate all working parts periodically, including hinges and overhead controls. (See Body Component Maintenance Chart)
3. Repair or replace worn seals.
4. Maintain proper door opening and closing adjustment. (See Body Component Maintenance Chart)

OUTWARD OPENING

Doors are mounted in a prefabricated framework, which eliminates the effect of body construction variations on door and seal operation. Doors are suspended completely on sealed ball bearings located at the top corners of the framework, inside the body. The interlink connection between the doors is a single assembly with oppositely threaded spherical bearing rod-end connectors on each end providing simple link length adjustment without disassembly. Simply loosen the lock nut, turn the tube, and retighten the nut when satisfactorily adjusted. The geometry of the mechanical link between the doors causes the rear door to close well ahead of the front door, so that the front nosing seal rubber always overlaps the rear. Oil-impregnated bronze bearings in the lower corners of the framework serve as pivots (not supports). All controls and mechanisms and the complete lower step tread are sealed inside the bus and out of the weather when the door is closed.

In the interest of safety through maximized driver visibility, the doors have been designed to have as much clear glass opening as possible. A four-inch-wide pad is mounted to the header cover over the opening. The manual control is the Blue Bird cover over center locking type with built-in Saf-Latch. The door’s ease of operation allows use of a short-handle arm, so the handle is six inches closer to the driver in the open position than with the jackknife door.

The electric operator is also the linear motion type with a ball-screw drive. It is connected to a lever off the front door. Mechanically operated switches control automatic stop positions as well as stepwell and warning lights.

OUTWARD OPENING (AIR DOOR)

The air operator is a simple linear cylinder connected to a lever on each door and located inside the header cover. An interconnecting link between the doors controls their operation sequence. A safety release valve is located over the door, and stepwell lights are operated by air pressure switches inside the header cover. Door operation by the driver is managed by a simple two-way manually operated valve, and air pressure holds the door either open or closed depending on the position of the valve. The operation speed is adjustable by use of flow control valves at cylinder inlet and outlet.

JACKKNIFE DOOR—(If so equipped)

1. Loosen the roller bracket at the top of the rear door.
2. Adjust the length of rod (between the door control and the door) and the location of the rod end bracket on the door for proper open and closed position.
   a. Lengthen the rod if the door opens too far and does not close against the top seal.
   b. Shorten the rod if the door closes too hard and does not open far enough.
   c. Move the rod end bracket forward if the door does not close against the seal and does not open far enough.
   d. Move the rod end bracket rearward if the door opens and closes too far.
3. Attach the roller bracket to the rear door and adjust.
   a. If the rear door hangs in the track when starting to close the door, move the bracket to the rear.
   b. If the rear door does not open to the front enough, move the roller forward.
4. Perform the following adjustments and maintenance for ease of operation. The top of door should be approximately 3/8 inch below door header.
   a. Move door upwards so that rubber door sweeps do not drag on stepwell treads. Adjust door
height by loosening bolts and nuts that attach front door panel to front hinge. Holes in hinge are slotted. This permits vertical adjustment of door.
b. Assure that top edge of door nosing rubber does not drag on door stop header rubber. Remove the first three upper screws in the inner and outer nosing rubber retainer strips and force the nosing rubber downwards. Replace screws after the rubber nosing has been adjusted.
c. The rear upper corner of the rear door panel should not drag on rubber door stop on the header. To provide the required clearance, move the door roller bracket towards the rear of the bus. This will effectively move the door panel away from the door stop rubber.
d. Clean stepwell rubber treads and lower door rubber sweeps regularly. Cleaning these surfaces will reduce friction as the door is operated.
5. Assure that the door control rod end bracket is mounted squarely on door—if it is not, then the yoke end pivot pin will bind. Adjust by loosening screws and tightening after bracket has been squared up.
6. Inspect the pivot nut on rod end bracket for burrs or other surface irregularities. Grind or file pivot nut so that its upper and lower surface is smooth.
7. Lubricate door hinge pin with a spray type lubricant (LPS No. 1). Lubricant should penetrate behind each hinge lug. Door hinge will operate quietly if properly lubricated.

**POWER JACKKNIFE DOOR**

*NOTE:* For air diagram, see drawing #0867606 supplied with vendor maintenance documents.

The following adjustments and lubrications should be performed on the power jackknife door to ensure its proper operation.
1. Lubricate center hinge with LPS No. 1 type lubricant.
2. Adjust cylinder yoke so that when cylinder rod is fully extended in the open position, the door is not forced beyond its normal stopping point at the front stepwell band. Adjust cylinder mounting bracket adjustable yoke if required. **NOTE:** Improperly adjusted cylinder yoke can cause premature failure of door components.
3. Adjust switch striker plate on cylinder rod so that it does not bind against the switch and switch bracket in the closed position.
4. Ensure that the roller bracket is installed squarely on the rear door panel.
5. Ensure that the center hinge barrel is not binding against the outer skin of the rear door panel.
6. Adjust opening and closing speed of the door at valves located on cylinder to ensure smooth action. Air pressure should be at normal operating range (100 to 125 psi).
7. Upper pivot bracket retaining screw at lever assembly should be tightened to at least 20 foot-pounds of torque.

Maintenance procedures for entrance doors are to be performed at intervals of one month or 1,000 miles, whichever occurs first.
**ELECTRIC OUTWARD OPENING DOOR**

The electrically operated outward opening door has a linear actuator that moves a lever attached to the front door. To open the door, hold the spring-loaded switch in the driver’s area in the OPEN position until the door stops moving. An automatic switch stops the action of the door. To close the door, move the switch to the CLOSE position and the door will stop automatically when fully closed. There is a keyed switch on the outside of the body on the cowl panel by the door that parallels the operation of the interior switch.

**Emergency Release**

With the door in the fully closed position, pull the release lever in the header panel rearward as far as possible. The linkage will release and the lever will “snap” into a “park” position so it will not return forward when released. Push the door open to exit the bus. To re-engage the release mechanism, move the lever in the header back to its forward position, and hold the driver operated spring loaded switch in the “open” position until engagement is obvious or until door is in the fully open position.

**SECURITY LOCK (Outward Opening Door)**

A key-operated “bolt” slides into a hole in the header when the door is in the closed position and locked. This option also requires use of the hinged stop on the door control. If the lock becomes difficult to operate, remove access plate on the inner door panel and channel and lubricate with No. 2 lithium grease. (Access plate shown removed in illustration.)
SECURITY LOCKS

ENTRANCE DOOR
To activate the optional electric entrance door security lock, pull the door to a fully closed position from the outside of the vehicle. When this is done, the security lock is activated. To deactivate the lock, insert key in lock located at right of the door (forward of door) and turn. Press against center section of door and it will open.

The manual security lock release handle is located in the lower kick panel of the entrance door. It rotates in a counterclockwise direction to latch. It can be locked in a latched position or in a 180° unlatched position. The latch engages a bracket on the inside of the door. Before using the security lock, the hinged stop on the door control cover must be flipped down to keep the door control from traveling over center when closing the door.

The outward opening door has an optional key locking mechanism exposed to the exterior of the bus. The mechanism engages a case-hardened bolt for increased security (see previous page).

Lubricate security lock every six months or 6,000 miles, whichever occurs first. Use LPS-1 or Apply™ type lubricant and spray into the bushing and shaft in the center at the base of the lock handle. Also spray lubricant into key lock mechanism. Rotate the lock handle to ensure smooth operation.

EMERGENCY DOOR
The emergency door and rear emergency window security lock has a lock cylinder which is placed in the lock to make the emergency door inoperable. When the cylinder is in place in the lock, the coach cannot be started. To complete the ignition circuit, the lock cylinder must be removed from the lock and placed in the receptacle at the side of the door. When this is done, the circuit is completed and the coach can then be started.

No lubrication is required with this system.

SLIDING BOLT SECURITY LOCK
The sliding bolt security lock (for the emergency door and rear emergency window) is an interior latch that prevents the door from being opened from the outside when engaged. The bolt is connected to an interlock assembly which prevents engine starting when the door is locked. If the lock is activated after the engine is running, an audible alarm is sounded in the driver’s area.

Lubricate sliding bolt mechanism every six months or 6,000 miles, whichever occurs first with LPS-1 spray lubricant.
HEATERS

GENERAL INFORMATION

Blue Bird heaters are hot water type, which depend on engine-generated heat for their function. Heat from the engine is picked up by the engine coolant, which is pumped through the heaters inside the body and back into the engine. A typical heater inside the body is made of a heat exchanger coil and fans which move air across the coil. Air moving across the coil picks up heat from the engine coolant and transfers it into the body.

Satisfactory performance of the body heaters is mostly dependent upon:
1. Adequate engine (coolant) temperature—This can be altered by thermostat rating (which should never be higher than recommended by the engine manufacturer) and/or shutters.
2. Adequate coolant flow—This varies with engine speed and can be increased if necessary by the use of an auxiliary water pump. The heaters are rated at six gallons per minute.
3. Proper fan operation—All motors have multiple speeds, and can most easily be checked for function by operating the motor switches individually and listening for variations in speed.

Many other factors affect performance, but these three are most important.

HEATER OPERATION

Be sure the engine radiator is full and all coolant flow valves are open. See charts on valve location. **Do not leave the engine running while opening or closing valves.** Warm up the engine to operating temperature with the engine at up to 1,800 rpm, if possible, and turn on the heater fans and the auxiliary water pump if so equipped.

Under extremely cold weather conditions, turning on the heater fans will cause the engine temperature to drop noticeably as heat from the engine is transferred into the body, but as air temperature inside the body rises, engine temperature also rises. The engine will also generate more heat as it does work in moving the vehicle. Once the engine is warm, heater fan motor speeds and subsequent air volumes across heater coils can be controlled at the driver’s discretion for best defrosting and overall passenger comfort.

CONTROL PANEL

The heater control panel is located on the rear surface of the dash to the right of the instruments. The indicated switches and levers control the motors and air outlets as shown.

The heater is located in the right front corner forward of the entrance door and an auxiliary unit is located under the driver’s seat. As indicated, the electrical switches and mechanical operators control the volumes and directions of air being moved. The main heater has a three-speed control switch for manual low or high speed operation and an additional maximum output position for flash defrosting or the most extreme of conditions. All the air from the main heater blower can be used for defrosting by leaving the main outlet and foot warmer outlet closed.

OUTLET LOCATIONS

1. Driver’s Heater
2. Foot Warmer
3. Main
4. Defrost
5. Fresh Air
HEATER ACCESS

The front heater can be accessed from two different places: outside the bus on the right side of the front, and inside on the dash near the stepwell.

NOTE: To gain access from the front, see Front Access Panels.

To gain access to the heater core and filter from the interior of bus, remove the interior heater access panel shown.

FILTER

The main heater coil is protected by an air filter, which prevents dirt and dust from collecting on the heat exchange surfaces and lowering heater efficiency. The filter should be kept clean. A dirty filter restricts air flow and reduces heater output. To clean or replace the filter, remove the filter access panel. The operating conditions of your bus will determine how frequently the filter should be serviced.

DEFROSTING

Windshield fogging and frosting is caused by warm, humid air coming into contact with a colder windshield, which causes the moisture in the air to condense and even freeze if the windshield is cold enough. The warmer the windshield, the less moisture will condense. During initial warm-up, the defroster blowers should be operated at low speed to preheat the inside of the windshield glass. If the defrosters are not turned on until after condensation starts, it is more difficult to heat the glass and drive moisture away.

As passengers are loaded onto the bus, the moisture content of the air inside the bus increases. Open the heater fresh air inlet to lower this moisture content. Conditions will be especially difficult when large passenger loads stay on board for extended periods of time, such as on a charter or over-the-road activity trip. Travelling at highway road speeds causes heat to dissipate through the windshield glass, and each passenger’s breath continually adds to the air’s moisture content. To reduce fogging, open the forward driver’s window slightly to let the moist air escape.

CARE AND CLEANING OF DEFROSTER FANS

Defroster fan motor bearings are lifetime-lubricated, and do not require maintenance. Clean the blade and guard occasionally with a soft bristle brush and a vacuum cleaner or compressed air to help maintain efficiency. As with any other fan, if the blade is damaged or unbalanced, vibrational damage can occur to the motor or surrounding components, so the blade should be replaced immediately.

WARNING: Do not operate a defroster fan without the fan guard properly installed.
Procedure:
1. Remove front half of fan guard by gently separating plastic tabs with a screwdriver or other hard instrument. Be careful not to damage these tabs, as they connect the halves of the fan guard.
2. To remove the fan blade, use a 3/32-inch Allen wrench in the set screw located directly behind the fan. This should loosen the fan blade for removal.
3. The rear half of the fan guard can also be removed if necessary. After pulling away the fan, remove the two nuts and washers on either side of the center point and lift off rear piece.

HEATER DEFROSTER LOCATION
The blower in the front main heater contributes to keeping the driver’s area glass clear of fog and frost. See OUTLET LOCATION diagram at the beginning of this section. For best results, fresh air should be flowing into the heater. To inspect the fresh air intake and make sure it is working properly, open the front access panel and observe intake on driver’s side of bus.

Again, the performance of the body heaters depends primarily upon adequate engine (coolant) temperature, adequate coolant flow, and proper fan operation.

DEFROSTER FAN LOCATIONS
Option 0525—On the TC with deluxe door control and standard manual control, the fan is mounted on the door control bracket. With power door controls, the fan is mounted on the dash cover.
Option 0531—One fan is installed per conditions outlined in Option 0525 for the lefthand fan. The other fan is mounted on the dash cover.
Option 0532—Fan is located on the upper inner panel in the center.
Option 0535—Fan is located on the upper inner panel six inches to the left of center.
Option 0541—Defroster fan is located on the dash cover.

DRIVER/PASSENGER COMFORT
When the windows are adequately defrosted, set the other openings as necessary for comfort. The adjustable outlets on the rear surface of the dash can be directed toward the driver and/or passengers as desired. The auxiliary unit under the driver’s seat has a two-speed electrical switch and it directs air upward for the driver’s left side and forward around the steering column area.

HEATER BLEEDING INSTRUCTIONS
Use of antifreeze (ethylene glycol type only) is recommended for summer or winter operation because of its corrosion inhibition and lubrication properties. A solution of 50 percent antifreeze and 50 percent water is preferred, and it gives freeze protection down to about -30°F. Ultimate protection is obtained at 68 percent (down to about -92°F), but no higher concentration should ever be used.

If it becomes necessary to completely refill the chassis coolant system, follow this procedure to ensure adequate heater bleeding. During the bleeding process, it will be necessary to remove the radiator cap and refill the cooling system several times to ensure adequate coolant is available to replace purged air and coolant lost when bleeding.
INITIAL FILL WITH GRAVITY HOSE WITH ENGINE OFF AND COOL

1. Open heater supply valve at rear of engine block and close heater return valve at the transmission oil cooler.
2. Open 1/4-inch vent line valve located above radiator and direct vent line flow back into the radiator fill neck.
3. Fill radiator with engine coolant until full and close heater supply valve.
4. Start engine and run at high idle (1,500 rpm). Refill radiator if coolant level drops. Open heater supply valve on rear of engine block. Allow coolant to flow through vent line back into top of radiator. It is very important to verify this coolant flow. Do not run engine longer than 50 seconds unless a flow of coolant is evident at vent line.
5. After solid stream of coolant (no bubbles) is evident at vent line discharge, close vent line valve. Refill radiator and install radiator cap. Check for leaks. Open heater return valve.
6. Shut off engine. Fill coolant recovery bottle to one inch above cold fill mark. (Level of coolant in bottle will stabilize only after several cycles of heating and cooling.)

CAUTION: Failure to properly bleed all the air out of the engine and heater circuit could result in irreparable damage to the engine.

WARNING: Never idle engine in closed areas. Never sit in a parked or stopped vehicle for any extended amount of time with the engine running. Exhaust gases, particularly carbon monoxide, may build up. These gases are harmful and potentially lethal. Carbon monoxide is colorless and odorless, but can be present with all other exhaust fumes. Therefore, if you ever smell exhaust fumes of any kind inside your vehicle, have it inspected immediately by your dealer and have the condition corrected. Do not drive with exhaust fumes present.

PREVENTIVE MAINTENANCE—to be performed annually

Hoses
Check all water hoses for kinks that can prevent water flow or chafing that can cause failure. Look and feel for hardening of rubber, or cracks that result from aging. Hoses should be replaced when external cover tube cracks first appear. Hoses exposed under floor and in the engine area will deteriorate faster than those inside the body due to their exposure to the elements. Therefore, these hoses need to be checked more frequently.

Coils
The heater will be most efficient when the coil and fins and air flow passages are kept clean and free from dust and dirt. The coil should be cleaned carefully with compressed dry air or vacuum and a soft bristle brush. Damaged fins should be straightened with a fin comb to prevent air flow restrictions. The heater coil can be accessed through the right front inside access panel, or for underseat heaters, by removing passenger seat cushions.
Motors, Switches, Blowers, and Fans

Motors are essentially maintenance-free and do not require lubrication or cleaning, but excessive vibration caused by damaged blower wheels or fans can cause motor damage. Check wheels and fans for obstruction or damage by running each fan alone, then listening and feeling for irregularity. Replace damaged wheels or fans to prevent vibratory damage to surrounding and supportive housing parts and fasteners as well as motors.

Switches are also maintenance-free, but loose wiring connections to switches or motors can cause excessive resistance and overheating damage. Wires to switches can be checked or repaired by removing the switch mounting panel next to the driver’s seat.

