VEHICLE FACTORS GROUP CHAIRMAN'S FACTUAL REPORT

Vehicle Attachment 7 - New Flyer Transit Bus Vehicle Specifications

Baltimore, MD

HWY17MH007

(16 pages)

2. VEHICLE SPECIFICATIONS

☞ **NOTE:**
Refer to the Major Component Layout when reviewing information in this manual.

VEHICLE TYPE	
Model	*New Flyer* D40LF transit bus
Customer	Maryland Transit Administration - SR979/1041
Build Year	2004
ENGINE & FUEL	
Engine	*Cummins* ISM
Horsepower	280 HP - 925 ft-lb.
Fuel	No. 1 Diesel
Usable Fuel Capacity	125 U.S. gallons (473 liters)
TRANSMISSION	
Transmission	*Voith* D864.3E
Self-Contained Retarder	3-stage accelerator/brake activated
DIMENSIONS	
Length (over bumpers)	41 ft. 4 in. (12.6 m)
Width	8 ft. 5 in. (2.6 m)
Height	10 ft. 3 in. (3.12 m) to top of exhaust pipe
Wheelbase	24 ft. 5 in. (7.4 m)
Turning Radius	44 ft. 5 in. (13.5 m)
Vehicle Weight (approx.)	29,660 lbs. (13,454 kg)
AXLES & SUSPENSION	
Front Axle	*M.A.N.* V8 65L-02
Front Load-Carrying Capacity	14,329 lbs. (6,500 kg)
Rear Axle	*M.A.N.* HP - 1352 - B - 07 (5.33:1)
Rear Load-Carrying Capacity	28,600 lbs. (13,000 kg)
Suspension	Air springs & shock absorbers

BRAKE SYSTEM	
Mechanical Components	Internal expanded S-cam type
	Automatic slack adjusters
Service Brake	Full air operated
	Meritor Wabco ABS & ATC controlled
Parking Brake	Spring applied, air released
Emergency Brake	Spring brake applied
	Brake treadle modulated to control
WINDOWS	
General	*Stormtite* black anodized frame (top fixed, bottom slider)
	Grey tint acrylic glazing
Emergency Escape	6 lower section windows
Driver's Window	2 piece full sliding interior & exterior handle
	72% green tint glass
DOORS	
Entrance	*Vapor* slide glide - 31.5" between door handles
Exit	*Vapor* push open/spring closed - 27.5" between door handles
	Driver enabled operation
Controls	5 position opening/closing control
	Entrance door manual control valve

3. STANDARD OPERATING FEATURES

3.1. Brake & Accelerator Interlocks

- ❒ Interlocks disable the accelerator and apply the rear brakes. They function only when the Master Run switch is in DAY-RUN or NIGHT-RUN position.
- ❒ Interlocks function only at zero speed (when the vehicle is stopped, or almost stopped).
- ❒ The brake lights illuminate when the interlocks apply.
- ❒ Parking brake application activates the accelerator interlocks.

3.2. Lighting

- ❒ The aisle lights switch off when the transmission is shifted into reverse [R].
- ❒ The timer circuit switches the aisle lights off after 30 minutes if the vehicle Master Run switch is switched off and the aisle lights are left on.
- ❒ All exterior lights switch on for 2 minutes if the engine is running, the transmission is in neutral [N], the parking brake is applied and both turn signal switches are pushed simultaneously. The lights are extinguished by shifting the transmission out of neutral [N]. This feature enables one person to test the exterior light system.
- ❒ All electronically controlled dash indicators illuminate for a test when the vehicle is first started.
- ❒ All indicators and aisle lights switch off during starter cranking interval.
- ❒ Retarder operation illuminates the stop lights.
- ❒ Retarder operation illuminates the Retarder On indicator.
- ❒ Exterior exit door lights are timed to remain illuminated 5 seconds after exit door fully closes.
- ❒ Door header lights are timed to switch off 15 minutes after the Master Run switch is positioned to NIGHT-PARK and the exit door is open.
- ❒ Engine lights switch off when the electronic control system is deactivated to prevent battery drain.
- ❒ Daytime running lights illuminate when the Master Run switch is in the DAY-RUN position and the engine is running. They can only be turned off by stopping the engine.

3.3. Transmission

- ❒ Transmission will not shift unless Engine Run switch on engine switch box is set to the FRONT position.
- ❒ Transmission will not shift unless brake treadle is pressed.
- ❒ Transmission will not shift unless wheelchair ramp is stowed.
- ❒ Transmission will not shift if there is no air pressure in front door.
- ❒ Transmission shift selector is operable in all the previous cases if the Door Master switch is set to the OFF position.