Panels and Housings

Fasteners which connect and retain structural and access panels should be checked and tightened as necessary. A loose screw may allow a panel to vibrate, resulting in excessive noise, more loose screws, and/or metal fatigue.

HOSE REPAIR

Hoses are installed with as few joints as possible so as to prevent the possibility of leaking joints. If a portion of hose becomes damaged, a new piece of hose can be spliced in by use of a four-inch brass tube (Blue Bird Part No. 1701903), and hose clamps. If hose must be replaced due to aging, the entire length of hose should be replaced. Air duct hose can be repaired with a good brand of wide PVC tape or duct tape.

REMOVAL OF UNDERSEAT FAN AND MOTOR ASSEMBLY

1. Remove front and rear screws securing outlet to heater (Figure 1).
2. Lower outlet panel and move it toward aisle to clear end of heater (Figure 2).
3. Rotate outlet panel toward rear, away from heater, exposing fan and motor assemblies. Remove screws securing fan and motor to heater for service (Figure 3).
STANDARD HEATER CUT OFF VALVE LOCATION

Valves No. 1 and 2 are used to isolate the heater system from the engine in case a leak occurs within the system while bus operation must be continued, or for repair to a system.

ENGINE: Cummins 5.9TA

Valve No. Location
1 Rear RH Corner of Engine Block
2 At Transmission Oil Cooler

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PRESSURE LINES
RETURN LINES

1 VALVES
HEATER HOSE CLAMP SERVICE

Tighten heater hose clamps after first 1,000 miles and annually thereafter. Heater hose clamps (Blue Bird Part No. 1056050) are located at the underseat heater coil, behind the access door in the heater hose covering immediately forward of the left front wheelhousing, and under the floor near the right front and driver’s heater. Torque clamps to 45 inch-pounds new and 34 inch-pounds for retorque.
HEATER AND HEATER CONNECTIONS WATER CAPACITY CHART

Note: Water capacity of heaters includes tubing within heater enclosure.

<table>
<thead>
<tr>
<th>Option No.</th>
<th>Description</th>
<th>Capacity (Quarts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Std.</td>
<td>90TC Front Heater</td>
<td>3.19</td>
</tr>
<tr>
<td>Std.</td>
<td>12 Driver’s Heater</td>
<td>0.25</td>
</tr>
<tr>
<td>1325</td>
<td>50 Front Underseat Heater</td>
<td>1.56</td>
</tr>
<tr>
<td>1330</td>
<td>50 Rear Underseat Heater</td>
<td>1.56</td>
</tr>
<tr>
<td>1332</td>
<td>50 Rear RH Underseat Heater</td>
<td>1.56</td>
</tr>
<tr>
<td>1336</td>
<td>80 Front Underseat Heater</td>
<td>2.34</td>
</tr>
<tr>
<td>1342</td>
<td>80 Rear Underseat Heater</td>
<td>2.34</td>
</tr>
<tr>
<td></td>
<td>1 Foot of Connecting Line</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Example:
Unit with 5.9TA Cummins Engine and Options 1325 and 1342

Driver’s Heater (Std) 0.25
Front Heater (Std) 3.19
50 Front Underseat (Opt. 1325) 1.56
80 Rear Underseat (Opt. 1342) 2.34
76 Feet of Heater Pipe with 0.17 quarts per foot 12.92

20.26 in heating system

Capacity of Engine Coolant System 24.60 quarts in engine
Total Capacity 44.86 quarts

ENGINE BLOCK HEATER(S)

Engine block heaters are designed to help maintain a warm engine block for easier starting and faster warm-up.

If the bus will be stopped longer than one hour in cold weather conditions (below freezing), plug in 120 V cord to outlet located as shown in illustrations. Be sure to unplug heater and properly stow the cord before moving the bus.
WINDSHIELDS AND WINDOWS

WINDSHIELD GLASS REPLACEMENT

The windshield is four-piece flat.
1. Remove vertical filler strip in glazing rubber on each side of broken glass; remove horizontal filler strip in glazing rubber on top and bottom of broken glass. It will be necessary to cut the horizontal filler strip after it is pulled past the glass.
2. Starting at a corner, push glass free of glazing rubber from inside of bus outward, and remove.
3. Position new glass in glazing rubber.
4. Using installation tool, work glass into glazing rubber (Figure 1).
5. Seal glass to glazing rubber from outside of the bus with an adhesive sealant such as Silastic 732 RTV Adhesive/Sealant.
6. Apply soapy solution to filler strip channel on glazing rubber to act as a lubricant for easier installation of filler strip.
7. Using filler strip tool, insert filler strip into channel on glazing rubber (Figure 2).

SPLIT SASH WINDOW AND GLASS REPLACEMENT

NOTE: The glass used in Blue Bird buses meets Federal Motor Vehicle Safety Standards 205 and 217. Therefore, when a piece of glass is broken, it should be replaced with an identical piece.
1. Remove four screws securing window frame to bow.
2. Pull window to inside of body and remove.
3. Remove six screws (three on each side of window) holding assembly together.
4. On bottom glass, simply pull aluminum channel off top and bottom of glass.
5. To remove glass from top part of window, remove six screws holding frame around glass.
6. Reassemble window by reversing above procedure.
7. Apply weather seal caulking around window frame to prevent leaking.

WARNING: When replacing broken or damaged glass, use extreme care at all times to prevent personal injury. Use proper replacement parts, tools, and personal protective equipment, such as gloves and safety goggles.

WINDOW LATCH REPLACEMENT
1. Remove screw and block located in side channel directly above stationary glass (Figure 1).
2. Lower sliding sash so that latch enters large notch covered by block removed in Step 1.
3. With latch in large notch, push finger holds outward until inside edge is exposed (Figure 2). Pull latch out of finger hole opening.
4. Finger latch is pried off attached metal latch with any tool that provides leverage. Latch may now be removed and replaced.
5. Reassemble by reversing procedure.

NOTE: Lubricate latches and sliding seal of top window with silicone spray every 30 days. See decal on driver’s window.
ENTRANCE DOOR GLASS REPLACEMENT
1. Apply pressure against glass from the outside of the bus, starting at a corner and push glass and glazing rubber off of metal flange.
2. Remove glazing rubber from around glass.
3. Put glazing rubber on new glass.
4. Wrap a cord around the glazing rubber and rest the glass on the bottom flange of the opening from outside the bus.
5. Pull cord slowly and work glazing rubber onto metal flange.
6. Apply pressure to glass from inside of bus to assure proper seal.

WARNING: When replacing broken or damaged glass, use extreme care at all times to prevent personal injury. Use proper replacement parts, tools, and personal protective equipment, such as gloves and safety goggles.

REAR VISION GLASS REPLACEMENT
1. Remove filler strip from channel in glazing rubber.
2. Apply pressure against glass from the outside of the bus starting at a corner and push glass and glazing rubber off of metal flange.
3. Remove glazing rubber from glass.
4. Put glazing rubber on new glass.
5. Apply a soapy solution to the flange on the bus body and to the filler strip channel on glazing rubber. This acts as a lubricant for easier installation. Wrap a cord around the glazing rubber and rest glass on bottom window flange from the inside of the bus body.
6. Apply pressure from the inside of the bus body to ensure glass is seated properly. Pull cord slowly and work glazing rubber onto the window flange.
7. Using filler strip tool, insert filler strip into channel on glazing rubber. Filler strip tool is available from your distributor.
8. Apply clear caulking around glass and window flange on the outside of bus body to ensure that no leaks occur.
TRANSIT SLIDING WINDOW MAINTENANCE
1. Remove screws in outside aluminum extrusion.
   NOTE: On push-out windows, when hinge screws are removed and
   interior latch released, window sash may be removed from frame.
2. Use putty knife to loosen sealer between window frame.
3. After sealer is loosened around entire perimeter of window frame, gently
   pry out using flathead screwdriver.
4. Reverse procedure for installation.

CAUTION: DO NOT pry window frame from body without loosening sealer.
This could bend the frame.

Glass Replacement Procedure
1. To remove push-out transit sliding window, release window lever (1)
   located inside the bus at the bottom of each push-out window. Remove
   hinge screws (2) on outside of body. Lift and pull window out of section.
   To remove stationary transit sliding window, remove all screws (3) between
   inner frame (4) and outer frame (5). Lift and pull window out of section.
2. Remove four screws and take out vertical brace (6) located in the center of
   the window.
3. Remove two window stops (one on each side at top of window). Slide
   glass to the center of the window. Spread apart the inner frame (4) just
   enough to lift out glass frame (7).
4. To remove glass from frame, slide rubber seal (8) out of vertical rail (9)
   exposing two screws. Window glass is removable after screws are removed.
5. Remove glass.
6. To replace glass, slip glazing vinyl seal around glass and slide into frame.
7. Reassemble by reversing procedure.

WARNING: When replacing broken or damaged glass, use extreme care
at all times to prevent personal injury. Use proper replacement parts, tools,
and personal protective equipment, such as gloves and safety goggles.
WINDSHIELD WIPERS

WIPER ARM REMOVAL AND INSTALLATION

To replace the wiper arm assembly if damaged, follow the procedure outlined below.

NOTE: Before removing any wiper arm, operate the wipers briefly, and stop the blades in the normal park position.

First install a .1 pin in hole located on wiper arm above the rubber boot in order to keep spring in stationary position during reinstallation. Remove the cap nuts, which secure the wiper arm and idler arm to the wiper and idler shaft, respectively. Remove the wiper arm and place new arm (Blue Bird Part No. 0348177) over wiper shaft and make sure the new arm is replaced in the same position as the old arm was removed. Place original cap nuts on shafts and tighten.

WASHER SOLUTION RESERVOIR

Periodically check the windshield washer solution reservoir, located behind the driver’s side front access panel of the AARE and TCFE, and located behind the front access panel on the entrance door side of the AAFE. Be sure there is an adequate supply of fluid at all times. The solution used is a 50/50 mixture of methanol alcohol and water.

WIPER ASSEMBLY REPLACEMENT

To replace wiper assembly (Figure 2, Blue Bird Part No. 0348144), loosen lock nut, remove screw, and pull wiper assembly loose from wiper arm. Replace the wiper assembly and use original screw and lock nut. Tighten lock nut securely, but do not tighten enough to compress the saddle. Blade must be free to move on axis (machine screw) and within the saddle. Threading the lock nut until flush with machine screw end will give a secure and serviceable installation.

WIPER REFILL REPLACEMENT

To remove wiper refills, follow the procedure outlined below.

1. Lift end clip with screwdriver as shown in Figure 3. This releases locking indentations (A in Figure 4) and allows end clip retainers (B) to be removed through blade claw.
2. Repeat procedure on opposite end of wiper.
3. New end clips (Figure 4) are provided with replacement Anco refills. To install, remove one clip and slide the refill through all claws until end clip locks into place.
4. Install second end clip, and snap-lock devices A and B into place to secure refill.
LOWER SIDE PANEL REPAIR PROCEDURE

1. Remove the lower portion of the side panel by carefully drilling out the vertical rows of rivets on each side of the panel from the bottom of the floor line rub rail to the bottom of the skirt and the rivets attaching the bottom rub rail to the panel to be removed. Cut the panel not less than one inch below the floor line rub rail, and remove.

2. Clean to bare metal the inch-wide section of panel left below the floor line rub rail and apply a one-inch wide bead of Amicon two-component epoxy, TX-4009 or equivalent, following directions and recommendations of the adhesive manufacturer.

3. Insert the replacement panel between the rub rail and the original side panel far enough to ensure a minimum of 1/2 inch of the replacement panel is under the rub rail. Install Cherry SSPV 86 blind rivets (Blue Bird Part No. 0888222) on 3-1/2 inch centers through the rub rail lower flange and the new and old side panel.

4. Replace the vertical rows of rivets and the rivets attaching the bottom rub rail with the same type, size, and quantity of fasteners as used in the original construction or with Cherry SSPV 86 blind rivets (Blue Bird Part No. 0888222) as necessary.

5. Allow the adhesive to cure the proper amount of time (fourteen days at room temperature for the Amicon TX-4009) before returning the vehicle to service.

SPARE TIRE LOCATION AND REMOVAL

If your unit is equipped with a frame-mounted spare tire carrier, follow this procedure to remove and replace spare:

1. Remove the two securing nuts and rotate tire out of holes.

2. Open access door, if equipped, through access hole, insert lug wrench, placing socket over hex head on shaft and turn clockwise and disengage ratchet.

3. Slowly lower tire by turning counterclockwise. **WARNING: Hold wrench securely while lowering tire, or tire’s weight may cause lug wrench handle to slip.**

4. Remove lifting platform from tire.

5. To raise tire, reverse procedures, making certain to engage ratchet before cranking clockwise.

**WARNING: At all times stay away from beneath tire.**

If your unit is equipped with a spare tire compartment, follow this procedure to remove and replace spare:

1. Unlatch the tire compartment door and secure in the open position with the chain and hook.

2. Pull out the rack.

3. Remove the wheel hold down clamp and lift off the wheel. Reverse the procedure above to replace the wheel.

**WARNING: At all times stay away from beneath tire.**
TIRES, WHEELS, AND RIMS

WARNING: An inflated tire and rim can be very dangerous when misused or worn out. Many accidents, some fatal, have resulted from improper handling and operation of bus rims and wheels. Therefore, it is of the utmost importance that the precautions outlined on these pages be carefully followed by all persons servicing bus rims and wheels to avoid personal injuries and costly damage.

Both the tubeless type and tube type tires are used on your vehicle. The tubeless tires are mounted on 15° drop-center rims and wheels. The tube type tires are mounted on two-piece flat base rims or wheels or three-piece flat base rims or wheels.

DAMAGED TIRES

WARNING: To help avoid personal injury and/or property damage if a blowout or other tire damage occurs, obtain expert tire service help if you can. If you must remove the wheel and change the tire without such help, take the following precautions:

• If the tire seems to contain air under pressure, stand to the side and check whether the wheel assembly appears normal by comparing it to another wheel assembly on the vehicle. Check whether the side ring and lock ring around the wheel rim (if so equipped) are seated properly for duals; look between the tires to check this. If they look as if they are not seated properly, or if you cannot be sure, stay away from the tire and wheel and do not attempt further repair without expert tire service help.
• If the side ring and lock ring appear to be seated properly (or the wheel is not so equipped), let the air out of the tire by taking out the valve core. If you have a way to put air back into a tire, note that it is good safety practice to let the air out of both tires of a dual assembly before taking off the damaged tire and rim assembly from the vehicle. After letting out the air, take off the tire and rim assembly and put on the spare wheel and tire assembly.
• If you are not fully expert on the procedures to follow, and/or are not equipped with the proper tools and equipment, again, do not attempt to raise the vehicle, or remove or install the tire and wheel assembly. Obtain expert tire service help.
• Do not put air back into a tire that has been run flat, or is seriously low on air, without first having the tire taken off the wheel and the tire and tube checked for damage.
• Note that taking off and putting tires on bus wheels requires proper tools, safety equipment, and special training. A person can be badly injured and/or damage can result from using the wrong service methods. Bus tires and wheels should be serviced only by trained people using the proper equipment.
• When putting air into a tire on the vehicle, stand to the side and use a clip-on chuck and hose extension. Never add to your tires unless an accurate pressure gauge is also used. In choosing the right tire pressure, be careful not to go past the maximum pressure capacity shown on the tire.

CAUTION: Tire inflation pressure must not exceed the recommendations of the tire and/or wheel rim manufacturer for the specific load, speed, and application. The inflation pressure on the tire sidewall does not take the wheel or rim capacities into consideration. Tires should not be inflated above the pressure listed on the label without consulting your tire/wheel distributor.
WHEEL AND RIM SAFETY

Wheels and wheel components must be properly maintained because otherwise they can adversely affect the life of the tire and/or wheel. An inflated tire is potentially very destructive. Accidents are caused by careless handling and inexperience. Safety literature can be obtained from your wheel and rim distributor, a wheel and rim manufacturer, NHTSA, or OSHA. If you have any questions, consult the distributor or manufacturer directly. The load-carrying requirements of each vehicle should also be determined before selecting the proper tire/wheel combination. Always remember that the weakest weight-carrying component of the vehicle (i.e., tire, wheel, axle, bearings, etc.) determines the overall maximum safe load-carrying capacity for the vehicle.

WARNING: Improper handling of wheels and rims has caused many injuries and deaths. Failure to follow directions is the leading cause of such accidents. Obtain procedures from wheel and rim manufacturer before working with a wheel or rim. Follow also the following rules:

The tire and wheel must always be properly matched. For example, do not mount a 20-inch tire on a 22-1/2-inch wheel. Failure to strictly adhere to these important instructions may result in an explosive separation and could cause serious bodily injury or death. It is very important to determine the size of each component before beginning any assembly operations.

When replacing tires, use the same size, load range, and construction type as originally installed on the vehicle. When replacing wheels, use original equipment manufacturer’s wheels or equivalent available from your dealer with equivalent capacity, width, offset, and mounting configuration as those originally installed on your vehicle. Use of improper replacement wheels and tires may adversely affect ride, handling, load carrying capacity, bearing life, the clearance to body and chassis components, vehicle ground clearance, vehicle width, and brake cooling. Do not intermix rim, lock ring, and wheel components from different manufacturers.

TIGHTENING WHEEL STUD NUTS

CAUTION: When the bus is new, or when the wheels or fasteners are new, have a technician tighten wheel stud nuts and/or rim clamp nuts with a torque wrench at 100, 500, and 1,000 miles (180, 800, and 1,600 kilometers). This precaution is necessary because the clamping system used on the wheels must seat before the fasteners will hold a uniform clamp load and remain fully tightened. Also, have a technician tighten wheel stud nuts and/or rim clamp nuts with a wrench after installing any wheel. In addition, nut tightness on all wheels should be set with a torque wrench every 1,000 miles (1,600 kilometers).

Use the following procedures, as applicable, when installing or tightening wheels.

DISC WHEEL

Mount front wheel or inner dual wheel over studs, being careful not to damage stud threads. Draw up nuts alternately in the sequence as shown. Do not tighten them fully (tighten nuts to 450-500 foot-pounds using the same alternate sequence). Mount the outer wheel and repeat the entire procedure. Torque outer nuts to 450-500 foot-pounds.

SPOKE WHEELS

Place rims and spacer band on wheel. Secure clamps evenly in position by tightening the nuts by hand. Tighten the nuts to 50 foot-pounds using the alternate sequence as shown. Check the wheel wobble, then rotate the wheel so that the furthest position out is at the top. Tighten the nuts to 100-150 foot-pounds using the procedure shown. Torque the nuts to 200-250 foot-pounds using the procedure shown.

NOTE: For dual tire installations, position outer tire and wheel assembly so that valve stems will be in adjacent holes or spaces.

Tire size, rim size, and tire inflation pressure are printed on the certification plate located in the driver’s area.
JACKING INSTRUCTIONS

1. Park vehicle on flat, level concrete or comparable surface capable of supporting jacking device.
2. Apply parking brakes.
3. Place chocks at front and rear of tires opposite wheel/or wheels to be lifted first.
4. Use jacks and jack stands or blocks of sufficient capacity to support the vehicle. Following the jack manufacturer’s recommended procedure, place jack securely under axle at spring or suspension beam and lift to required height for servicing. Be sure any locking device on the jack is in place and operating and solidly support the vehicle under the main frame rails with jack stands or blocks before working under or around the bus.
5. After servicing is complete, reverse above procedure.

WARNING: Bumpers are designed to protect the vehicle and occupants from front and rear collisions. Do not work under bus supported by bumper jacks. Use only appropriate jack stands supporting frame rails when working under bus.
ENGINE OPERATING INSTRUCTIONS

ENGINE EXHAUST CAUTION DIESEL AND GAS
(Carbon Monoxide)

WARNING: Never idle engine in closed areas. Never sit in a parked or stopped vehicle for any extended amount of time with the engine running. Exhaust gases, particularly carbon monoxide, may build up. These gases are harmful and potentially lethal. Carbon monoxide is colorless and odorless, but can be present with all other exhaust fumes. Therefore, if you ever smell exhaust fumes of any kind inside your vehicle, have it inspected immediately by your dealer and have the condition corrected. Do not drive with exhaust fumes present.

Avoid inhaling exhaust gases because they contain carbon monoxide, which by itself is colorless and odorless. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal.

If at any time you suspect that exhaust fumes are entering the bus, have the cause determined and corrected as soon as possible.

The best protection against carbon monoxide entry into the bus is a properly maintained engine exhaust system, body, and body ventilation system. It is recommended that the exhaust system and body be inspected by a competent mechanic:

- Each time the vehicle is raised for oil change.
- Whenever a change is noticed in the sound of the exhaust system.
- Whenever the exhaust system under body or rear of the vehicle is damaged.
- Inspection of all piping and joints—replace clamps if leaking. **Note:** Clamps are not reusable. Reseal with exhaust sealant and install new clamp.

Do not run engine in confined areas, such as garages, any more than needed to move vehicle in or out of area. When your bus is stopped in an open area with engine running for any more than a short period, and if it is equipped with combination heating and external ventilation, then adjust the heating or ventilation system to force outside air into the bus with blower set at medium or high speed.

**Remember:** Keep air inlet grille clear of snow or other obstructions at all times to assure proper operation of the ventilation system.

Sitting in a parked vehicle with engine running for an extended period, in either a confined or open environment, is dangerous.

DIESEL ENGINE STARTING PROCEDURE

1. Apply parking brake.
2. Place transmission shift lever in neutral position.
3. See appropriate engine manufacturers operating manual for proper starting procedures. Starting procedures vary from different engine manufacturers and also varies with temperature.
4. After engine starts, release accelerator to maintain a fast idle (1,000-1,600 rpm) until the engine is warmed up.

**IMPORTANT:** After engaging starter for 30 seconds, follow with 120 seconds (2 minutes) off time. If engine fails to start after a reasonable time, determine cause of failure. Pumping the accelerator will not assist engine starting in any way. Refer to engine manufacturer’s recommended procedures. **DO NOT RACE THE ENGINE TO SPEED WARM-UP!**

STARTING WITH BOOST CABLES

**WARNING:** Batteries can emit potentially explosive fumes. Prevent sparks near the batteries. They could cause vapors to explode. Do not allow battery cable ends to contact each other or the engine.

**CAUTION:** Do not smoke when observing the battery electrolyte levels. Electrolytes are corrosive and can cause personal injury if they contact skin or eyes. Always wear protective glasses when working with batteries.
Your bus has a 12-volt starting system. Use only the same voltage for boost starting. The use of a higher voltage will damage the electrical system.

Always connect the boost cables in parallel with the bus battery cables, **Negative (-) to Negative (-) and Positive (+) to Positive (+)**. Do not reverse the battery cables. The alternator can be damaged. Attach ground cable last and remove first.

1. Fasten the positive (+) clamp of the boost cable to the positive (+) post of the battery.
2. Fasten the negative (-) clamp of the boost cable to the negative (-) post of the battery.
3. Start the engine.
4. After the engine starts, disconnect the negative (-) boost cable from the battery.
5. Disconnect the positive (+) boost cable from the battery.

**COLD START AID (OPTIONAL)**

The cold start aid is designed as an aid to start the diesel engine in temperatures below 32°F (0°C). This cold start aid utilizes a pressurized cylinder of ethyl ether which is injected into the intake manifold on the engine. The ether may be injected prior to cranking. To operate, press button for 1 second and release. Wait 2 seconds and engage starter. For temperature below 0°F (-18°C), repeat the above steps. Use the aid only for starting. **NOTE:** Not available with electronic engines.

**WARNING:** Ether starting fluid is highly flammable and toxic. Observe the precautions printed on the container when using or storing this fluid and when discarding the empty containers.

**NOTE:** It is not recommended to use ether capsule starting aids, or to spray ether into the air intake system.

**USING ENGINE AS A BRAKE**

In descending a steep or long grade it is a good practice to use the engine as a brake to retard vehicle speed. Reduce speed before the grade and shift into a lower gear (with either automatic or manual transmissions), being careful to select a gear which will slow the vehicle without overspeeding the engine. Under such conditions, use the brakes sparingly to prevent them from overheating, which reduces their effectiveness.

**WARNING:** Do not take transmission out of gear when going down a steep or long grade. You may not be able to get the transmission back in gear, and the drastic slowing of engine speed could reduce air pressure supply to the air brake system, and result in a reduction of brake capacity.

**ENGINE WARNING SYSTEM**

Your unit may have an optional alarm system to signal low oil pressure and high engine temperature. If the engine temperature exceeds 210°F, or if the oil pressure drops below 6 psi, a buzzer sounds and an indicator light glows.

**CAUTION:** If the alarm system sounds, shut the engine off immediately. Operation of the engine after the alarm sounds could cause serious engine damage.

**ANTIFREEZE**

The unit is equipped with a 50-50 solution of antifreeze and water. This mixture protects to -30°F. The driver should check antifreeze before taking unit into cold climate. For protection to -92°F, the mixture should be 68 percent antifreeze and 32 percent water. Never have more than 68 percent antifreeze.

**CAUTION:** Cold water should never be poured into the cooling system when engine is hot. Wait until engine cools, then add coolant with engine running.
WARNING: Extreme care must be used when removing radiator cap. As coolant becomes hot, pressure is built up in the cooling system. Rapid venting and/or removal of radiator cap will cause coolant to boil up and spray out and can result in serious burns. Slowly vent off pressure before removing radiator cap.

NOISE EMISSIONS WARRANTY

Blue Bird Body Company warrants to the first person who purchases this vehicle for purposes other than resale, and to each subsequent purchaser, that this vehicle, as manufactured by Blue Bird, was designed, built, and equipped at the time it left Blue Bird control, to conform to all applicable United States Environmental Protection Agency Noise Control Regulations.

This warranty covers this vehicle as designed, built, and equipped by Blue Bird, and is not limited to any particular part, component, or system of the vehicle manufactured by Blue Bird. Defects in design, or assembly, or in any part, component, or system of the vehicle as manufactured by Blue Bird, which at the time it left Blue Bird control, caused noise emissions to exceed Federal standards, are covered by this warranty for the life of the vehicle.

FUEL AND LUBRICANT REQUIREMENTS

DIESEL FUEL

TC units should take advantage of the high energy content and generally lower cost of No. 2 diesel fuel. Experience has shown that diesel engines will operate satisfactorily on No. 1 fuel.

CAUTION: This coach is equipped with a BFR-mounted 60 gallon fuel tank. Use caution when filling with a high delivery nozzle to prevent spillage.

WARNING: FUEL SPRAY MAY CAUSE INJURY, REMOVE CAP SLOWLY. Do not fill more than 95% of liquid capacity.

RECOMMENDED LUBRICANT

CAUTION: Do not mix petroleum-based and synthetic lubricants, or different brands of synthetic lubricants due to possible incompatibility. In addition, there may be increased lubricant change intervals recommended for synthetic lubricants. Consult manufacturer’s label for lubricant requirements.


NOTE: For engine oil lubricant, follow engine manufacturer’s recommendations for SAE grades.
INTRODUCTION

The compressed natural gas (CNG) fuel system consists of DOT-certified CNG storage tanks (which replace the fuel tank), a structure to hold and protect the storage tanks, metallic fuel lines to deliver the fuel, high and low pressure regulators to reduce the pressure entering the throttle body, a fuel shut-off solenoid, and the throttle body which delivers the CNG/air mixture to the engine. The regulator includes an integral heater to preheat the CNG for anti-icing control.

A pressure relief system is part of the fuel system. This system is designed to vent the tank contents when pressure and temperature become excessive.

A fill connection is located near the entrance of the bus.

If so equipped, the engine powering this bus is engineered specifically for use with CNG. Operation and maintenance procedures are similar to those used on gasoline or diesel engine vehicles. Differences identified are obvious.

OWNER / OPERATOR RESPONSIBILITIES

The owner/operator should be aware of the code requirements and be familiar with applicable codes which apply to the area of operation. The owner/operator should be aware that fuel cylinders for CNG (Compressed Natural Gas) must be inspected every three years in accordance with NGV-2 specifications. The owner/operator should be aware that cylinder expiration date is fifteen years after date of cylinder manufacture and that cylinders must be replaced. This testing and certification is not covered by Blue Bird warranty.

WARNING: Due to the dangerous potential of high-pressure cylinders, it is suggested that anyone involved in their use be completely familiar with the Department of Transportation “Code of Federal Regulations Title 49” and the various Compressed Gas Association pamphlets that are available covering the care and use of high pressure cylinders. Regulations do not permit filling NGV cylinders with an overcharge.

NATIONAL FIRE PROTECTION ASSOCIATION #52 states:

Cylinders shall be manufactured, inspected, marked, tested, retested, equipped and used in accordance with U.S. Department of Transportation (DOT) or Canadian Transport Commission (CTC) regulations, exemptions or special permits specifically for CNG service and shall have a rated service pressure of not less than 2400 psig at 70°F (16.5 MPa at 21.1°C).

Pressure vessels shall be manufactured, inspected, marked and tested in accordance with the rules for construction of unfired pressure vessels, Section VIII (Division 1), ASME Boiler and Pressure Vessel Code.

When a vehicle is involved in an accident or fire causing damage to the CNG container, the CNG container shall be replaced or removed, inspected and retested in accordance with the document under which it was originally manufactured before being returned to service.

When a vehicle is involved in an accident or fire causing damage to any part of the CNG fuel system, the system shall be retested before being returned to service.

Damaged supply lines shall be replaced, not repaired.

The owner or user or both shall maintain all containers, container appurtenances, piping systems, venting systems and other components in a safe condition.

As a precaution to keep pressure relief devices in reliable operating condition, care shall be taken in the handling or storing of compressed natural gas containers to avoid damage. Care shall also be exercised to avoid plugging by paint or other dirt accumulation of pressure relief device channels or other parts which could interfere with the functioning of the device. Only qualified personnel shall be allowed to service pressure relief devices. Only assemblies or original manufacturer’s parts shall be used in the repair of pressure relief devices unless the interchange of parts has been proved by suitable tests.

CODE OF FEDERAL REGULATIONS #49 states:

In addition to the requirements of this paragraph, cylinders marked DOT-3HT must be requalified in
accordance with CGA pamphlet C-8 and must comply with the following:

Cylinders built prior to implementation of FMVSS 304 must be subjected, at least once in three years, to a test by hydrostatic pressure in a water jacket, for the determination of the expansion of the cylinder. A cylinder must be condemned if the elastic expansion exceeds the marked rejection elastic expansion.

Cylinder service life must not exceed fifteen years.

Each cylinder must be reinspected and hydrostatically retested every three years in accordance with 49 CFR 173.34(e) as prescribed for DOT-8HT cylinders, except that the rejection elastic expansion criteria does not apply, permanent volumetric expansion must not exceed 5 percent of total volumetric expansion at test pressure and retest dates must be imbedded in the epoxy coatings in a permanent manner other than stamping. Retest dates may be steel stamped on the shoulder of the top head in accordance with 178.BB-15(c). Reheat treatment or repair of cylinders not authorized.

FUEL SYSTEM DESCRIPTION

The fuel system begins with DOT-certified tanks designed to hold compressed natural gas (CNG) up to 3,600 psi at standard day temperature (70°F, or 21°C). The tanks are high-strength aluminum wrapped with fiberglass for further strength.

The fuel flows from the tank to the engine through manually-controlled shutoff valves. These include an integral pressure relief valve consisting of a combination rupture disk (for pressure) and fuse plug (for temperature) to vent the contents of the tank should high pressure and high temperature occur, such as in a fire. The rated temperature for relief is 212°F.

From the valve, fuel flows into a common fuel line through high-pressure stainless steel compression fittings. The tanks are joined to the common line through high-pressure stainless steel T’s and crosses. Any open tank thus communicates to any other open tank, so for fueling, the fuel is backfed through the common line to all tanks (with open valves) simultaneously. The tank shutoff valves only isolate the interior of the tanks; the T’s on the valves still have the high line pressure.

Do notuncouple fittings until all tanks are closed and pressure has been purged from the line.

The lines are high pressure rated 3/8 stainless steel seamless tubing which carries the fuel to the high-pressure regulator.

In refilling, the fuel enters the fill valve on the entrance side of the bus and then flows through a check valve into the common tubing before reaching the tanks.

From the high pressure regulator, the fuel flows to the shutoff solenoid. The shutoff solenoid is activated by the ignition switch, engine operation, and the fire suppression system. The loss of any of these will shut off fuel supply to the low pressure regulator (LPR).

The dashboard fuel gauge is proportional to the pressure when corrected to 70°F.

NOTE: Fuel level is only accurate for the tanks that are open.

SAFETY CAUTIONS AND WARNINGS

Both gasoline and CNG are volatile flammable fuels, yet they are safe to work around when necessary precautions are taken. As on a gasoline-fueled system, carelessness with CNG can lead to a fire or explosion when a leak occurs. CNG will not pool and spread like gasoline. It has a narrower range of flammability than gasoline, as well as a higher ignition temperature. Despite these relative safety advantages, fire potential does exist. CNG is lighter than air, therefore, it can collect in the higher regions of a room and possibly go undetected, creating fire potential.

Since the fuel system is a very high-pressure system employing a flammable gas, all safety issues normally considered in these situations should be applied. Some of the more obvious precautions are listed below. This list is not necessarily intended to be complete, and responsibility for assuring full safety is that of the person(s) doing the work or operating the system.

WARNING: Handle natural gas with care. Compressed natural gas is a volatile fuel stored under high pressure. If fuel storage or delivery components are installed, serviced, or operated improperly, fire, explosion, and/or serious injury could result. Do NOT smoke while working on or around natural gas equipment. Avoid flames, sparks, and operation of electrical devices in or around a vehicle with a
possible natural gas leak. Properly tighten all connections and thoroughly check for leaks after servicing fuel system. Natural gas fumes may cause sickness or death. Work in well-ventilated area.

WARNING: Protect against high-pressure CNG. Compressed natural gas is stored and routed to the engine at a pressure up to 3,600 psi. Do NOT attempt to remove or disassemble any fuel system component while it is pressurized. Explosive separation of components and escaping natural gas can cause serious injury. Avoid the hazard by relieving pressure before disconnecting any CNG fitting or line. Properly tighten all connections and thoroughly check for leaks before applying pressure. Never attempt to overpressurize the system.

WARNING: Protect against extremely cold escaping CNG. Compressed natural gas is stored at an extremely high pressure. If compressed natural gas escapes from a leak, it will expand into an extremely cold (-260°F) gas. Severe frostbite may occur from contact with escaping natural gas or its associated components. Avoid the hazard by relieving the pressure before disconnecting any CNG fitting or line. Properly tighten all connections and thoroughly check for leaks before applying pressure.