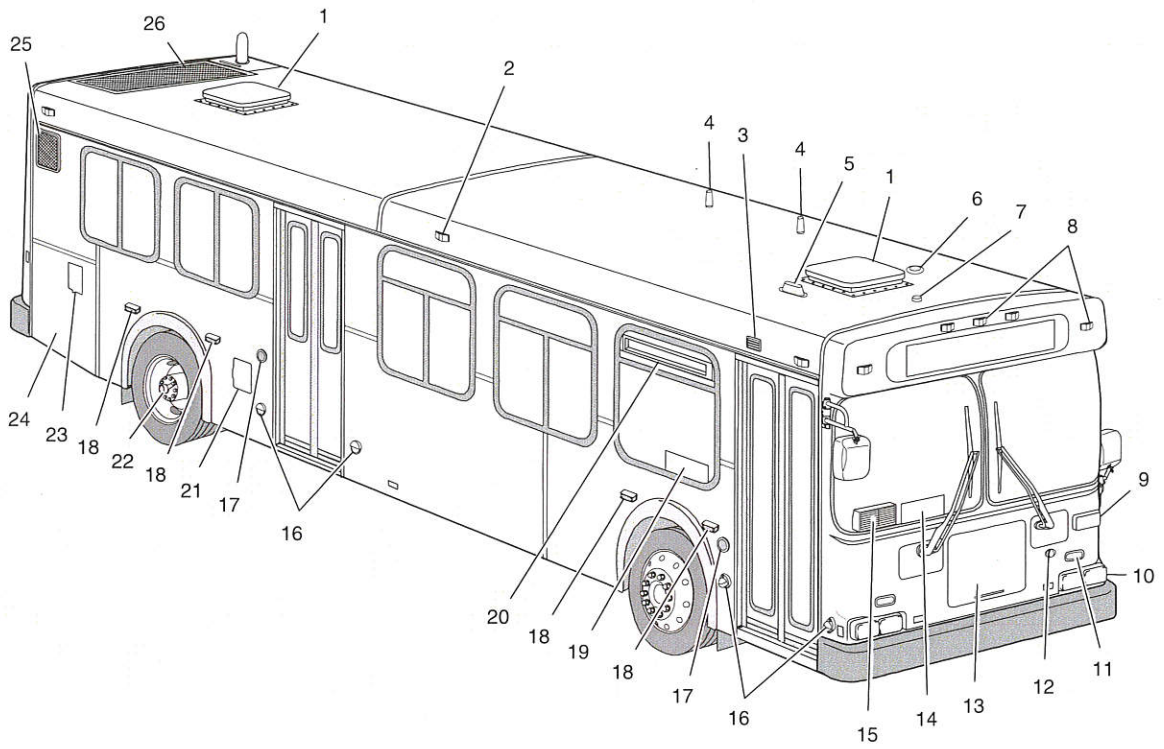
3.4. Starting

- ❒ To start the vehicle from the driver's seat, the Engine Run switch on the engine switch box must be set to the FRONT position, the Master Run switch on the driver's side console must be set to either the DAY-RUN or NIGHT-RUN position, the transmission must be in neutral [N], the starter must not be locked out, the fire detection system must not indicate any faults, and the parking brake must be applied. The vehicle can then be started by pushing the Start button on the driver's side console.
- ❒ To start the vehicle from the rear engine switch box, the Engine Run switch must be set to the REAR position, the transmission must be in neutral [N], the starter must not be locked out, the fire detection system must not indicate any faults, and the parking brake must be applied. The vehicle can then be started by pushing the Start button on the engine switch box.
- ❒ The voltage regulator does not go on line until the vehicle has been running for 3 seconds.

4. EXTERIOR VIEWS

4.1. Structure

The basic frame structure is a semi-monocoque design, which uses high tensile steel plate and tube for structural strength. Full length longitudinal members are used, with cross member pillars, roof bows and bulkheads. All joints are Gas Metal Arc Welded (GMAW). The exterior panels carry no load. Steel tapping plates are GMAW welded to the structure. All fixtures and accessories attached to the structure are drilled and tapped into the tapping plates to maintain the strength of the structure. See "Fig. GI-1: Front Exterior View" on page 8. & See "Fig. GI-2: Rear Exterior View" on page 9.



1. Roof Vent/Hatch
2. Side Marker Light
3. Exterior Speaker
4. WLAN Antenna
5. UHF Antenna
6. GPS Antenna
7. GPS IVN Antenna
8. Clearance Marker Lights
9. Driver's Vent
10. Headlight
11. Front Turn Indicator
12. Tow Connector
13. Defroster Access Door
14. Route Card Holder
15. Front Route Sign
16. Curb Lights
17. Ramp/Kneel Warning Light
18. Side Turn Indicator
19. Route Card Holder
20. Side Destination Sign
21. Fuel Filler Access Door
22. Hubodometer
23. Battery Cutoff Switch Access Door
24. Battery Access Door
25. Engine Air Intake Grille
26. HVAC Condenser Grille

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Fig. GI-1: Front Exterior View

4.3. Doors

The entrance and exit doors each consist of two panels fitted with door shafts, roller brackets and glass inserts. The entrance door is a slide/glide style door. The exit door is a push open/spring closed style door. Both doors are opened using the door controller on the driver's side console. Microswitches on each base plate inform the PLC of door status. These switches are used as signals for the interlock and wheelchair ramp systems.

A base plate assembly is mounted behind an access panel above each door. The entrance door base plate is supplied air from the accessories air tank. The entrance door base plate is equipped with a cylinder which operates a rack and a gear lever assembly. When the door controller is actuated, the air pressure differential in the base plate cylinder moves the internal rack and rotates the gear and lever assembly. This action operates connecting rods fastened to the door shaft levers. The levers rotate and the door panels open. A manually operated emergency valve is located above the entrance door behind a protective cover.

The exit door base plate consists of an unlock solenoid, a cylinder, a teeter lever and cam assembly and a return spring. The door controller actuates the exit door unlock solenoid to enable the door. The door panels can then be pushed open. The return spring closes the door panels. An emergency handle is located next to the exit door behind a protective cover.

4.4. Windows

The two windshield halves are laminated, formed safety glass which is placed into a reinforced fiberglass aperture. The driver's side window is a full sliding style and has an aluminum sash and 1/4" single-density, laminated safety glass. Passenger windows are manufactured by Storm-Tite and have clamp-type anodized aluminum frames. The tinted windows are glazed with a 1/2" cell cast acrylic glazing. The curbside window behind the entrance door is a clear tint to allow for visibility of the side destination sign.

4.5. Lighting

The exterior lighting consists of clearance markers, turn indicators, stop lights, tail lights, headlights, kneeling lights and entrance lights.

4.6. Destination Signs

The destination sign system consists of a front, side and rear sign. The system is controlled by an operator control unit, which is located above the driver on the front destination sign door.

4.7. Access Compartments

4.7.1. Engine Compartment

The engine access door is located at the rear of the vehicle. The door is equipped with one fixed handle to raise the door, and two assist cylinders to support the door when in the open position. One of the two cylinders is equipped with a safety latch. The door is also equipped with a license plate holder and a license plate lamp.

4.7.2. Battery Compartment

- Battery Tray

The battery tray is a slide out style tray, constructed of acid resistant stainless steel, on stainless steel rollers. Rubber isolation mounts help to isolate the tray from the structure of the vehicle and an isolator pad on the surface of the tray helps to isolate the batteries from the tray. These mounts reduce road vibrations from being transmitted directly to the batteries.

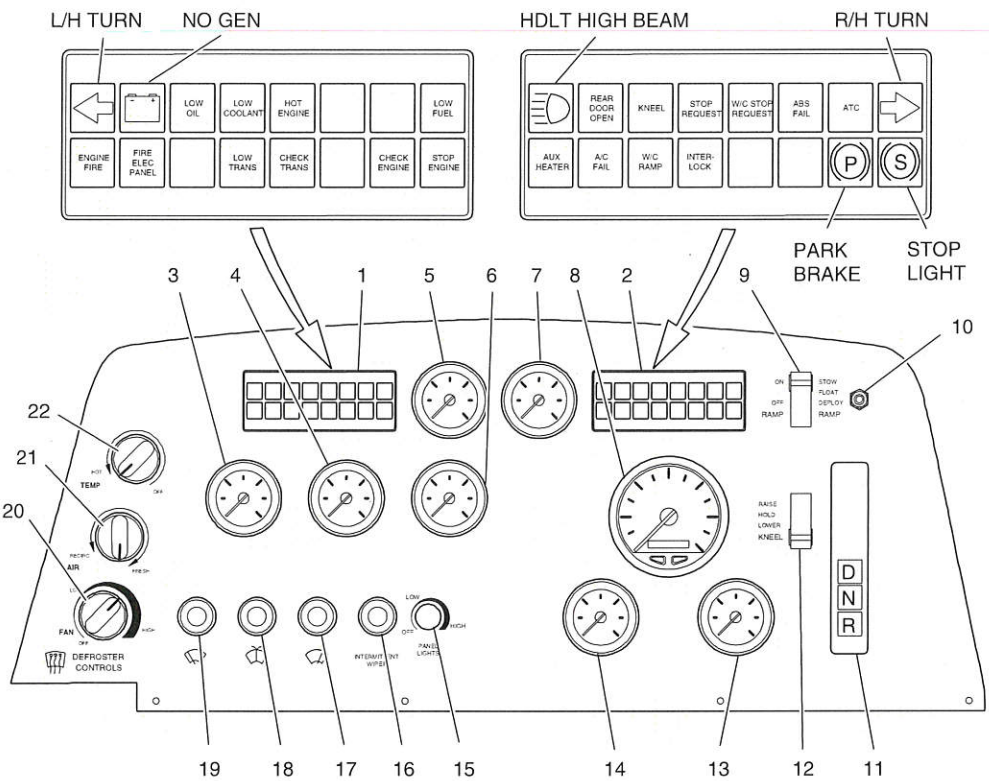
- Voltage Equalizer

A voltage equalizer is provided to supply 12 volt DC loads from the 24 volt system, to discharge the batteries equally when the alternator is off line, and to ensure the maintenance of the same state of charge in both of the 12 volt batteries while charging.

5. INSTRUMENT PANEL

5.1. Description

The instrument panel is located in front of the operator behind the steering wheel. It is fitted with indicators, gauges and manual controls. See "Fig. GI-3: Instrument Panel" on page 12. A removable cover allows access to the backs of the instruments, fuses wiring harnesses and luminous strips. The wiring harnesses and cables pass through the dashboard of the vehicle.



1. Left Indicator Strip
2. Right Indicator Strip
3. Front Air Pressure Gauge
4. Rear Air Pressure Gauge
5. Fuel Gauge
6. Transmission Temperature Gauge
7. Auxiliary Air Gauge
8. Speedometer/Odometer
9. Ramp Enable Switch
10. Ramp Switch
11. Transmission Shift Selector
12. Kneel Switch
13. Water Temperature Gauge
14. Oil Pressure Gauge
15. Panel Lights Dimmer Switch
16. Intermittent Wiper Switch
17. Right-Hand Wiper Control
18. Washer Control
19. Left-Hand Wiper Control
20. Defroster Fan Control
21. Defroster Air Recirculation Control
22. Defroster Temperature Control

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Fig. GI-3: Instrument Panel

7. AIR TANK INSTALLATION

7.1. Description

Stainless steel air tanks are mounted behind the fluorescent light panels along the sides of the vehicle. They are part of a system which includes the engine air intake and air compressor, the air dryer, muffler tank and wet tank. This system provides air to the rear brakes, front brakes, parking brake control valve and vehicle accessories. Vehicle accessories include the driver's seat, entrance and exit doors, and the windshield wipers. Charging fittings are provided in the engine compartment and under the front bumper to allow remote charging of the air system for vehicle towing. See "Fig. GI-5: Air Tank Installation" on page 14.