WARNING: Storage tanks must be tested according to specified procedures at required dates. Failure to do so relieves the manufacturer of all responsibility and is a violation of Federal law. See manufacturer’s label.

CAUTION: In the event of an accident, all tanks, lines, and fittings should be thoroughly checked by qualified personnel before the vehicle is used again.

NOTE: All valves are closed when turned fully clockwise viewed from the top of the valve handle, and open when turned counterclockwise viewed from the top of the valve handle.

CAUTION: Always provide good ventilation, including near roofs and ceiling.

CAUTION: Avoid working in noisy environments, as the sound of leaking gas may go undetected.

WARNING: Never attempt to find a leak with your hands. A large leak can freeze burn the skin.

WARNING: Never place hands or any other part of the body on a leak.

IMPORTANT: Always have rated fire extinguishers on hand and automatic fire suppression equipment.

CAUTION: Avoid heat near pressure relief valves; the manufacturer’s rating is 212°F for the relief valve. Should it vent, the entire area will be filled with natural gas.

IMPORTANT: Rust or corrosion on tanks, lines, fittings, and valves can be a serious problem. Any part with serious corrosion should be replaced.

IMPORTANT: Fiberglass coating on tanks should be in excellent condition. Any cracks or serious scrapes may require tank replacement. Contact the manufacturer.

WARNING: Tanks cannot be filled to more than 3,000 psi or 3,600 psi temperature-corrected.

IMPORTANT: Use only authorized refueling stations with adequate pressure controls and venting capacity.

NOTE: Venting contents of tanks should follow any Federal and State guidelines, including EPA.

WARNING: Use only fuel connections designed for use with that on the bus. Do not attempt to force damaged fittings.
WARNING: Keep sources of heat and ignition away from fuel system and refueling apparatus.

For more information see drawing #1589001 in the owner’s information package supplied with the vehicle.

COMPRESSED NATURAL GAS FUEL

The performance and reliability of a natural gas vehicle is dependent upon the quality of fuel used. BTU content of natural gas can vary depending on locale. Excessive moisture can cause driveability problems, loss of power, and regulator freezing. Other contaminants, specifically lubricants and oil, can cause serious damage which is not covered by the engine manufacturer’s warranty. In addition, poor-quality fuel can affect emission certification.

CAUTION: It is the owner’s/operator’s responsibility to ensure that clean, quality fuel is used to prevent damage to the fuel system components and power plant. Damage caused by poor-quality fuel is not covered by Blue Bird warranty.

Fuel control systems used on engines fueled by compressed natural gas contain electronic sensors and other delicate components which are not tolerant to contaminants. Vehicle performance is dependent upon clean fuel and a regular schedule of vehicle maintenance.

Compressed natural gas is expected to be delivered from the compressor station and storage cascade free of contaminants including oil, water, and particulates.

Conditions exist in some CNG fill stations that cause inferior fuel to load into the vehicle’s fuel storage system.

The driving range of a natural gas vehicle is dependent upon driver, fuel BTU content, vehicle weight, gear ratio, tire size, terrain, engine tune and condition, frequency of starts and stops, level of fuel, and other factors.

COMPRESSED NATURAL GAS FILTERS

Particulate and coalescer type filters are installed in Blue Bird CNG fuel systems. The primary filter is of stainless steel construction and is located at the fill point. This filter can be checked for contamination by closing main shutoff valve on frame and then relieving pressure which is trapped between the check valve in the fill nozzle and the main system check valve. The owner/operator should establish a service interval based on quality of gas from the compressor station. It is recommended that the filter sump be checked after the initial fill and every fifth fill thereafter, or on a schedule based on need.

The secondary filter has a black anodized housing and is adjacent to the fuel shutoff solenoid close to the engine. The secondary filter can be checked after relieving system pressure. This is best accomplished by closing the main shutoff on frame and running engine until fuel supply is depleted and pressure is zero. Contamination of the secondary filter should not occur if a proper maintenance schedule has been followed at the fill point primary filter. Contamination of the secondary filter also shows that CNG storage cylinders on the vehicle are contaminated. The owner/operator should insist that fuel from a compressor station be clean and dry.

Replacement filter elements are available through the Blue Bird Service Department.

WARNING: Natural gas is extremely flammable and high pressure gas can cause personal injury, loss of sight, or death.

FUEL COMPOSITION

Natural gas composition varies throughout the country, depending on original gas composition and processing. Pipeline-quality natural gas is composed of several different gases, of which methane typically accounts for 85 to 99 percent. Other hydrocarbons present in natural gas include ethane, propane, some butanes, and trace amounts of other hydrocarbons. Nitrogen, helium, carbon dioxide, and trace amounts of hydrogen sulfide, water, and odorants are also present. Most natural gas available does not vary significantly in content; however, significant variations are more likely from small gas utilities. The removal of all carbon dioxide,
water, hydrogen sulfide, and odorants is required for liquefaction, thus LNG does not contain these constituents.

Large amounts of non-methane hydrocarbons will enrich the fuel mixture, reduce the octane number, lead to increased hydrocarbon emissions, and increase the potential for engine knock. Accordingly, engine parameters such as air/fuel mixture and ignition timing should be adjusted based on composition of the local natural gas supply.

**REFUELLING**

**CAUTION:** Refueling must be conducted in well-ventilated areas to prevent accumulation of dangerous gas levels.

The National Fire Protection Association has recommended guidelines for CNG refueling systems. State and local regulation regarding NGV refueling may preclude economic feasibility of indoor refueling (such as in New York City). However, the significance of this issue may diminish if increased experience with fuel leads to less stringent regulations.

CNG refueling transfers natural gas under pressure and may be set up as either slow-fill or fast-fill. Slow-fill generally uses overnight refueling and requires less costly refueling station equipment than fast-fill. However, fast-fill refueling time is only slightly longer than gasoline refueling time. LNG refueling transfers a cold (-260°F) liquid under pressure (around 15 psi) and generally takes slightly longer than conventional refueling because a greater volume of liquid is transferred to compensate for its lower energy content.

The refueling station has a supply connection hose and a coupling which must be properly attached to the fuel system fill valve. The supply side is regulated for maximum pressure and uses a proper purge valve when decoupling from the filler. The regulators and relief valves of the fill station must be checked for proper values and operation.

Fuel enters the bus coupling from the filler connection, travels through a one-way check valve into the fuel lines and then into any open tanks. Any tank that is open is in communication with any other open tank through the common fuel lines.

**CAUTION:** Do not refill with the engine running or any source of ignition or heat nearby. The refueling station must be in a safe working condition with approved operable relief and vent valves.

**NOTE:** A ground stud is provided for attachment of the grounding cable at the compressor station. Check that the tank shutoff valves are open. Any tank with an open valve will be filled, any tank with a closed valve will not. If the bus has been operating with some tanks closed, it is preferable to fill the empty tanks first and then fill the remainder. Fill to the desired pressure. Maximum is 3,600 psi at 70°F. (NOTE: Most fill stations have a dome valve to make the temperature correction automatically.) When fueling is complete, open the fill connector purge valve. Use only fuel filling couplings designed for use with the CNG. Do not force damaged couplings together.

**CAUTION:** A check valve is included in the system behind the fill connector to prevent backflow of fuel when purging and disconnecting the fuel nozzle.

**NOTE:** The tanks are full at 3,000 psi, or 3,600 psi and 70°F. The pressure will vary with temperature, decreasing with lower temperature and increasing with higher temperatures. Filling apparatus compensates for the temperature effect.

**WARNING:** Never fill to more than permissible pressure. Contact the manufacturer if an accidental overfill occurs.

**NOTE:** The fuel level is only accurate for tanks that are open. For example, if one tank is open and reads 1,000 psi, then the fuel available to the engine is proportionate to the total capacity.
**SPECIFIC GRAVITY**

The specific gravity of natural gas relative to air (air=1.00) is 0.56 to 0.62, depending on gas composition. This means that natural gas is lighter than air. In the event of a natural gas leak, the gas will rise and dissipate given open conditions. There is no possibility of CNG accumulating in pools on the ground beneath a spill.

**NOTE:** Odorants have been added that allow natural gas to be detected before reaching dangerous concentrations.

In the case of LNG releases, the cold vapor initially released is heavier than the surrounding warmer air and thus stays low, near the ground (a visible vapor cloud is often formed from the condensation of water in the cold air-gas mixture). As the vapor cloud warms, it will increase in volume, become lighter than air, and rapidly dissipate.

**FUEL TOXICITY AND SAFETY**

Natural gas is a nontoxic gas. However, it is flammable under proper conditions. Also, it can cause suffocation if it displaces enough oxygen. LNG has the added safety concern of being a cold (-260°F) liquid under pressure. Contact with LNG or associated cold components may cause severe frostbite. Furthermore, many common materials change their strength characteristics when exposed to LNG temperatures, thus presenting additional hazards.

**WARNING:** LNG tanks have the potential for explosions under circumstances such as those described for LPG explosions.

Although natural gas has odorants to aid in detection of leaks, these odorants are removed during liquefaction, thus LNG vapors cannot be detected by smell. **NOTE:** LNG odorants have been developed but are not commonly used due to the relatively restricted use of LNG at this time.

**FLAMMABILITY**

Autoignition temperature for natural gas at atmospheric pressure is 1,004°F compared to an autoignition temperature range of 442° to 880°F for gasoline and approximately 500°F for diesel fuel. The risk of fire in the presence of an ignition source exists when the ratio of air to fuel is within flammability limits (i.e., fuel can not ignite if it is mixed with too much or too little oxygen). The flammability limits for natural gas are 5.3 to 15 percent volume of gas in air. For comparison, the flammability limits of unleaded gasoline are 1 to 7.6 percent volume of gasoline in air. As a practical matter, there is no oxygen present in CNG cylinders or LNG tanks, therefore ignition within the cylinder or tank is not possible. In the event of a fuel leak, there will be a small area in which the air/fuel ratio is within the flammability limits. In a closed garage, or within the passenger compartment, ignition conditions are more likely to be met. Odorants used in CNG allow its detection before the lower flammability limit is reached.

**ANTIKNOCK PROPERTIES**

Natural gas has a research octane rating of about 130, making it relatively resistant to engine knock. The antiknock property is a result of the high ignition temperature, resistance to autoignition, and the relatively low flame speed of natural gas. Antiknock properties allow the use of engine compression ratios in the range of 15:1 (compared to 8:1 to 10:1 for gasoline). The low flame speed of natural gas results in a longer duration of combustion. To compensate for the lower flame speed, ignition timing is advanced. As with other fuels, knock may occur with advanced ignition timing, prolonged combustion (i.e., too lean a mixture), and excessively high compression ratios.

**ENERGY CONVERSIONS**

- 100-125 cubic feet NG = 1.0 gallon gasoline
- 136 cubic feet NG = 1.0 gallon diesel
- 1 cubic foot NG = 1,000 Btu
- 114,000 Btu = 1.0 gallon gasoline
- 83,700 Btu = 1.0 gallon LNG

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VEHICLE PERFORMANCE AND EMISSIONS

NGV performance, fuel economy, and emissions can be significantly altered with vehicle tuning (e.g., ignition timing, air/fuel ratio). Appropriate tuning adjustments can optimize performance, fuel economy, and emissions. Alternatively, a compromise tuning may be effected. Tuning optimization for power generally increases emissions. Substantial improvements in performance and emissions can be obtained using natural gas conversion kits that are specially designed for a given vehicle make and model. Further improvements can be achieved with factory-built, dedicated NGVs.

STARTING PROCEDURE

Make sure that the main shutoff valve and at least one tank valve are open. The fuel gauge shows empty if no fuel is available to the mixer. Check the tank and main fuel shutoff valves if no fuel is indicated on the fuel gauge. 

NOTE: Fuel gauge takes time to register after turning the key.

Starting procedures are identical to those of a gasoline engine vehicle. With the vehicle in neutral, turn the key until the engine catches. Do not press the accelerator. If the engine has trouble starting, depress the accelerator slightly and release when the engine catches. Pumping the accelerator in no way assists in starting the engine.

Engine operation and characteristics should be similar to those of a gasoline engine.

COLD START

For cold starts in low ambient temperatures, natural gas has an advantage over liquid fuels because it is already in the vapor phase. With correct conversion kit installation and vehicle maintenance, cold start ability is better with natural gas than gasoline.

OPERATION AND MAINTENANCE OF VEHICLE COMPONENTS

CNG vehicles require Department of Transportation (DOT)-certified cylinders for the storage of pressurized (maximum 3,600 psi) natural gas. Refueling port and lines with pressure safety valves must also be installed. High-pressure fuel lines from the storage cylinder lead to a pressure regulator/reducer, which reduces gas pressure in one or two steps. In a fuel-injected converted vehicle, a mixer/carburetor must be added for the injection of natural gas. In carbureted fuel systems, a specialized mixer/carburetor for natural gas may be installed. LNG vehicles require insulated, pressurized (10 to 35 psi) fuel tanks. LNG is vaporized in the fuel line and warmed in the heat exchanger generally located under the hood. Pressure is reduced by the pressure regulator before the vapors are transported to the mixer/carburetor.

MAINTENANCE

Service manuals supplied by converters and installers should be consulted for maintenance of NGV-specific parts. Components such as the pressure regulator/reducer can be checked with a pressure gauge to determine if the unit is operating properly. Measurements with an EGA can indicate proper air/fuel mixtures and ignition timing. NGV maintenance issues are briefly listed below.

CNG Cylinders—CNG cylinders must periodically be recertified to maintain compliance with DOT standards. The Compressed Gas Association has published several pamphlets with recommendations of standards for the inspection of compressed gas cylinders.

Oil Changes—Due to the clean-burning characteristics of natural gas, collection of particulate matter in engine oil does not occur as rapidly as with gasoline. However, even though the oil may appear clean by visual inspection, oil compounds break down under engine heat. These chemical changes reduce the lubricating ability of the oil and stress the engine system. Therefore, it is recommended that the oil should be changed according to manufacturer recommendations, regardless of oil appearance. (NOTE: There are reports of oil in NGV engines maintaining its lubricating properties longer than in gasoline engines, but considerably more research is needed in this matter.)

Spark Plugs—Spark plugs should be replaced as recommended by the vehicle manufacturer.

CAUTION: Do not use CNG pressure or vent lines to clamp, hang, connect, or attach any items, including harnesses, hoses, power steering hose, refrigerant hoses, or any other item.
MANUAL FIVE SPEED TRANSMISSION

The standard transmission used in the TCFE is a five-speed Synchro-Mesh transmission. Refer to the gearshift knob for proper shift sequence. Disengage the clutch and move the lever into first or reverse gear. If the lever does not engage immediately, let the clutch partially back-up, while keeping a gentle pressure against the shift lever until full engagement is accomplished.

CAUTION: Do not “ride the clutch” by resting your foot on the clutch when not shifting gears. Do not use the clutch to hold the vehicle at a standstill on an upgrade, as when waiting for a traffic light. Such misuse could cause premature clutch wear and damage.

ALLISON AUTOMATIC TRANSMISSION

AT 545

The Allison transmission provides four forward speeds and one reverse. Selective control is obtained through the selector lever located on the right area of dash. The selector lever must be in N (neutral) to start the engine. If the engine starts in any other position, the neutral start switch is malfunctioning. Use D (drive) for all normal driving conditions. The vehicle will start in first gear and as you depress the accelerator, the transmission will upshift to second, third, and fourth gear automatically. As the vehicle slows down, the transmission will automatically downshift to the correct gear. Use 3 and 2 when the road load or traffic conditions make it desirable to restrict the automatic shifting to a lower range. When the conditions improve, return the range selector to the normal driving position. These positions also provide progressively greater engine braking power (the lower the gear range, the greater the braking effect). Use 1 when pulling through mud or snow or driving up steep grades. This position provides maximum engine braking power. Use R (reverse) for backing up the vehicle. The vehicle should be completely stopped before shifting from a forward gear to reverse. Reverse gear provides the greatest tractive advantage.

CAUTION: In the lower ranges (1, 2, and 3) the transmission will upshift above the highest gear selected when the recommended engine-governed speed for that gear is exceeded.

ALLISON TRANSMISSION CABLE ADJUSTMENTS

To adjust the transmission shift cable properly, do the following:
1. Place the selector in neutral with the cable connected at the selector and disconnected at the transmission.
2. Find neutral on the transmission by rotating the manual range selector shaft on the transmission all the way counterclockwise, then rotating it one click clockwise.
3. Adjust the trunnion pin so that it slides easily in and out of the hole in the shift lever on the transmission. Check the neutral safety switch on the selector to be sure the engine will start only in neutral.
Adjust the mechanical modulator as follows:
1. With the modulator cable disconnected at the engine, rotate fuel control lever on the engine to full throttle position.
2. Adjust modulator slip joint to push cable until the cable comes within 1/8 inch of bottoming, when throttle is wide open.
3. Adjust the clevis or trunnion on the end of the cable to permit “free pin” with the fuel control lever. Install and secure the pin.
4. Check accelerator linkage for the proper return to the idle position.
5. Check to be certain there is between 1-3/16 and 1-9/16 inches travel in modulator cable.
6. If the throttle linkage is readjusted for any reason, the mechanical modulator must be readjusted as above.

**MD3060 WORLD TRANSMISSION**

The Allison electronic world transmission provides five forward speeds and one reverse. Fourth gear is a 1-to-1 ratio while the fifth gear is an overdrive with a 0.75-to-1 ratio. The push-button shift selector is located on the right area of the dash. The transmission and selector must be in neutral to start the engine.