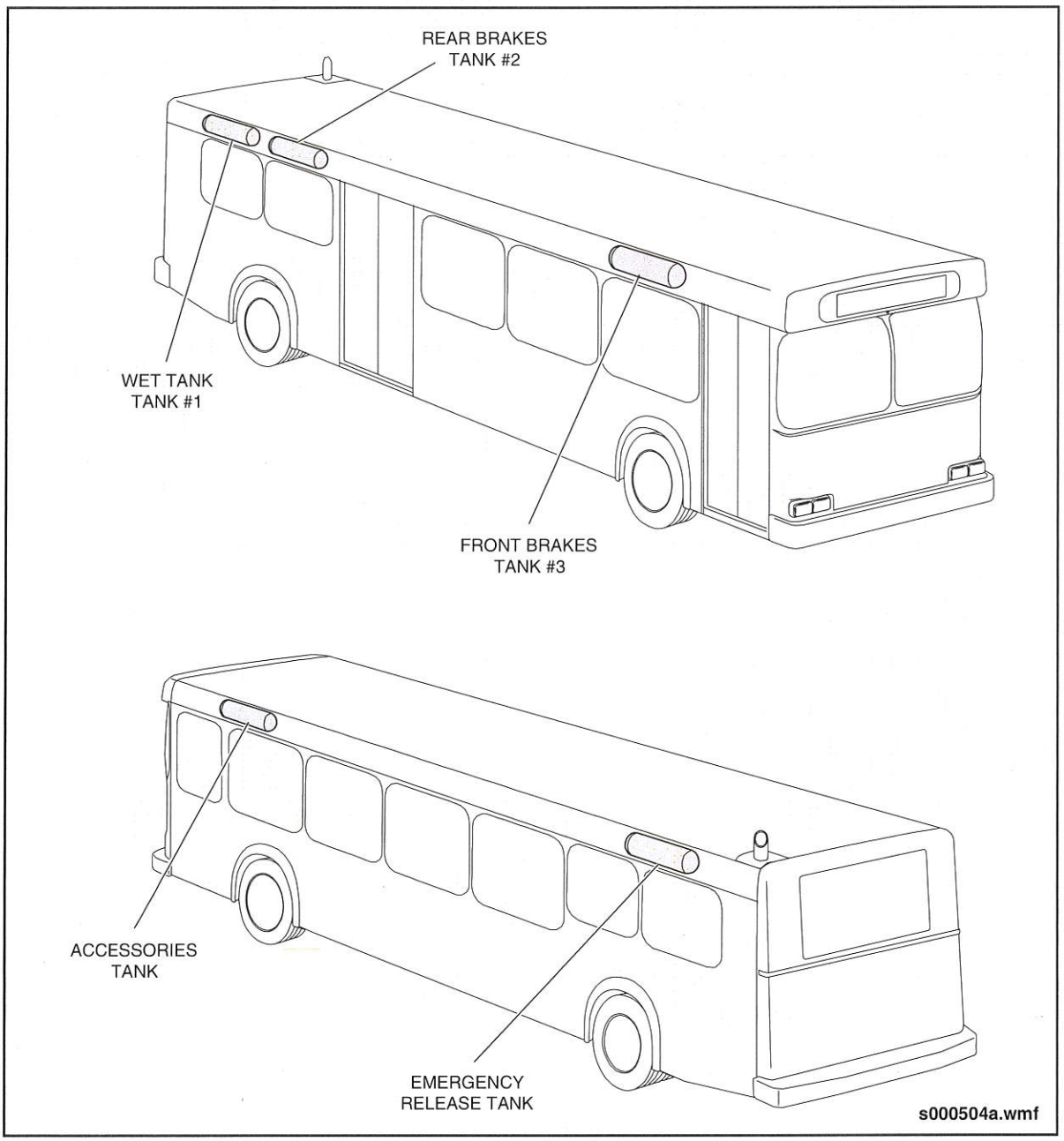

Fig. GI-5: Air Tank Installation

9. PRESSURE SWITCHES

9.1. BRAKE TANK PRESSURE SENDING UNITS

9.1.1. Description

Air pressure sending units are mounted directly on the brake system air tanks and transmit an analog signal to the System Control Unit (SCU) located in the instrument panel. The pressure readings are displayed on individual instrument panel gauges corresponding to each brake system air tank. The LED indicator on the gauge face will illuminate and a warning buzzer will sound if the air pressure drops below 70 psi.

9.2. STOP LIGHT SWITCH

9.2.1. Description

The Stop Light switch (PS-3) is an electro-pneumatic 1 psi non-grounded switch that completes the electrical circuit to illuminate the stop lights when the brakes are applied. The switch is a non-serviceable item and is replaceable only as an assembly.

9.2.2. Operation

When the brakes are applied, air pressure from the brake valve enters the cavity below the switch diaphragm and moves the piston until it contacts the leaf spring.

The leaf spring pivots on a fulcrum at 1 psi and snaps a shorting bar which mates with the contact strips. This snap action spring is designed to minimize arcing.

The electrical circuit closes, causing the stop lights to illuminate.

9.3. STOP LIGHT SWITCH (SL-5)

9.3.1. Description

The Stop Light switch (SL-5) is an electro-pneumatic 5 psi non-grounded switch that completes the electrical circuit and illuminates the stop lights when the rear brakes are applied. The Stop Light switch can be used with either 12 or 24 volt systems.