**NOTE:** Transmission and shift selector will return to \textbf{N} when engine is stopped and power switched off. If it does not return to \textbf{N} or if it starts in any other gear, the unit has malfunctioned. Seek service immediately.

The push-button shift selector has \textbf{R}, \textbf{N}, \textbf{D}, down arrow, up arrow, a \textbf{MODE} button, and a digital display. When a range button is pressed, a tone sounds, the \textbf{SELECT} indicator displays the chosen operation (if Electronic Control Unit (ECU) determines the shift is acceptable), and the transmission shifts to the starting range as indicated on the \textbf{MONITOR} display. In \textbf{DRIVE}, selection of a specific gear can be accomplished by pressing the \textbf{UP} or \textbf{DOWN} arrow buttons. Conditions resulting in the \textbf{CHECK TRANSMISSION} light located below shift selector will disable the pad and no tones will be heard (see Check Transmission Light).

The \textbf{MODE} button, located on the push-button shift selector, activates a second shift schedule. The initial start up is in primary (power mode) and secondary (economy mode) is selected by pressing the \textbf{MODE} button. The display will indicate the mode on for secondary (economy mode). In economy mode the transmission shift to higher gear at lower engine rpm.

With an Allison MD-equipped vehicle, it is not necessary to select the right moment to upshift or downshift during the changing road and traffic conditions. The Allison MD does it for you. However, knowledge of the gear ranges and when to select them will make it even easier to control the vehicle.

**MD 3060 GEAR SELECTION**

**WARNING:** In the event the operator leaves the vehicle, even momentarily, while the engine is running, be sure that the transmission is in \textbf{Neutral}, parking brake and/or emergency brakes are set and properly engaged, and the wheels are chocked. The vehicle may move unexpectedly and suddenly if these precautions are not taken.

\textbf{R—Reverse}

The vehicle must be completely stopped before shifting from forward to reverse or from reverse to forward. The \textbf{SELECT} indicator and the \textbf{MONITOR} will display \textbf{R} when the vehicle is in reverse.

\textbf{N—Neutral}

Use neutral to start the engine, to check vehicle accessories, and for extended periods of engine idle operation. Under normal operation, the transmission is directed by the ECU to neutral during the start-up procedure. This occurs automatically with the push-button selector. If the vehicle starts in any range except
neutral, seek service immediately. Neutral is also used during stationary operation of the power takeoff (if your vehicle is equipped with a PTO). The SELECT indicator and the MONITOR will display N.

**WARNING:** Do not allow your vehicle to coast in neutral. This practice can result in transmission damage. Also, no engine braking is available in neutral.

**D—Drive**

When D is selected, the vehicle will begin in first gear, and the transmission will upshift automatically through each gear as the speed increases. As the vehicle slows down, the transmission will downshift automatically. The SELECT indicator will display the highest gear available and the monitor will display the current operating gear.

**2, 3, 4, 5 Gears**

Occasionally, the road conditions, load, or traffic conditions will make it desirable to restrict the automatic shifting to a lower gear. Positions 5, 4, 3, and 2 provide progressively greater engine braking for going down grades (the lower the gear, the greater the braking effect). The push-button selector utilizes arrow buttons. Push the Up or Down arrow to the desired gear. The SELECT indicator will display your choice and the MONITOR will display the selected gear when it is attained.

**1 Gear**

Use position 1 gear when pulling through mud and deep snow, when maneuvering in tight spaces, or while driving up or down grades. Low gear provides the vehicle with its maximum driving power and maximum engine braking power.

The transmission incorporates a hold feature to prohibit upshifting above the gear selected during normal driving. For downhill operation, however, the transmission may upshift above the highest selected gear when the engine governed speed is exceeded and damaging engine overspeed is a possibility.

**CHECK TRANSMISSION LIGHT**

The CHECK TRANSMISSION light is located on the shifter cover. The electronic control system is programmed to inform you if operating parameters have been exceeded and automatically take action to protect the operator, vehicle, and transmission. A diagnostic code will be registered when the CHECK TRANSMISSION light is on and also when other conditions are diagnosed which do not require the CHECK TRANSMISSION light to be on.

Every time the engine is started, the CHECK TRANSMISSION light turns on for a few seconds. This momentary lighting is to show that the lighting circuit is working properly. If the light does not come on during engine start, service the light immediately.

If the light turns on, and is followed by eight seconds of short beeps from the shift selector, it means that shifts are being restricted. The SELECT digit on the display will be blank. The operator may continue in order to reach service assistance. The ECU may restrict upshifts and downshifts. Direction changes will not occur. For push-button shift selectors, the ECU will not respond to operator requests. The ECU will cause the transmission to shift to a safer gear and a Hold-In-Range. See Allison Operator’s Manual for Hold-In-Range and reset procedure.

**USING THE ELECTRIC RETARDER**

- The electric retarder control switch is mounted on the vertical panel to the left of the driver. It has five positions (one off and four retard positions). Each higher number increases the amount of retardation to slow the vehicle.
- Remember the retarder is a vehicle slowing device, not a stopping device. Final stopping must be made with the service brake.
- Always release the accelerator completely before applying the retarder.
- Do not use the retarder when road surfaces are slippery.
- Consult the retarder manufacturer’s owner/operator manual for additional information.
ALLISON AUTOMATIC TRANSMISSION DRIVING TIPS

Accelerator Control

The pressure of your foot on the accelerator pedal influences the automatic shifting. When the pedal is fully depressed against the pedal stop on the floor, the transmission will automatically upshift near the recommended governed speed for the engine. A partially depressed position of the pedal will cause the upshifts to occur sooner at a lesser engine speed. With AT 545, the timing of the shifts is accomplished by using a cam and cable from the throttle. With MD 3060, an electronic signal tells the ECU how far the operator has depressed the pedal. This provides the accurate shift spacing and control necessary for maximum performance.

Downshift Control for AT 545

The transmission can be downshifted or upshifted, even at full throttle, and although there is no speed limitation on upshifting, there is a limit on downshifting and reverse. Avoid downshifting when the vehicle is above the maximum speed attainable in the next lower gear. The downshift inhibitors within the valve body prevent those harmful shifts when the vehicle is going too fast for the next lower gear.

If the downshifts are attempted at excessive speeds, the inhibitors prevent the selected downshift until the vehicle slows to an acceptable speed.

Downshift or Reverse Inhibitor Feature with MD 3060

Although there is no limitation on upshifting, there is a limit on downshifting and shifts from Neutral into Drive or Reverse. If a downshift or neutral-to-range shift is selected when the engine speed or throttle position is too high, the ECU will not allow the shift until reaching a lower speed. If idle speed is too high, shifts to range are inhibited. A continuous “beep” tone emits if reverse is selected during forward movement or a neutral-to-range shift is selected at too high an engine speed.

Cold Weather Starts for MD 3060

Most World transmissions are programmed to restrict full operation until specific temperatures are reached. Refer to the chart at right for temperature restrictions.

<table>
<thead>
<tr>
<th>Sump Oil Temperature</th>
<th>CHECK TRANSMISSION Light</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>-32° C (-25° F) and below</td>
<td>ON</td>
<td>Neutral only</td>
</tr>
<tr>
<td>-31° C to -7° C (-24° F to +20° F)</td>
<td>OFF</td>
<td>Neutral, 1st, 2nd, or Reverse</td>
</tr>
<tr>
<td>-7° C (20° F) and above</td>
<td>OFF</td>
<td>Full operation in all gears</td>
</tr>
</tbody>
</table>

Using the Engine to Slow the Vehicle

AT 545

To use the engine as a braking force, shift the range selector to the next lower range. If the vehicle is exceeding the maximum speed for a lower gear, use the service brakes to slow the vehicle to an acceptable speed where the transmission may be downshifted safely.

An automatic, compared to a manual, shift transmission has a longer “coast down” time. Until you are accustomed to this characteristic, you may need to downshift manually to reduce speed.

With a little experience in driving the automatic, you will learn to decelerate a bit sooner, or brake until automatic downshifts occur. This will reduce the need for manual downshifting.
To use the engine as a braking force, select the next lower gear. If the vehicle is exceeding the maximum speed for this gear, use the service brakes to slow the vehicle. When a lower speed is reached, the ECU will downshift the transmission automatically. Engine braking provides good speed control for going down grades. When the vehicle is heavily loaded, or the grade is steep, it may be desirable to preselect a lower gear prior to the grade. If engine speed is exceeded, the transmission will upshift automatically to prevent damage to the engine.

**TRANSMISSION OIL TEMPERATURE**

The transmission oil temperature is indicated in some vehicles by a gauge specifically designed for this purpose and in some vehicles by the engine coolant temperature indicator. Extended operations at low vehicle speeds with the engine at full throttle can cause excessively high oil temperatures in the transmission. These temperatures may tend to overheat the engine cooling system as well as cause possible transmission damage.

If excessive temperature is indicated by the engine coolant temperature gauge. Stop the vehicle and check the cooling system. If the cooling system appears to be functioning properly, shift to neutral and accelerate the engine to 1,200-1,500 rpm. This should reduce the sump temperature to operating level within two or three minutes. If high temperature persists, stop the engine and have the overheating condition investigated by service personnel.

If excessive temperature is indicated by the transmission oil temperature gauge, check the oil level in transmission (refer to the Oil Check Procedure in your Allison Transmission operators manual). Stop the vehicle and shift to neutral. Accelerate the engine to 1,200-1,500 rpm. The temperature should return to normal within two or three minutes before the vehicle resumes operation. Normal temperature for both on and off-highway operation is 160° to 200°F. Oil temperature should never exceed 250°F. In units equipped with the MD 3060 transmission, if the sump oil temperature reaches 250°F, the ECU will inhibit operation in the higher gears and turn on the OIL TEMP light, located on the shifter cover.

If high temperature in either engine or transmission persists, stop the engine and have the overheating conditions investigated by maintenance personnel.

**CAUTION:** The engine should never be operated for more than 30 seconds at full throttle with the transmission in gear and the vehicle not moving. Prolonged operation of this type will cause the transmission oil temperature to become excessively high and will result in severe overheat damage to the transmission.

If the transmission overheats during normal operation, check the oil level in the transmission.

**TRANSMISSION BREATHER**

The transmission has a self-contained breather near the cooler line ports. Be careful to avoid plugging this breather with paint, undercoating, or any other material. The breather provides a passage for normal expansion and contraction of air and fluid within the transmission. A small amount of oil mist comes out of the breather during normal operation. If an excessive amount of oil is found in this area, the cause should be investigated.
HYDRAULIC BRAKES

Bendix hydraulic disc brakes are standard on all CS, TC, and All American body models.

The hydraulic brakes have the Bendix Maxi Power Booster dual hydraulic brake system. The system has a two-compartment reservoir mounted on the floor behind the driver. The Hydro-Max Booster is a hydraulic assist system using a hydraulic power steering pump. This pump is gear-driven by the engine. There is an electrical backup power assist in the event of a malfunction in the hydraulic power pump system or loss of engine power. The battery provides the reserve power for the electrical backup power assist.

CAUTION: Hydraulic brake systems are power-assisted. Braking capacity is reduced without engine assist. Do not move bus with dead engine.

The electric power backup pump will operate whenever the engine is not operating and the key switch is in either the ON or START position or when the key is in the OFF position and the brake pedal is depressed.

Test daily by feeling for the electric motor operation while applying the brakes with engine not operating, or when the key switch is in the ON or START positions and the engine is not operating. Initially, the pedal will be hard to push, but will become softer as the electric motor starts.

WARNING: Do not drive the bus when the electrical backup pump does not operate. In the case of a loss of a power assist, there will be reduced brake capacity without the electrical backup.

DUAL BRAKE SYSTEM

The dual brake system allows the driver reasonable brake capacity in case either the front or the rear brake circuit fails.

CAUTION: When one circuit of the dual system fails, the following conditions will exist.

1. Bus stopping distance will increase. Drive the bus only with extreme caution. Service immediately!
2. The brake pedal will be softer to push.
3. The brake pedal will travel further, even as far as the floorboard. These conditions exist because only one axle will be stopping the bus.

MAINTENANCE

The Bendix disc brakes self-adjust for lining wear. Brake fluid in the reservoir, located behind the driver’s seat, must be maintained to the correct level. As the brake linings wear, fluid from the reservoir will displace the lining thickness loss. Be sure to use only brake fluid in this reservoir.

The power steering reservoir is located behind the front grille access panel on the driver’s side. The power steering fluid serves the power steering gear-driven pump, power steering gear and Bendix Hydro-Max Booster.

CAUTION: Put only brake fluid in the brake fluid reservoir and power steering fluid in the power steering system. Failure to use the proper fluids could result in loss of braking or steering.
**BRAKE WARNING SYSTEM**

The brake warning system includes a buzzer and a dash-mounted red light labeled **BRAKE**. The light and buzzer will operate as a result of the following:

1. Engine is running, brakes not applied, with a loss of electrical power to the electric backup pump motor.
2. Engine is running, brakes not applied, with a loss of power assist from the power steering pump.
3. Engine is running, brakes are applied, and either the front or rear section of the system has failed. The backup pump, buzzer, and light will remain on even after the brake pedal has been released.
4. Engine is not running, brakes not applied, but ignition key is **ON**. This condition should happen every time the driver starts the bus. The bus should not be driven if the backup pump system is not working. The backup system should go off when the engine starts.
5. Engine is not running, brakes are applied, ignition is in **ON** or **START** position. This is a method for checking that the backup pump system is not working. **NOTE:** With engine not running and ignition OFF, a depressed brake pedal will cause the backup to run with no light and buzzer. The backup system should go off when the pedal is released. Without the assist of the power steering pump and without the assist of the backup pump, the master cylinder will allow the brakes to be applied. However, brake capacity will be very limited and the bus should not be driven under these conditions.

**PARKING BRAKE (HYDRAULIC BRAKES)**

The parking brake is designed to hold the loaded bus up to a 20 percent grade. The parking brake is not to be used as a normal service brake, but can be used to help stop in an emergency situation.

When the parking brake is applied, and the ignition switch is **ON**, a dash-mounted yellow light labeled **PARK** will warn the driver that the brake is applied. The bus should not be driven when the parking brake is applied. Doing so will prematurely wear the parking brake or damage other drive train components.

**WARNING:** Improper adjustment of the parking brake can significantly reduce the holding ability of the parking brake system. This could result in the vehicle’s moving when unattended.

**CAUTION:** The parking brake is designed to hold on the above mentioned grade on a clean, dry, and smooth road surface. Parking on wet, icy, or snow-covered grades is not recommended. Chocking of wheel(s) is recommended when parking on any grade.

**WARNING:** Exercise extreme caution when the drive shaft is removed on a unit equipped with hydraulic brakes. The parking brake becomes inoperative when the drive shaft is disconnected. Do not leave the bus unattended until appropriate measures have been taken to prevent vehicle movement.

The parking brake is adjusted by turning the knob on the parking brake lever. The knob is held in place with a set screw. The knob can be adjusted when the parking brake is released. When the parking brake is properly adjusted, the lever will snap firmly into place. Lever effort will be 80-100 pounds.

Extreme caution should be exercised when the drive shaft is removed on a unit equipped with hydraulic brakes. The parking brake becomes inoperative when the drive shaft is disconnected. Do not leave the bus unattended until appropriate measures have been taken to prevent vehicle movement.
AIR BRAKES

A coach equipped with a dual air brake system consists of separate complete systems for the front and rear service brakes. A separate reservoir and air gauge is provided for each of these systems. A dual treadle valve is provided for operating the service brake system. In addition to providing excellent service brake performance, this dual brake system includes safety features which allow the driver to use the emergency stopping system through the service brake treadle valve. If there is a failure in the air reserve for the front brakes, the rear service brakes can still be applied using the treadle valve, since the two service brake systems operate independently of each other. If there is a failure in the air reserve for the rear service brake system, the front service brakes and the rear spring brakes can be applied through the treadle valve. This allows the operator to use a normal method of braking during an emergency situation. However, in the case of an air reserve failure, the low air pressure warning buzzer will activate, indicating trouble, and the respective air gauge on the dash will show which system has lost air pressure. The coach must not be operated under those conditions, but be repaired before continuing use.

The rear spring brakes can also be controlled by a dash-mounted valve located on the lower portion of the instrument panel. These spring brakes cannot be fully released until the air reserve pressure is above 60 psi. These brakes are in the released position when the control valve is pushed in, and in the applied position when the control valve is out. In the event of an air pressure loss, the valve will automatically move to the applied-brake position, and cannot be released until the air reserve pressure is replenished.

AIR BRAKE ADJUSTMENT

1. Raise the tire off the floor. (NOTE: Install jack under the axle, not under the bumper.)
2. Turn the tire and adjust the brake slack adjuster until the brake shoes are tight against the brake drum.
3. Back off the slack adjuster until wheel rotates freely (very little drag).
4. Apply maximum brake application (100 psi +) and check brake chamber push rod travel. Readjust if travel is greater than 1 1/4 inches.

FUEL STOP SOLENOID (AIR BRAKES ONLY)

The bracket assembly, mounting, fuel stop solenoid is the on-off fuel flow control for the air brake TCFE Cummins 5.9 powered unit. The solenoid requires 12 V to energize, which allows fuel flow. Lubricate the pivot points with light-duty engine oil. Clean the solenoid and linkage periodically. If service is required, assemble and adjust per drawing #1530435, found with the vendor maintenance documents supplied per order.

PARKING

Use the dash-mounted valve to apply the rear spring brake when parking the coach. When the parking brake is applied, and the ignition switch is ON, a dash-mounted yellow light labelled PARK will warn the driver that the brake is applied.