The Stop Light switch is not a serviceable item and must be replaced as a unit if found defective.

9.3.2. Operation

When the brakes are applied, air pressure from the brake valve enters the cavity below the Stop Light switch diaphragm and moves the piston until it contacts the leaf spring.

The leaf spring pivots on a fulcrum and snaps a shorting bar which mates with the contact strips. This snap action spring is designed to minimize arcing.

The stop light electrical circuit closes, illuminating the stop lights before the brake application air pressure reaches 6 psi.

9.4. ELECTRONIC STROKE ALERT PRESSURE TRANSDUCER

9.4.1. Description

This pressure transducer is teed into the front brake apply circuit. It receives power from the brake stroke monitor chassis communication module and supplies a variable voltage signal to the module based on brake application pressure. Refer to "Electronic Stroke Alert" in section 9 of this manual for further information on this equipment.

9.6. RETARDER SWITCHES

9.6.1. Description

Three Retarder switches, 2 psi, 4 psi, and 6 psi, are installed in a common manifold that is bolted to the vehicle structure below the driver's platform. These are electro-pneumatic non-grounded switches used to activate the transmission retarder when the brakes are applied. These switches are non-serviceable and must be replaced as an assembly. See "Fig. GI-8: Voith Retarder Switches" on page 18.

9.6.2. Operation

The three pressure switches share a common manifold and sense brake application pressure. When activated, these pressure switches provide an input to the PLC system. The PLC uses these signals to engage the retarder in three successive stages. Retarder application will also cause the stop lights to illuminate.

NOTE:

A relay is installed in parallel with the 2 psi switch to allow first stage retarder operation when the accelerator is released. Refer to the Transmission Electrical Schematic supplied with this service manual for system details.

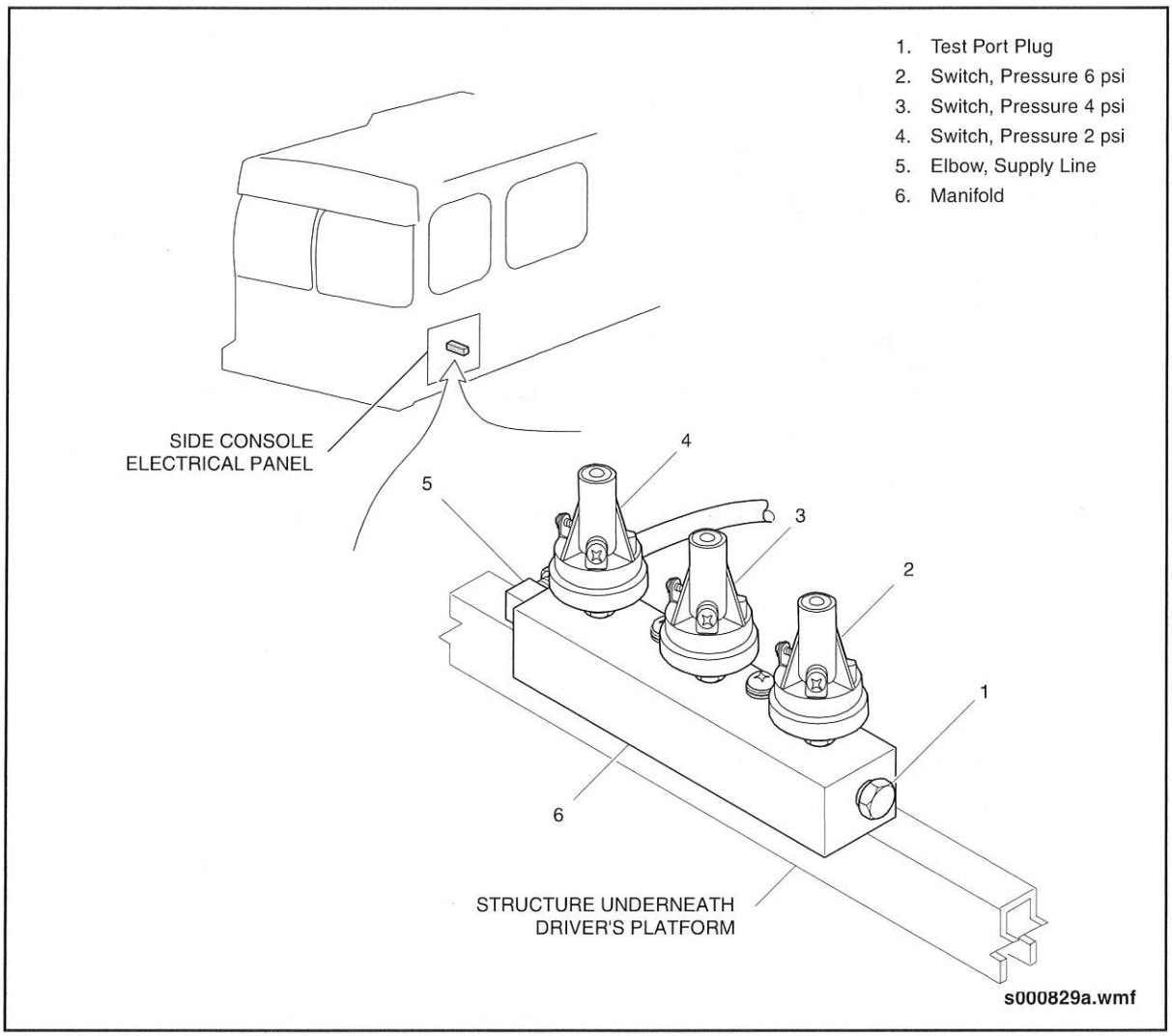

Fig. GI-8: Voith Retarder Switches

10.1. Description

The brake interlock control valves are located in the rear equipment box next to the rear curbside battery compartment.

- The brake interlock pressure regulator receives its air supply from the rear brake tank via the rear brake relay valve. The regulator is adjusted to 45 psi to attenuate brake application when the interlocks are activated. The outlet of the regulator is connected to the rear brake interlock mag valve.
- The rear brake interlock mag valve is normally closed. When energized by the PLC, it opens and allows pressure from the brake interlock pressure regulator to operate the rear brake relay valve. The rear brake relay valve then applies the service brakes.

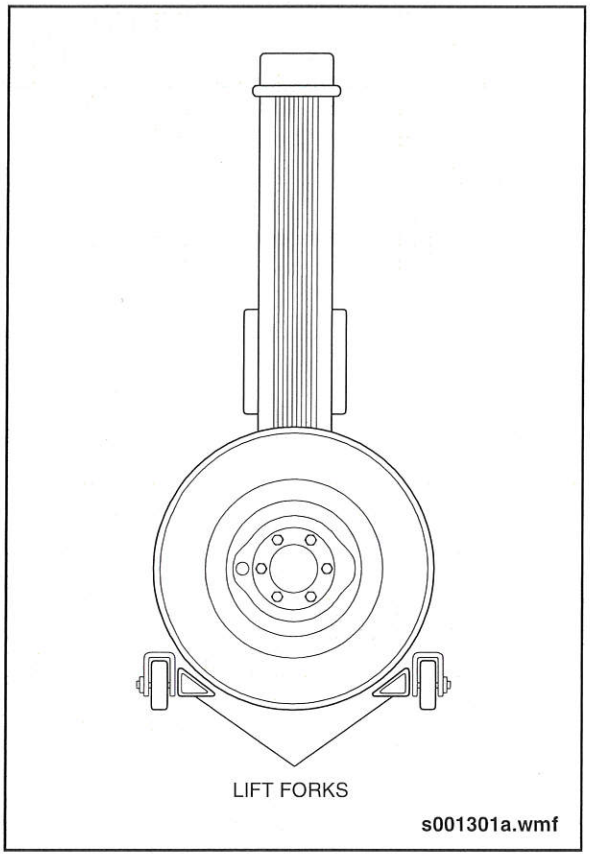

Fig. GI-10: Typical Wheel Lifts

11.3. Hoisting the Vehicle

1. Position vehicle over hoist and align hoist posts and adapter pads so these will contact the designated points on the two axles as far outboard as possible. See "Fig. GI-11: Typical Center Post Hoist" on page 23.
2. Raise hoist posts just enough so that hoist adapter pads positively contact the axle hoist points. DO NOT LIFT VEHICLE. See "Fig. GI-12: Wheel Placement in Hoist" on page 24.
3. Release parking brake.

NOTE:

If system air is depleted, either cage spring brakes or connect a filtered shop air supply, 70 psi minimum, to hold off spring brakes. This will also maintain air suspension system pressure.

4. Always inspect above hoist area, before raising the vehicle to ensure that nothing will interfere with the procedure or cause damage to the vehicle.
5. Ensure that hoist adapter pads are still properly located, then raise vehicle.
6. Raise front and rear of vehicle at the same rate, maintaining correct level at all times.