CAUTION: Do not attempt to move bus before spring brakes are released.

DRAINING AIR TANKS

Condensation must be drained from all air tanks daily. To drain tanks properly, leave cocks open until all air escapes and draining stops. NOTE: Daily draining is not required on units equipped with automatic drain valve or an air dryer. The air dryer removes water, oil, and other contaminants before they reach the wet tank. The automatic drain valve contains a reservoir to collect condensation in the air brake system which ejects during the on-off cycle of the compressor. On valves with heating elements, freeze-up protection is operational when the ignition is turned on.
**SCHRADER VALVE**

The coach is equipped with a Schrader valve, located at the end of the wet tank. It allows the air brake reservoir to be charged with a common type of air hose normally used by service stations and garages. Charging this system in this manner is only a means of providing air pressure for the air brake system with an inoperable air compressor or without cranking the engine and should only be used for moving the coach while servicing or in case of emergency.

**MGM SERVICE AND PARKING BRAKE**

Releasing Spring Brake Manually: If air pressure fails in the piston chamber, the power spring applies the brakes and, unless pressure can be re-established, the service brakes must be released as follows in order to move the coach.

**WARNING:** Do not release spring brake until coach is secured by wheel chocks or tow vehicle. To do otherwise may result in bodily injury or property damage.

Remove the release stud tool and nut from the carrying pocket on the brake chamber assembly. Remove the access plug from the end of the spring chamber. Insert the release stud through the opening in the chamber and into the spring pressure plate. Turn the release stud one quarter turn to engage the stud tangs with the slot in the pressure plate. Keep the stud engaged and install the nut on the release stud. Tighten the nut until the spring is fully caged and the brakes are released. Do not loosen or remove the release stud and nut unless the brake chamber is completely assembled and is securely clamped. When air pressure is restored, remove the release stud and install in carrying pocket.
DOOR/BRAKE INTERLOCK

(If so equipped)

The door/brake interlock includes a 12 V DC power unit with integral pressure switches, a single actuator (displacing 2.9 cubic inches of system fluid), and an electronic control module. The operator interface of the electronic control module consists of an on/off switch, an audible alarm, and amber and green system indicator lights, located at the switch panel to the driver’s left. The maximum system pressure control is factory-set.

The interlock can also be used as a supplemental brake locking device.

The interlock repressurizes the brake system and sounds an audible alarm if pressure drops below required system levels. If an audible alarm sounds repeatedly, a small leak and/or air is present in the interlock or the vehicle brake system.

PRINCIPLES OF OPERATION

The door/brake interlock is armed when vehicle ignition is on. A switch contact closure activates the door/brake interlock when door is opened. At that point, the door/brake interlock uses the existing service brake system to apply brakes.

LOCK SYSTEM

The door/brake interlock is a SUPPLEMENTAL safety device and is NOT to be used in place of original equipment parking brake. When used with existing vehicle parking brake, the door/brake interlock uses a portion of the vehicle’s hydraulic service brake system to provide additional brake holding action.

WARNING: If a system leak develops, discontinue use of the door/brake interlock until the malfunction is diagnosed and corrected.

WARNING: Brake lock and warning circuits are disabled if battery power is lost or disconnected.

NOTE: The following are decals along with WARNINGS located forward of the switch panel below the driver’s side window.

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**WARNING**

Serious injury or death can occur if these instructions are not followed.

Vehicle equipped with Brake Lock System.
Operator must read and understand operating instructions before using vehicle.
Brakes will release if ignition is turned off when Brake Lock is remotely activated.
Do not use Brake Lock in place of original equipment parking brake.
Always set parking brake and use wheel chocks and outriggers with Brake Lock.
Do not use Brake Lock for overnight or prolonged parking.
Release Brake Lock before moving vehicle.
Brake Lock and warning circuit are disabled if battery power is lost or disconnected.

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**WARNING**

Serious injury or death can occur if these instructions are not followed.
Opening vehicle service door causes brakes to be applied.
Vehicle equipped with Door/Brake Inter-lock.
Operator must read and understand operating instructions before using vehicle.
Brakes will release if ignition is turned off when Door/Brake is remotely activated.
Do not use Door/Brake for overnight or prolonged parking.
Close vehicle service door before moving vehicle.
Door/Brake and warning circuit are disabled if battery power is lost or disconnected.
1. Hydraulic fan will not run.
   A. Check hydraulic oil level in reservoir. (Sight glass)
   B. Check fan motor for free rotation; fan motor should rotate freely. If not, rebuild or replace fan motor.

   **CAUTION:** Engine should be shut off when checking fan motor for free rotation.

   C. Disconnect wires from relief valve solenoid or temperature control switch, and start engine. If fan runs with wire disconnected, the temperature control switch is at fault. Replace switch. If fan does not run with wire disconnected, the solenoid valve may be at fault. Repair or replace solenoid valve. If this does not correct the problem, proceed as follows.
   D. With hydraulic system at normal operating temperature check pump output pressure to specifications below. Check pressure with wires disconnected from relief valve solenoid, or temperature control switch.

   **Note:** A pressure tap can be installed at port marked “PR” on the relief valve.

<table>
<thead>
<tr>
<th>Engine</th>
<th>Pump Pressure (psi)</th>
<th>Engine rpm</th>
<th>Fan rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.9 Cummins</td>
<td>100-300</td>
<td>800</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>2,000</td>
<td>2,500</td>
<td>1,900</td>
</tr>
<tr>
<td>8.3 Cummins</td>
<td>2,450</td>
<td>2,400</td>
<td>1,950</td>
</tr>
</tbody>
</table>

   E. If pressure is low, adjust the pressure relief adjustment screw by loosening the jam nut and turning the adjustment screw clockwise to increase pressure. If the pressure comes up to specifications, and the fan speed does not, the fan motor has excessive internal leakage and is at fault. Repair or replace fan motor. If specified pressure is obtained, the relief valve is faulty. Repair or replace relief valve.
   F. If the pressure does not come up to specification after adjusting the pressure relief screw, the pump may be at fault. Repair or replace pump.

   **NOTE:** If the pump is faulty, the power steering will probably also show signs of low pressure.

2. Fan motor runs continuously.
   A. Check for 12 V at the relief valve solenoid. Solenoid will not operate properly with less than 12 V.
   B. If check shows 12 V at solenoid, solenoid or solenoid valve may be faulty. Repair or replace solenoid or solenoid valve.
   C. If check shows no voltage at solenoid, check voltage supply at temperature control switch. If check shows 12 V at temperature control switch, the switch is at fault. Replace switch. If check shows no voltage, check circuit breaker and all connections for a short in circuit or open circuit.

3. Fan motor runs under speed.
   A. Check engine speed at idle and full rpm.
   B. See Steps 1-D through 1-F.

4. Shaft seal leak on pump is recognized by excessive addition of hydraulic oil, or in the Cummins 5.9T, and overfilled condition of the engine crankcase. Replace shaft seal or pump. Change engine oil.
COOLING SYSTEM

CAUTION: Use extreme care when removing a radiator pressure-control cap. The sudden release of pressure from a heated cooling system can result in a loss of coolant and possible personal injury (scalding) from the hot liquid or steam.

Coolant should be drained and replaced every two years. See individual Quick Reference Maintenance Chart for complete guidelines for each engine.

On vehicles used in stop-and-go service, such as the TC, engine hoses deteriorate more rapidly; therefore it is important to inspect all such hoses frequently. Hoses which are worn, chafed, hardened, or cracked must be replaced before a leak develops. On an age-hardened hose, retightening a worm screw clamp will not stop connection leaks, and further indicates that the hose needs replacement. It is also important not to overtighten clamps as this can damage the hose, or distort the tubing connector. When replacing a hose, the clamp should be torqued to 45 inch-pounds. When checking a hose clamp, clamps should be torqued to a minimum of 34 inch-pounds.

FAN CLUTCH

OPERATION

The Cummins Electromagnetic Fan Clutch is activated by 12 V DC from the vehicle electrical system. Bolted to the front of the engine, the fan gets power from belts the usual way. A separate control functions to turn the fan on and off as dictated by operating conditions. It operates by connecting 12 V DC to the magnetic coil to engage the clutch and breaking the 12 V circuit to disengage the clutch.

An increase of the engine coolant temperature above a preset limit causes a normally open thermal switch in the engine cooling system to close, “Close-on-Rise” at the present temperature.

A manual switch can also be added to the switch panel. This switch connection is parallel with the temperature switch allowing you to turn the fan on anytime.

FAN CLUTCH WIRING HARNESS

Closure of the sensor switch or of the manual switch completes the 12 V DC circuit to ground. When the circuit is completed, 12 V DC flows to the coil of the electromagnet, fixing the fan hub to the belt pulley. As long as any switch is closed, the fan turns.

When the switch opens or power is interrupted for any reason, the coil loses power and the magnetic field collapses, releasing the fan hub from the drive pulley. As the field collapses, polarity across the diode reverses, making a low-resistance circuit to ground, protecting switch contacts. If the diode fails or there is some other break in the diode circuit, there is likely to be arcing damage in the opening switch.

TROUBLESHOOTING

If clutch fails to operate with engine temperature over 205°F, check the temperature sensing device first, then the wiring and terminals. Then, using a jumper wire, touch the two terminals of the temperature switch. If the clutch clicks in when jumping these terminals, the temperature sensing device has failed (during the test, the engine temperature must be over 205°F with the clutch still not engaged). If this is the case, connect the two terminals and this will temporarily bypass the temperature sensing device, allowing the fan to run continuously. Install a new temperature sensing device as soon as possible.
If it becomes necessary to remove the pitman arm from the steering gear, it is possible to do so with
the gear still on the vehicle. The pitman arm may be removed as follows:
1. Remove the front of the drag rod from the pitman arm.
2. Rotate the steering gear so that the pitman arm nut and bolt are accessible with a socket and
 aren head for a ratchet wrench.
3. Locate and mark pitman arm and steering gear output shaft with a scribe or felt marker before
 removal of pitman arm to ensure reinstallation in the same location.
4. After removing the pitman arm nut and bolt, the pitman arm boss must be spread in order to
 loosen the pitman arm for removal from the shaft. Do this with the correct size Allen wrench, a
 chisel, or a pitman arm spreader.
5. When the boss is spread, slide the pitman arm off the steering gear shaft.
6. If vendor-supplied mark does not line up with mark on the steering gear output shaft, cross out
 vendor-supplied mark on pitman arm with a small chisel or punch and hammer.
7. Make a new mark to line up with mark on the steering gear output shaft.

If the same pitman arm is to be reinstalled onto the steering gear, clean the end of the steering gear
 shaft and the outside of the pitman arm so that the alignment marks on each are visible.

The pitman arm may be installed as follows:
1. Rotate the output shaft on the steering gear so that the mark on the output shaft is perpendicular
to the input shaft.
2. On the TCFE install the pitman arm on the steering gear output shaft (1) spline to the rear from
 parallel to the input shaft so that the marks on the splines align.
3. Install the pitman arm clamp bolt, nut and hardened flatwasher on the nut side. Be sure there is
 no spreading wedge left in the pitman arm boss before torquing the pitman arm clamp bolt to
 between 280 and 325 foot-pounds.
4. Reinstall the drag rod onto the pitman arm. Torque to between 120 and 170 foot-pounds.
WHEELBEARING ADJUSTMENT

FRONT AXLE
1. Assemble the bearings and hub onto the axle spindle.
2. Install the wheel bearing adjusting nut. Torque the adjusting nut to 50 foot-pounds, while rotating the hub and drum in both directions, so all bearing surfaces are in contact, then back off one-sixth to one-quarter turn to allow the wheel to rotate freely.
3. Install the nut lock.
   NOTE: Rotate the bearing nut slightly for alignment.
4. Install the jam nut and torque to between 125 and 150 foot-pounds.
5. Bend the lockwasher over the jam nut.
6. Check for excessive bearing end play; not to exceed 0.010.
7. Install the hub cap gasket and the hub cap. Torque the mounting bolts to between 11 and 13 foot-pounds.

REAR AXLE

Spicer Rear Axle F170-S, J190-S, J210-S, and J230-SB
1. Assemble the bearings and hub onto the axle spindle.
2. Install the dowelled wheel bearing adjustment nut. Torque the adjusting nut to 50 foot-pounds, while rotating wheel in both directions, so all bearing surfaces are in contact, then back off one-sixth to one-quarter turn to allow wheel to rotate freely.
3. Install the nut lock.
   NOTE: Rotate the bearing nut slightly for alignment.
4. Install outer jam nut and torque to between 250 and 275 foot-pounds.
5. Check for excessive bearing end play; not to exceed 0.010.
6. Install the axle shaft gasket over the studs in the hub.
7. Slide the axle shaft into place, over the studs in the hub.
8. F170-S:
   Torque Nylok nuts to between 95 and 115 foot-pounds.
   Torque steel crimp lock nuts to between 115 and 125 foot-pounds.
J190-S, J210-S, J230-SB
   Torque Nylok nuts to between 217 and 240 foot-pounds.
   Torque steel crimp lock nuts to between 275 and 320 foot-pounds.

REAR AXLE VENT

All drive axles have a vent on the top of the axle housing that allows the axle to breathe as the axle temperature changes. The vent must remain open to prevent seal failures. Note that it is normal for the vent to ooze some lubricant.
The allowable side-to-side movement between spring leaf and shackle or between shackle and spring hanger is 1/4 inch. The allowable movement between spring torque leaf bushing tube and the spring hanger is 1/4 inch. Total movement may be determined by inserting a 12- to 16-inch bar through the spring hanger bracket and the torque leaf at the spring eye, shifting the torque leaf side to side and up and down. **DO NOT** use a bar over 16 inches in length, to prevent damage to spring hanger or spring.
WASHING YOUR VEHICLE
The best way to preserve your vehicle’s finish is to keep it clean by washing frequently. Wash the vehicle in lukewarm or cold water. Do not use hot water or wash in the direct rays of the sun. Do not use strong soap or chemical detergents. All cleaning agents should be promptly flushed from the surface and not allowed to dry on the finish.

CAUTION: Pressure washing may cause damage to finish. Pre-test pressure washer on similar surface before applying pressure and chemicals to your vehicle. Pressure washers using recirculated water should filter the water to remove abrasive grit.

POLISHING AND WAXING YOUR VEHICLE
Polishing with nonabrasive wax is recommended to remove accumulated residue and eliminate any “weathered” appearance.

FOREIGN MATERIAL DEPOSITS
Calcium chloride and other salts, ice-melting agents, road oil and tar, tree sap, bird droppings, chemicals from industrial chimneys, and other foreign matter may damage vehicle finishes if allowed to remain on painted surfaces. Prompt washing may not completely remove all of these deposits. Additional cleaners may be needed. When using chemical cleaners developed for this purpose, be certain they are safe for use on painted surfaces.

FINISH DAMAGE
Any stone chips, fractures, or deep scratches in the finish should be repaired promptly. Exposed metal will corrode quickly and may develop into a major repair expense.

FLOORS AND FLOOR COVERING
It is imperative that the interior of the bus be kept clean, and floor covering is an important part of this maintenance. Regular cleaning and care will prolong the life of floor covering and improve the general appearance.

Floor coverings should be swept daily and mopped weekly with a mild detergent and water. Do not use floor sweeping compounds. Be sure to remove dirt, pencils, paper, and any other debris that may cause the emergency door to seal improperly. Do not use harsh detergents or excessive amounts of water. Do not use a water hose to wash out the bus; deterioration and damage to the wood floor could occur.

WARNING: Petroleum products, such as oil and grease, quickly deteriorate the floor covering. These types of products should be removed from the surface as soon as possible.

Continuous care must be exercised in the stepwell area, where foreign objects can create a safety hazard. Soil and debris must not be allowed to accumulate, as this not only creates a hazard for passengers but also hinders door operation and door sweeps. Ensure that screws for floor trims and aisle trims are seated tightly, so as not to loosen and create a safety hazard.
SCHEDULED MAINTENANCE

MONTHLY OR 1,000 MILES
- Grease safety barrier latch on Braun wheelchair lift.
- Lubricate roof hatch weatherseals and lock mechanisms.
- Inspect all emergency equipment mounting fasteners.
- Lubricate window latches and slides.
- Lubricate hinge pin on entrance doors.
- Lubricate pivot points on outward opening door.
- Check/adjust roller bracket and control rod bracket on jackknife door.
- Check/adjust air pressure in power jackknife door.
- Inspect outer fasteners and lubricate electric stop arms.
- Tighten all tie-down bolts to 37-41 foot-pounds torque at 1,000 miles, 2,000 miles, and quarterly thereafter.
- Inspect seat frames for secure attachment to the floor and wall.
- Lubricate rear emergency door positive hold open hinge.

MONTHLY OR 3,000 MILES
- Check fuel system (Drain fuel and contaminants, if required).
- Check battery water level.
- Inspect brake chambers.

3 MONTHS OR 5,000 MILES
- Inspect fire extinguisher to see if fully charged.
- Check first aid kits to see if fully equipped.
- Oil all hinges and window latches for ease of operation.
- Lubricate all window channels with silicone or graphite.
- There is one drain hole in each floor section under windows. Be sure hole is clear of debris so any water may escape.
- Clean all rubber door seals and lubricate with rubber lubricant.
- All rear and side emergency door latch slide bars to be lubricated with light grease to reduce friction.
- Tighten all tie-down bolts to 37-41 foot-pounds torque at 1,000 miles, 2,000 miles, and quarterly thereafter.
- Change main heater air filter (depending on operating conditions).
- Grease emergency door hinges.
- Check seat cushion clamps.
- Inspect mounting bolts on body tie-down.
- Inspect mounting fasteners and upholstery on seats.
- Lubricate bridge plate hinge and pivot on Collins wheelchair lift.
- Clean and lubricate fold cam slot, platform cam slots and handrail V-block on Collins wheelchair lift.
- Check fluid level in Collins wheelchair lift.
- Lubricate hinge and latch mechanisms on access doors.
- Check internal fasteners on electric stop arms.
- Lubricate entrance door security lock.
- Inspect heater valves to verify proper function.
- Change engine oil and oil filter.

(continued on next page)
• Inspect fuel cap, tank and fuel lines.
• Inspect engine fuel tank vents.
• Inspect engine air filter, replace if required.
• Inspect driveshaft.
• Lubricate universal joint and slip joint.
• Lubricate clutch release bearing.
• Inspect accelerator system cable.
• Lubricate emergency brake linkage.
• Lubricate brake calipers.
• Clean and lubricate fuel stop solenoid.
• Lubricate brake camshaft, king pins, tie rod ends, and slack adjusters.

3 MONTHS OR 24,000 MILES
• Inspect Bendix air dryer.
• Check for loose or disconnected electrical connections and damaged wiring.
• Check the vehicle brake warning system.
• Check the brake fluid level of the master cylinder reservoir.
• Check the hydro-max exterior and all connecting lines for fluid leakage.
• Check brake linkage and brake calipers.

6 MONTHS OR 6,000 MILES
• Inspect exhaust system piping, joints for leaks, corrosion, etc. (See CHASSIS COMPONENT MAINTENANCE CHART)
• Check lubricant level in rear axle.
• Inspect rear axle vent.
• Clean and/or replace air compressor filters.
• Check power steering fluid level.
• Lubricate steering drag rod.
• Check single and double check valves.
• Lubricate spring pin.
• Inspect alternator.
• Clean battery posts.
• Disassemble and clean the air compressor governor and repair, as required.
• Lubricate entrance door security lock.
• Check/adjust emergency door security lock.
• Lubricate lock mechanism and door hinge on emergency door.
• Inspect destination sign for proper operation.
• Lubricate hinges and roller gears on destination signs.
• Check/adjust curtain on destination signs.
• Lubricate all working part joints on driver’s seat using lithium-based grease (aerosol).
• Check/adjust door control rod on manual entrance doors.
• Clean and flush Anchorlok air dryer each spring and fall.
• Clean and lube treadle valve.
• Change engine fuel filter.
12 MONTHS OR 12,000 MILES
- Complete Quarterly Maintenance Checklist.
- Remove all seat cushions, thoroughly clean with upholstery cleaner, and reinstall on a rotating basis.
- Adjust door control rod and closing mechanism to entrance doors.
- Bleed all air from heaters.
- Tighten all heater hose clamps.
- Check cylinder chains, hoses and wires on the Braun Wheelchair lift.
- Check heater hoses, motor wheels, and fans.
- Clean heater core.
- Tighten heater hose clamps.
- Inspect power steering pump.
- Inspect steering gear.
- Lubricate steering column.
- Check front and rear suspension U-bolt torque.
- Check spring pin lock bolt.
- Check spring pin and bushing wear.
- Inspect suspension system and components.
- Inspect shocks.
- Inspect suspension hanger bracket to frame fastener torque.
- Inspect quick starting aid.
- Inspect engine block heaters.
- Inspect radiator hoses.
- Pressure test engine cooling system.
- Check heater panels and housing.
- Wash underseat heater core filter(s).

12 MONTHS OR 24,000 MILES
- Check air tank pop-off valves.
- Change automatic transmission filter.
- Change internal automatic transmission filter.
- Inspect automatic transmission vent.
- Change power steering reservoir filter.
- Change lubricant in rear axle.

24 MONTHS OR 24,000 MILES
- Clean radiator and shutters.
- Change thermostat.
- Clean relay valves, spring brake valves, parking brake valves, and quick release valves.
- Clean pressure protection valves.
- Inspect and clean Cyclo-Gard air dryer.
- Change coolant.

These checklists are suggested. They do not replace or supersede local or state required driver inspection procedure.
TCFE MAINTENANCE SERVICE KEY
**QUICK REFERENCE MAINTENANCE CHARTS**

**NOTE:** For engine service, operation, and maintenance, see the Engine Operator’s Manual supplied in the owner’s packet provided with this vehicle.

## SUSPENSION MAINTENANCE CHART

<table>
<thead>
<tr>
<th>Operation</th>
<th>Service Intervals*</th>
<th>Months / Miles, Whichever Occurs First</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/3,000</td>
<td>3/6,000</td>
</tr>
<tr>
<td>SPRING SUSPENSION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Front U-Bolt Torque</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Rear U-Bolt Torque</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Spring Pin Lock Bolt</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Spring Pin and Bushing Wear</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Lubricate Spring Pin</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Suspension</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Shocks</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Hanger Bracket Fastener Torque</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>NEWAY REAR AIR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check U-Bolt Torque</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Front Pivot Bolt</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Shock Mounting Bolts</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Air Spring Fasteners</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Shocks</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Ride Height</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>NEWAY FRONT AIR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Front Axle to Suspension Fasteners</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Front Pivot Bolts</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Shock Mounting Bolts</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Air Spring Fasteners</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Shocks</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Height of Suspension</td>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>

*Service intervals to be performed on a continuing basis. Example: 1/3,000 means every month or every 3,000 miles.

<table>
<thead>
<tr>
<th>General Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque to 300-310 foot-pounds.</td>
</tr>
<tr>
<td>Torque to 325 foot-pounds.</td>
</tr>
<tr>
<td>Bolt, hardened flatwasher, and locknut must be in position.</td>
</tr>
<tr>
<td>Inspect by using a pry bar to apply pressure to the spring pin and bushing.</td>
</tr>
<tr>
<td>8 Fittings. Lubricate at first 1,000 miles and then at regular intervals. Use NLGI grade No. 2 grease. See page 86, Key No. 1.</td>
</tr>
<tr>
<td>Inspect all spring components for damage or misalignment.</td>
</tr>
<tr>
<td>Inspect for leaks.</td>
</tr>
<tr>
<td>Torque to 75-85 foot-pounds.</td>
</tr>
<tr>
<td>Torque to 350-375 foot-pounds.</td>
</tr>
<tr>
<td>Torque to 600-625 foot-pounds.</td>
</tr>
<tr>
<td>Torque to 100-125 foot-pounds.</td>
</tr>
<tr>
<td>1/2 inch: Torque to 30-35 foot-pounds, 3/4 inch: Torque to 30-35 foot-pounds.</td>
</tr>
<tr>
<td>Inspect for leaks.</td>
</tr>
<tr>
<td>4 7/8 inches between bottom of frame rail and top of axle.</td>
</tr>
<tr>
<td>Torque to 260-280 foot-pounds.</td>
</tr>
<tr>
<td>Torque to 460-480 foot-pounds.</td>
</tr>
<tr>
<td>Torque to 100-125 foot-pounds.</td>
</tr>
<tr>
<td>1/2 inch: Torque to 30-35 foot-pounds, 3/4 inch: Torque to 30-35 foot-pounds.</td>
</tr>
<tr>
<td>Inspect for leaks.</td>
</tr>
<tr>
<td>9 1/4 inches from top of axle pad to bottom of frame rail.</td>
</tr>
</tbody>
</table>
# AXLE MAINTENANCE CHART

<table>
<thead>
<tr>
<th>Operation</th>
<th>Service Intervals*</th>
<th>Months / Miles, Whichever Occurs First</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/3, 6, 12, 24/24</td>
<td>General Instructions</td>
</tr>
<tr>
<td></td>
<td>3/5, 6/10, 12/24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6/10, 12, 24/24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9/15, 18, 24/24</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>REAR AXLE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Lubricant</td>
<td>●</td>
<td>See Spicer Maintenance Manuals on F170S, J190S, J210S, and J2305B Axles. Keep oil to level of filler plug. Drain and refill at first 1,000 to 3,000 miles and then at recommended intervals. Check level testing plug on rear of axle bowl. See vendor reference for recommended lubricant. See page 86, Key No. 2.</td>
</tr>
<tr>
<td>Change Lubricant</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Vent</td>
<td>●</td>
<td>See page 80. See page 86, Key No. 3.</td>
</tr>
<tr>
<td>Wheelbearing Adjustment</td>
<td>As Required</td>
<td></td>
</tr>
<tr>
<td><strong>FRONT AXLE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate King Pin</td>
<td>●</td>
<td>Four fittings. Use NLGI Grade No. 2 Grease. See page 86, Key No. 4.</td>
</tr>
<tr>
<td>Lubricate Tie Rod</td>
<td>●</td>
<td>Two fittings. Use NLGI Grade No. 2 Grease. See page 86, Key No. 5.</td>
</tr>
<tr>
<td>Wheelbearing Adjustment</td>
<td>As Required</td>
<td>See page 80.</td>
</tr>
<tr>
<td>Inspect Alignment and Component Wear</td>
<td>If Tire Wear Indicates</td>
<td>Caster 3° ± 1°. POSITIVE. CAMBER 0° ± 7/16°. RH and LH. (TOE-IN 0 TO 1/16°). Spring and Neway Air suspensions. Axle settings are the same for both radial and bias ply tires.</td>
</tr>
<tr>
<td><strong>FRONT AXLE STEERING</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Hydraulic Reservoir Fluid Level</td>
<td>●</td>
<td>Check level sight glass. Use Dexron II.</td>
</tr>
<tr>
<td>Change Reservoir Filter</td>
<td>●</td>
<td>More frequent filter changes may be necessary in a dusty environment. BB filter #2108/99.</td>
</tr>
<tr>
<td>Lubricate Drag Rod</td>
<td>●</td>
<td>Two fittings. Use NLGI Grade No. 2 Grease. See page 86, Key No. 6.</td>
</tr>
<tr>
<td>Inspect Power Steering Pump</td>
<td>●</td>
<td>Check for leakage around the shaft or housing. If leak is evident (fluid oozing), it should be corrected immediately.</td>
</tr>
<tr>
<td>Inspect Steering Gear</td>
<td>●</td>
<td>Check for leakage around the shaft or housing. If leak is evident (fluid oozing), it should be corrected immediately. See page 86, Key No. 7.</td>
</tr>
<tr>
<td>Index Pitman Arm</td>
<td>If Arm Is Removed</td>
<td>See page 79.</td>
</tr>
<tr>
<td>Lubricate Steering Column</td>
<td>●</td>
<td>Lubricate the slide. Access to slide is obtained by removing rubber boot. Use NLGI Grade No. 2 Grease.</td>
</tr>
<tr>
<td>Lubricate Steering Gear</td>
<td>●</td>
<td>See TRW Ross Steering Gear Manual. Grease fitting located on rear of gear. Use hand grease gun only. Use NLGI Grade No. 2 Grease. See page 86, Key No. 7.</td>
</tr>
<tr>
<td><strong>TIRES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Tires</td>
<td>Weekly</td>
<td>See page 54.</td>
</tr>
</tbody>
</table>

*Service intervals to be performed on a continuing basis. Example: 1/3,000 means every month or every 3,000 miles.
**BRAKE MAINTENANCE CHART**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Service Intervals*</th>
<th>Months / Miles, Whichever Occurs First</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/3,000</td>
<td>3/5,000</td>
</tr>
<tr>
<td><strong>AIR BRAKE SYSTEM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Brake Operation</td>
<td>See page 74.</td>
<td></td>
</tr>
<tr>
<td>Clean and Replace Air Compressor Filters</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Clean Governor</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Bendix Air Dryer</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect and Clean Cyclic-Gard Air Dryer</td>
<td>●</td>
<td>See Cyclo-Gard Air Dryer Form #313.</td>
</tr>
<tr>
<td>Clean Anchorlok Air Dryer Tank and Flush Drain Valve</td>
<td>●</td>
<td>See Anchorlok Air Dryer Service Instructions. Service in spring and fall.</td>
</tr>
<tr>
<td>Inspect Heated Reservoir Drain Valve</td>
<td>See Stark Expel Valve Form S-103. Maintenance-free, no adjustment or cleaning necessary.</td>
<td></td>
</tr>
<tr>
<td>Drain Air Tanks</td>
<td>Daily—cold weather Weekly—warm weather</td>
<td>Drain condensation.</td>
</tr>
<tr>
<td>Check Pop-Off Valves</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Single and Double Check Valves</td>
<td>●</td>
<td>See Bendix Air Brake Handbook. Disassemble all valves and lubricate at 100,000 miles.</td>
</tr>
<tr>
<td>Clean and Lube Treadle Valve</td>
<td>●</td>
<td>See Bendix Air Brake Handbook. Disassemble all valves and lubricate at 100,000 miles.</td>
</tr>
<tr>
<td>Clean Relay Valves</td>
<td>●</td>
<td>See Bendix Air Brake Handbook. Disassemble all valves and lubricate at 100,000 miles.</td>
</tr>
<tr>
<td>Clean Spring Brake Valves</td>
<td>●</td>
<td>See Bendix Air Brake Handbook. Disassemble all valves and lubricate at 100,000 miles.</td>
</tr>
<tr>
<td>Clean Parking Brake Valve</td>
<td>●</td>
<td>See Bendix Air Brake Handbook. Disassemble all valves and lubricate at 100,000 miles.</td>
</tr>
<tr>
<td>Clean Quick Release Valves</td>
<td>●</td>
<td>See Bendix Air Brake Handbook. Disassemble all valves and lubricate at 100,000 miles.</td>
</tr>
<tr>
<td>Inspect Brake Chambers</td>
<td>●</td>
<td>See Bendix Air Brake Handbook.</td>
</tr>
<tr>
<td>Clean Pressure Protection Valves</td>
<td>●</td>
<td>See Bendix Air Brake Handbook. Disassemble all valves and lubricate at 100,000 miles.</td>
</tr>
<tr>
<td><strong>SHOE-TYPE BRAKES (AIR)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brake Inspection and Adjustment</td>
<td>Weekly or as needed depending on application</td>
<td>See Rockwell Field Maintenance Manual No. 4 or See Eaton EB-31 Service Manual or See Eaton EB-32 Service Manual. Also see page 74.</td>
</tr>
<tr>
<td>Lube Parking Brake Linkage</td>
<td>●</td>
<td>Four fittings. See page 74 and page 86, Key No. 8, Use NLGI Grade No. 2 Grease.</td>
</tr>
<tr>
<td>Adjust Parking Brake</td>
<td>●</td>
<td>See page 75.</td>
</tr>
<tr>
<td>Lubricate Brake Camshaft</td>
<td>●</td>
<td>Four fittings. Use NLGI Grade No. 2 Grease. See page 86, Key No. 9.</td>
</tr>
<tr>
<td>Lube Brake Slack Adjusters</td>
<td>●</td>
<td>Four fittings. Use NLGI Grade No. 1 Grease. (Special Stopmaster Grease) See page 86, Key No. 10.</td>
</tr>
<tr>
<td><strong>HYDRAULIC BRAKES (DISC)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic Brake Operation</td>
<td>See page 71.</td>
<td></td>
</tr>
<tr>
<td>Check Brake Fluid Level of Master Cylinder Reservoir</td>
<td>●</td>
<td>Replenish, if necessary. Fluid BB #0607671; Vendor #218; or Wagner FL 10341.</td>
</tr>
<tr>
<td>Check the Hydro-Max Exterior and Connecting Lines for Leaks</td>
<td>●</td>
<td>Replenish, if necessary. Fluid BB #0607671; Vendor #218; or Wagner FL 10341.</td>
</tr>
<tr>
<td>Check for Loose or Disconnected Electrical Connections and Damaged Wiring</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Brake Linkage</td>
<td>●</td>
<td>Do not lubricate.</td>
</tr>
<tr>
<td>Check Brake Calipers for Fluid Leaks</td>
<td>●</td>
<td>No adjustment required.</td>
</tr>
<tr>
<td>Lubricate Brake Calipers</td>
<td>●</td>
<td>Lubricate each time caliper is removed for pad change or repair.</td>
</tr>
</tbody>
</table>
## CHASSIS COMPONENT MAINTENANCE CHART

<table>
<thead>
<tr>
<th>Operation</th>
<th>Service Intervals*</th>
<th>Months / Miles, Whichever Occurs First</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/24,000</td>
<td>3/6,000</td>
</tr>
<tr>
<td>ACCELERATOR SYSTEM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect Cable</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Clean and Lube Treadle Valve</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Clean and Lube Slave Cylinder</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>ELECTRICAL SYSTEM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Battery Water Level</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Battery Posts</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Alternator</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Quick Starting Aid</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Engine Block Heaters</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>EXHAUST SYSTEMS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect Exhaust Piping and Joints</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>AUTOMATIC TRANSMISSION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Fluid</td>
<td>Daily</td>
<td></td>
</tr>
<tr>
<td>Change Fluid</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Change External Filter</td>
<td>First 5,000 miles, then at normal intervals</td>
<td></td>
</tr>
<tr>
<td>Change Internal Filter</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Vent</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Shift Cable</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Adjust Shift Cable</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>DRIVELINES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect Driveshaft</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Lubricate Universal Joint</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Lubricate Slip Joint</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Torque Capscrews and Bolts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straighten / Balance Angles and Phasing</td>
<td>If damaged or removed for service</td>
<td></td>
</tr>
</tbody>
</table>

*Service intervals to be performed on a continuing basis. Example: 1/3,000 means every month or every 3,000 miles.