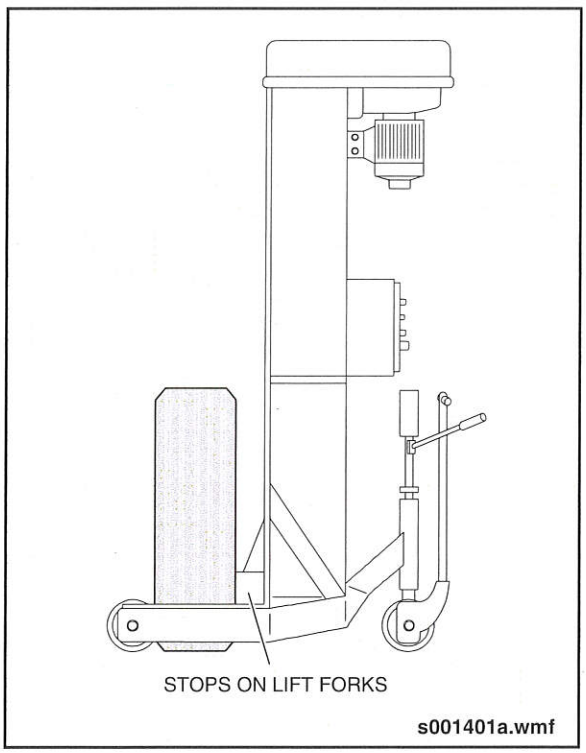

Fig. GI-12: Wheel Placement in Hoist

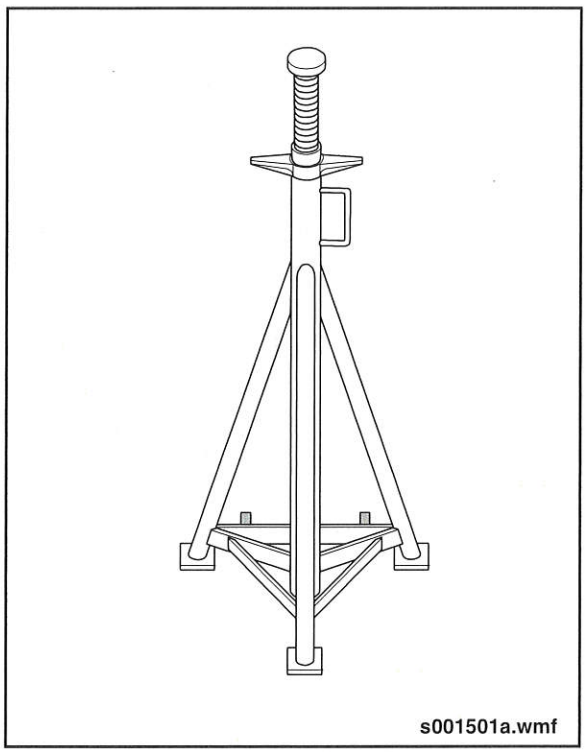

Fig. GI-13: Jack Stand

11.4. Jacking the Vehicle

⚠ CAUTION:
DO NOT attempt to jack the vehicle on an incline, or rough or uneven surface.

11.4.1. Front Jacking Procedure

A chassis tube assembly is located forward of the front wheels of your New Flyer vehicle. A jacking adapter assembly available from NFIL, is installed into this tube assembly when the front of the vehicle requires jacking. See "Fig. GI-14: Jacking Adapter" on page 25.

1. Apply the park brake.
2. Place blocks behind the rear wheels.
3. On the side requiring jacking, install the jacking adapter as follows:
   a. Locate the chassis tube assembly.
   b. Install the jacking adapter.
   c. Secure the jacking adapter by installing the locking pin through both the chassis tube and the jacking adapter.
   d. Insert the hairpin cotter to secure the locking pin.
4. Using a 10" bottle jack on a stable, level surface, jack the front side of the vehicle as follows:
   a. Position the bottle jack under the jacking adapter point A.
   b. Raise the bottle jack to its maximum height.
   c. Place support blocks under the chassis tube assembly.
   d. Lower the bottle jack to rest the chassis tube assembly on the blocks.
   e. Position the bottle jack under the jacking adapter point B.
   f. Raise the bottle jack to a sufficient height for the required repair.
   g. Place additional support blocks under the chassis tube assembly.
   h. Lower the bottle jack to rest the chassis tube assembly on the blocks.

11.4.2. Rear Jacking Procedure

⚠ CAUTION:
DO NOT attempt to jack the vehicle on an incline or on a rough or uneven surface.

1. Apply the park brake.
2. Ensure the front wheels are facing forward.
3. Place blocks in front of the front wheels.
4. Using a 10" bottle jack on a stable, level surface, jack the rear side of the vehicle as follows:
   a. Locate the appropriate jacking pad under the frame rail at the rear of the vehicle. See "Fig. GI-15: Jacking (hoisting) Points & Stand Placement" on page 26.
   b. Position the bottle jack under the jacking pad.
   c. Raise the bottle jack to a sufficient height for the required repair.
   d. Place support blocks under the frame rail.
   e. Lower the bottle jack to rest the frame rail on the support blocks.
5. Lower the vehicle using the bottle jack as follows:
   a. Position the bottle jack under the jacking pad.
   b. Raise the bottle jack to free the support blocks.
   c. Remove the support blocks.
   d. Lower and remove the bottle jack.
6. Remove the blocks from in front of the front wheels.