General Instructions

- Check cable for proper connection, cracking, abrasion, or deterioration. No lubrication required.
- See Williams Control Service Bulletin S-051. Refer to the diagram Air Throttle Control, supplied with vendor maintenance documents for schematic of air throttle.
- See Williams Control Service Bulletin SB388UIC3D.
- Use distilled water to fill.
- Clean more often if corrosion appears. Use heavy grease to help prevent corrosion.
- See Delco-Remy Service Bulletin 1G-266.
- Check system for proper operation. Check wiring and tubing for proper connection and deterioration. Replace parts as necessary.
- Check wiring and hoses for proper connection, cracking, abrasion, and deterioration. Replace parts as necessary.
- Inspect piping and joints for leakage, corrosion, etc. Replace clamps if joint is leaking. Clamps are not reusable. Reseal with exhaust sealant and install new clamp.
- See Allison Operators Manual. Use Dexron or Dexron II fluid. See page 86, Key No. 11.
- See Allison Operators Manual. Use Dexron or Dexron II fluid. See page 86, Key No. 11.
- Filter located on RH side of engine block. Filter—AC 25011122 or PF 897.
- Remove transmission fluid pan. Use vendor kit #23019201.
- See page 71.
- No lubrication required.
- See page 67.
- See Spicer Service Manual. Use NLGI Grade No. 1 or 2 Grease. See page 86, Key No. 12.
- See Spicer Service Manual. Use NLGI Grade No. 1 or 2 Grease. See page 86, Key No. 13.
## BODY COMPONENT MAINTENANCE CHART

<table>
<thead>
<tr>
<th>Operation</th>
<th>Service Intervals*</th>
<th>Months / Miles, Whichever Occurs First</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/3,000 3/5,000 3/6/6,000 6/6/10,000 12/12/12,000 12/12/24,000 24/24/24,000</td>
<td></td>
</tr>
<tr>
<td>OUTWARD OPENING DOOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjust Door Linkage Rod</td>
<td>As required</td>
<td>Adjust door linkage rod for proper open and closed position.</td>
</tr>
<tr>
<td>JACKKNIFE DOOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjust Door Control Rod</td>
<td>●</td>
<td>Adjust door control rod for proper open and closed position. See page 36.</td>
</tr>
<tr>
<td>Adjust Roller Bracket</td>
<td>●</td>
<td>Adjust roller bracket for easier door operation. See page 36.</td>
</tr>
<tr>
<td>Adjust Control Rod Bracket</td>
<td>●</td>
<td>Adjust bracket to prevent pivot pin binding. See page 36.</td>
</tr>
<tr>
<td>Lubricate Hinge Pin</td>
<td>●</td>
<td>Lubricate each hinge lug. See page 37. Use LPS No. 1 lubricant.</td>
</tr>
<tr>
<td>POWER JACKKNIFE DOOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate Hinge</td>
<td>●</td>
<td>Lubricate hinge pin. Use LPS No. 1 lubricant.</td>
</tr>
<tr>
<td>Adjust Air Pressure and Switch</td>
<td>●</td>
<td>See page 37-38.</td>
</tr>
<tr>
<td>AIR STOP ARM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubrication</td>
<td></td>
<td>No lubrication required.</td>
</tr>
<tr>
<td>Adjustment</td>
<td>As required</td>
<td>Adjust air pressure for proper opening and closing of stop arm.</td>
</tr>
<tr>
<td>ELECTRIC STOP ARM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubrication</td>
<td></td>
<td>Lubricate breakaway hinge at four pivot points. Use Tri-Flow™ (DuPont) lubricant.</td>
</tr>
<tr>
<td>Inspect Outer Fasteners</td>
<td>●</td>
<td>Check outer fasteners for tightness.</td>
</tr>
<tr>
<td>Inspect Internal Fasteners</td>
<td>●</td>
<td>Check inner fasteners for tightness.</td>
</tr>
<tr>
<td>SECURITY LOCKS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate Entrance Door</td>
<td>●</td>
<td>Lubricate bushing and shaft in center at base of lock handle. See page 39. Use Apply™ lubricant.</td>
</tr>
<tr>
<td>Lubricate Entrance Door Key</td>
<td>●</td>
<td>Spray lubricant into key lock. Use Apply™ lubricant.</td>
</tr>
<tr>
<td>Lock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate Sliding Bolt</td>
<td>●</td>
<td>Lubricate sliding bolt mechanism. Use LPS No. 1 lubricant.</td>
</tr>
<tr>
<td>Inspect and Adjust Emergency</td>
<td>●</td>
<td>No lubrication and adjustment required.</td>
</tr>
<tr>
<td>Door</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUS BODY CARE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wash</td>
<td>As required</td>
<td>See page 82.</td>
</tr>
<tr>
<td>EMERGENCY EXITS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate Lock Mechanisms</td>
<td>●</td>
<td>Spray lubricant into lock mechanism. Use Silicon spray.</td>
</tr>
<tr>
<td>Lubricate Roof Hatch</td>
<td>●</td>
<td>Spray silicon lubricant into lock mechanism. Work lock handle back and forth to ensure smooth operation. See page 29. Use Silicon spray.</td>
</tr>
<tr>
<td>Lubricate Door Hinge</td>
<td>●</td>
<td>Spray lubricant into hinge lugs. Use LPS No. 1.</td>
</tr>
<tr>
<td>Lubricate Rear Emergency Door</td>
<td>●</td>
<td>Grease with door closed. Use low temp grease per ASTM D4950 GC-LB Grade 2. 45° F to 350° F. One lube per hinge.</td>
</tr>
<tr>
<td>Positive Hold Open Hinge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMERGENCY EQUIPMENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect All Mounting Fasteners</td>
<td>●</td>
<td>Inspect all emergency equipment mounting bracket fasteners to ensure tightness.</td>
</tr>
<tr>
<td>DESTINATION SIGNS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate Hinges</td>
<td>●</td>
<td>Lubricate all hinge lugs. Use lightweight lubricating oil.</td>
</tr>
<tr>
<td>Lubricate Roller Gears</td>
<td>●</td>
<td>Lubricate roller gears where required. Use lightweight grease such as White Lube.</td>
</tr>
<tr>
<td>Check and Adjust Curtain</td>
<td>●</td>
<td>See page 12.</td>
</tr>
<tr>
<td>Replace Bulb</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>WINDOWS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate Latch</td>
<td>●</td>
<td>Spray lubricant into window latch mechanism. Use Silicon spray.</td>
</tr>
<tr>
<td>Lubricate Window Slides</td>
<td>●</td>
<td>Spray lubricant into sliding frame of window. Use Silicon spray.</td>
</tr>
</tbody>
</table>

*Service intervals to be performed on a continuing basis. Example: 1/3,000 means every month or every 3,000 miles.

General Instructions
## BODY COMPONENT MAINTENANCE CHART

<table>
<thead>
<tr>
<th>Operation</th>
<th>Service Intervals*</th>
<th>Months / Miles, Whichever Occurs First</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/3,000</td>
<td>3/5,000</td>
</tr>
<tr>
<td>HEATERS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Heater Hoses</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Clean Heater Coil and RH Front</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Heater Air Filter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Motor Wheels and Fans</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check Heater Panels and Housing</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Tighten Heater Hose Clamps</td>
<td>First 1,000 miles and annually thereafter</td>
<td>Heater hose clamps are located at the underseat heater coil, behind the access door in the heater hose covering immediately forward of the left front wheelhousing and under the floor near right front and driver's heaters.</td>
</tr>
<tr>
<td>BODY MOUNTING</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Mounting Bolts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BODY MOUNTING</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>MIRRORS</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>Adjust Mirrors</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>SEATS</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Mounting Fasteners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect Cushion Attachments</td>
<td>Weekly</td>
<td></td>
</tr>
<tr>
<td>Inspect Upholstery</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Lubricate Driver's Seat</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Inspect Seat Belts</td>
<td>Weekly</td>
<td></td>
</tr>
<tr>
<td>Inspect Seat Belt Buckles</td>
<td>Weekly</td>
<td></td>
</tr>
<tr>
<td>Lubricate Seat Belt Buckles</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>Clean Seat Belt Webbing</td>
<td>As required</td>
<td></td>
</tr>
<tr>
<td>General Instructions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## WHEELCHAIR LIFT MAINTENANCE CHART

<table>
<thead>
<tr>
<th>Operation</th>
<th>Service Intervals*</th>
<th>Months / Miles, Whichever Occurs First</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MONTHS</td>
<td>MILES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Braun</td>
<td>1</td>
<td>1,000</td>
</tr>
<tr>
<td>Lubricate Hinges and Pins</td>
<td>1 or 100 cycles</td>
<td>1,000</td>
</tr>
<tr>
<td>Check Cylinder Chains, Hoses, and</td>
<td>12</td>
<td>12,000</td>
</tr>
<tr>
<td>Collins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate Bridge Plate Hinge and</td>
<td>3 or 600 cycles</td>
<td>5,000</td>
</tr>
<tr>
<td>Clean and Lubricate Fold Cam Slot,</td>
<td>3 or 600 cycles</td>
<td>5,000</td>
</tr>
<tr>
<td>Check Fluid Level</td>
<td>3 or 600 cycles</td>
<td>5,000</td>
</tr>
</tbody>
</table>
GENERAL DATA

DIMENSIONS

- Headroom: 74 to 77 inches
- Exterior height: approximately 118 to 121 inches
- Exterior height w/ AC: add 16 inches
- Exterior width: 96 inches
- Interior width: 90.75 inches

FLUID CAPACITIES (in quarts)

<table>
<thead>
<tr>
<th>Engine</th>
<th>Engine Crankcase Oil</th>
<th>Engine Coolant</th>
<th>Transmission Fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>w/Filter</td>
<td>w/o Filter</td>
<td>Manual</td>
</tr>
<tr>
<td>Cummins 6BTA5.9</td>
<td>17.0</td>
<td>15.0</td>
<td>24.6</td>
</tr>
<tr>
<td></td>
<td>23.6</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Cummins ISB</td>
<td>18.0</td>
<td>16.0</td>
<td>24.6</td>
</tr>
<tr>
<td></td>
<td>23.6</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Cummins ISC, 8.3 “C”</td>
<td>24.0</td>
<td>20.0</td>
<td>38.0</td>
</tr>
<tr>
<td>Cat 3126</td>
<td>30.0</td>
<td>27.0</td>
<td>41.0</td>
</tr>
<tr>
<td>John Deere 8.1</td>
<td>32.0</td>
<td>30.0</td>
<td>42.0</td>
</tr>
</tbody>
</table>

REAR AXLE FLUID CAPACITIES (in pints)

- Spicer F-170-S, Single Speed: 23.0
- Spicer J-190-S, Single Speed: 31.5
- Spicer J-210-S, Single Speed: 31.5
- Spicer J-230-SB, Single Speed: 31.5
- Spicer M-190-T, Two Speed: 35.0

ENGINE OIL PRESSURE

- Cummins ISB: 50 to 65 psi at 2,500 rpm, warm
- Cummins ISC: 50 to 65 psi at 2,500 rpm, warm
- Cat 3126: 48 psi at 210°F
LENGTH
1 inch (in) = 2.54 centimeters (cm)
1 foot (ft) = 12 inches (in) = 30.5 centimeters (cm)
1 mile (mi) = 5,280 feet (ft) = 1.609 kilometers (km)
1 centimeter (cm) = 10 millimeters (mm) = 0.01 meter (m)
1 meter (m) = 100 centimeters (cm) = 3.28 feet (ft)
1 kilometer (km) = 1,000 meters = 0.62 mile (mi)

WEIGHT/MASS
1 pound (lb) = 16 ounces (oz)
1 pound is equivalent to 0.45 kilogram (kg).
1 kilogram (kg) = 1,000 grams (g)
1 kilogram is equivalent to 2.2 pounds (lb).

AREA
1 square foot (ft²) = 144 square inches (in²)
= 0.0929 square meter (m²)
1 square meter (m²) = 10,000 square centimeters (cm²)
= 10.76 square feet (ft²)

METRIC CONVERSION

<table>
<thead>
<tr>
<th>Fraction of an inch</th>
<th>Decimal</th>
<th>Millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/64</td>
<td>0.0156</td>
<td>0.396</td>
</tr>
<tr>
<td>1/32</td>
<td>0.0312</td>
<td>0.793</td>
</tr>
<tr>
<td>1/16</td>
<td>0.0625</td>
<td>1.587</td>
</tr>
<tr>
<td>3/32</td>
<td>0.0937</td>
<td>2.381</td>
</tr>
<tr>
<td>1/8</td>
<td>0.1250</td>
<td>3.175</td>
</tr>
<tr>
<td>5/32</td>
<td>0.1562</td>
<td>3.968</td>
</tr>
<tr>
<td>11/64</td>
<td>0.1718</td>
<td>4.365</td>
</tr>
<tr>
<td>3/16</td>
<td>0.1875</td>
<td>4.762</td>
</tr>
<tr>
<td>7/32</td>
<td>0.2187</td>
<td>5.556</td>
</tr>
<tr>
<td>15/64</td>
<td>0.2343</td>
<td>5.953</td>
</tr>
<tr>
<td>1/4</td>
<td>0.2500</td>
<td>6.350</td>
</tr>
<tr>
<td>9/32</td>
<td>0.2812</td>
<td>7.143</td>
</tr>
<tr>
<td>19/64</td>
<td>0.2968</td>
<td>7.540</td>
</tr>
<tr>
<td>5/16</td>
<td>0.3125</td>
<td>7.937</td>
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<tr>
<td>13/64</td>
<td>0.3281</td>
<td>8.334</td>
</tr>
<tr>
<td>21/64</td>
<td>0.3437</td>
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<tr>
<td>3/8</td>
<td>0.3593</td>
<td>9.128</td>
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<tr>
<td>25/64</td>
<td>0.3750</td>
<td>9.525</td>
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<tr>
<td>13/32</td>
<td>0.4062</td>
<td>10.318</td>
</tr>
<tr>
<td>27/64</td>
<td>0.4218</td>
<td>10.715</td>
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<tr>
<td>7/16</td>
<td>0.4375</td>
<td>11.112</td>
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<tr>
<td>29/64</td>
<td>0.4531</td>
<td>11.509</td>
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<tr>
<td>15/32</td>
<td>0.4687</td>
<td>11.906</td>
</tr>
<tr>
<td>31/64</td>
<td>0.4843</td>
<td>12.303</td>
</tr>
<tr>
<td>1/2</td>
<td>0.5000</td>
<td>12.700</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fraction of an inch</th>
<th>Decimal</th>
<th>Millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>33/64</td>
<td>0.5156</td>
<td>13.096</td>
</tr>
<tr>
<td>17/32</td>
<td>0.5312</td>
<td>13.493</td>
</tr>
<tr>
<td>9/16</td>
<td>0.5625</td>
<td>13.890</td>
</tr>
<tr>
<td>19/32</td>
<td>0.5937</td>
<td>14.287</td>
</tr>
<tr>
<td>5/8</td>
<td>0.6250</td>
<td>14.684</td>
</tr>
<tr>
<td>31/32</td>
<td>0.6603</td>
<td>15.081</td>
</tr>
<tr>
<td>5/32</td>
<td>0.6932</td>
<td>15.478</td>
</tr>
<tr>
<td>41/64</td>
<td>0.7287</td>
<td>15.875</td>
</tr>
<tr>
<td>8/16</td>
<td>0.7656</td>
<td>16.271</td>
</tr>
<tr>
<td>21/32</td>
<td>0.8093</td>
<td>16.668</td>
</tr>
<tr>
<td>39/64</td>
<td>0.8593</td>
<td>17.065</td>
</tr>
<tr>
<td>41/64</td>
<td>0.8843</td>
<td>17.462</td>
</tr>
<tr>
<td>63/64</td>
<td>0.9218</td>
<td>17.859</td>
</tr>
<tr>
<td>7/8</td>
<td>0.9531</td>
<td>18.256</td>
</tr>
<tr>
<td>11/16</td>
<td>0.9843</td>
<td>18.653</td>
</tr>
<tr>
<td>19/32</td>
<td>1.0156</td>
<td>19.050</td>
</tr>
<tr>
<td>1/2</td>
<td>1.0000</td>
<td>19.446</td>
</tr>
</tbody>
</table>

VOLUME
1 quart (qt) = 2 pints (pt) = 0.25 gallon (G) = 0.946 liter (L)
1 liter (L) = 1,000 milliliters (mL)
= 1,000 cubic centimeters (cm³, cc)
= 1.057 quarts (qt)

Note: 1 liter of water has a mass of 1 kilogram, and a volume of 1,000 cubic centimeters.

TORQUE
1 foot-pound (ft·lb) = 1.355 newton-meters (N·m)
1 newton meter (N·m) = 0.738 foot-pound (ft·lb)

PRESSURE
1 pound per square inch (psi) = 6.895 kilopascals (kPa)
1 kilopascal (kPa) = 0.145 pound per square inch (psi)

TEMPERATURE
To convert from degrees Fahrenheit (°F) to Celsius (°C), subtract 32, then multiply by 5/9.
To convert from Celsius to Fahrenheit, multiply by 9/5, then add 32.

Freezing point of water: 32°F (0°C)
Boiling point of water: 212°F (100°C)
Average room temperature: 68°F (20°C)
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