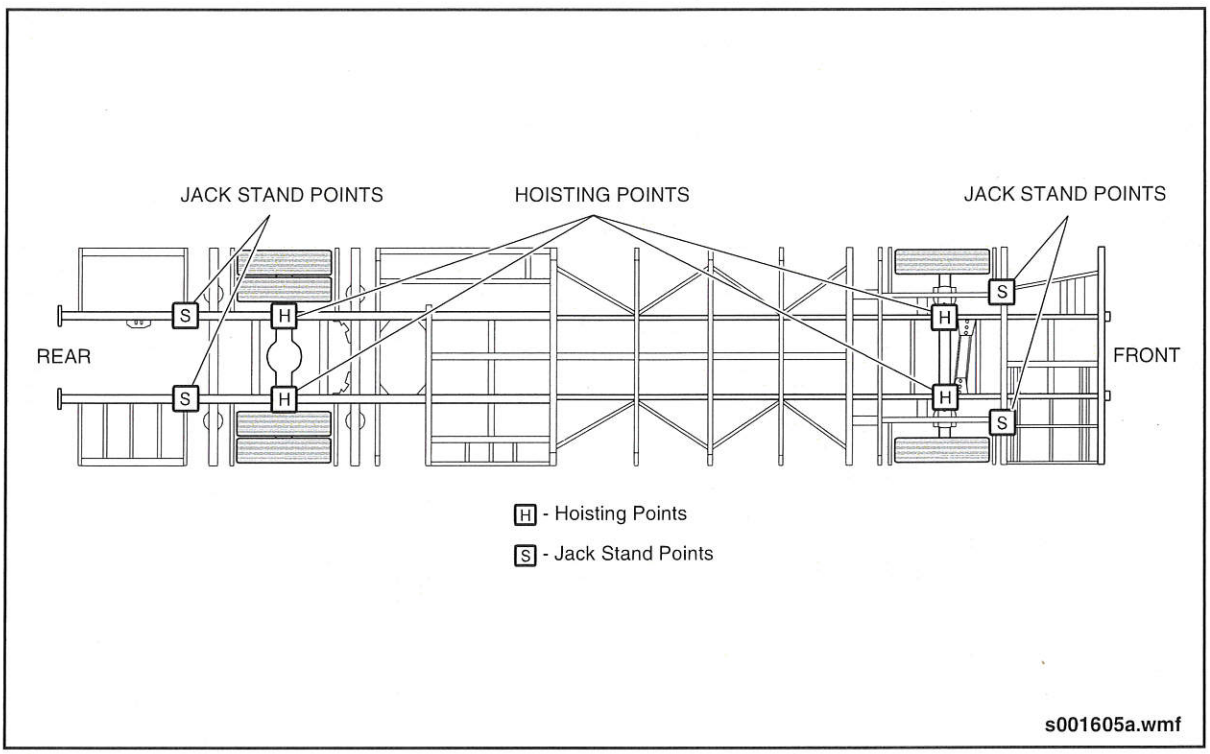

Fig. GI-15: Jacking (hoisting) Points & Stand Placement

12.2. Safety Precautions

1. Follow all State (provincial in Canada) and local traffic regulations regarding such items as warning signals, night illumination, speed and so forth.
2. A safety restraint system must be used that is independent of the primary lifting and towing attachments.
3. All loose or protruding parts of a damaged vehicle should be secured prior to towing.
4. Do not go under a vehicle which is being lifted by the towing equipment, unless the vehicle is adequately supported by safety stands or appropriate blocking.
5. No towing operation should be attempted for any reason which jeopardizes the safety of the operator, wrecker, bystanders or other motorists.
6. Do not exceed the recommended maximum speed of 35 mph (55 km/h) while towing.

12.3. Driveshaft Removal

12.3.1. Safety Precautions

Ensure the vehicle is appropriately lifted and supported, and know the limitations of the lifting and blocking equipment. Always ensure that jarring and shaking created by component removal does not cause the vehicle to become unstable.

⚠ WARNING:

DO NOT attempt to lift or jack the vehicle on an incline, rough or uneven surface.

DO NOT use inadequate lifting or blocking methods. They can result in the vehicle falling off the lifting or blocking equipment, causing severe injury or death to service personnel.

DO NOT allow individuals to board the vehicle while supported solely by the lifting or blocking equipment.

DO NOT run engine or engage transmission while vehicle is resting on lifting or blocking equipment.

12.3.2. Lifting & Supporting Vehicle

1. Ensure vehicle is positioned on a stable, level surface.
2. Ensure front wheels are facing forward and chocked in position.
3. Raise vehicle to facilitate removal of driveshaft and place safety stands or appropriate blocks at designated locations to support vehicle at this height. Refer to "Raising the Vehicle" in this section for jack stand locations.

⚠ WARNING:

Ensure each safety stand or block is precisely the same height and sitting completely level.

4. Lower vehicle slowly and carefully until it comes to rest on the safety stands or blocking.

12.3.2.1.Removal Procedure

☞ NOTE:

Tie up heavy driveshafts with a nylon support strap.

1. Remove driveshaft guard.
2. Disconnect driveshaft from transmission and differential yokes. Refer to Section 2 of this manual for more detailed information on driveshaft removal.

☞ NOTE:

To prevent bearing caps from sliding off universal joint, tape or wire them in place.

3. Remove driveshaft from under vehicle.
4. Raise vehicle to facilitate removal of safety stands or blocking.
5. Lower vehicle slowly and carefully.
6. Store driveshaft in an area on the vehicle that will prevent damage to the driveshaft and surrounding area of the vehicle in which it is stored.
7. Vehicle is now ready for towing.

13. TORQUE INFORMATION

13.1. Bolt Torque Specifications

Always use bolts and nuts with the same torque values and strength as those being replace. Damage to parts and systems can be caused by using bolts and nuts with the wrong specifications.

Bolts and capscrews are identified by either numbers or radial lines on the head.

- U.S. customary bolts and capscrews have radial lines on the head to indicate the SAE Grade Number. A (SAE) Grade 8 bolt or capscrew head will have 6 radial lines. A (SAE) Grade 5 bolt or capscrew will have 3 radial lines.
- Metric capscrews and nuts have a Commercial Steel Class Grade Number such as: 8.8, 10.9, 12.9 on the capscrew head or on the surface of the nut. A higher number indicates greater tensile strength.

The following are examples of capscrew identification specifications:

Metric

Bolt, M8 - 1.25 x 25 mm Lg.		
M8	**1.25**	**25 mm**
Major Thread Diameter in Millimeters	Thread Distance in Millimeters	Length in Millimeters

U.S. Customary

Bolt, 5/16" - 18 x 1 1/2" Lg.		
5/16"	**18**	**1 1/2"**
Major Thread Diameter in Inches	Number of Threads per Inch	Length in Inches

NOTE:

ALWAYS use specific torque values if such are stated in text or accompanying illustrations. Use the torque values in this chart if specific torque values are not specified. If the ft-lb. value is less than 10 ft-lb., converting to in-lb. will allow using a in-lb. torque wrench to produce a more accurate reading. As an example: 6 ft-lb. = 72 in-lb.

The torque values in the charts are noted for SAE Grade 8 or 5 bolts, capscrews and nuts, cadmium plated with hardened washers and non-lubricated threads. The ft-lb. torque value is shown first, with Nm torque value in brackets.

CAUTION:

Before torquing a bolt or nut, clearly identify the type, size and grade. Over-torquing or under-torquing threaded fasteners can damage the components and/or the bolts and nuts. Personal and component safety hazards can be caused by loose, elongated or sheared bolts, capscrews and nuts.