

Appendix 1

LEAK CLASSIFICATIONS

LEAK	DESCRIPTION	ACTION
Weeping	Lube is moist to touch, but doesn't form a drop.	It's acceptable.
Seeping	Lube comes out to form a drop, but not enough to drip off during inspection	Keep an eye on it. Change the seal if the case loses 15 – 20% of the lube between scheduled services.
Leaking	Lube that drips from the item being inspected.	Change the seal.

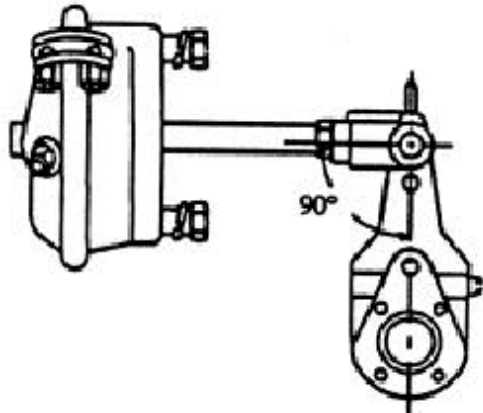
Appendix 2

King Pins

Play is in excess of:

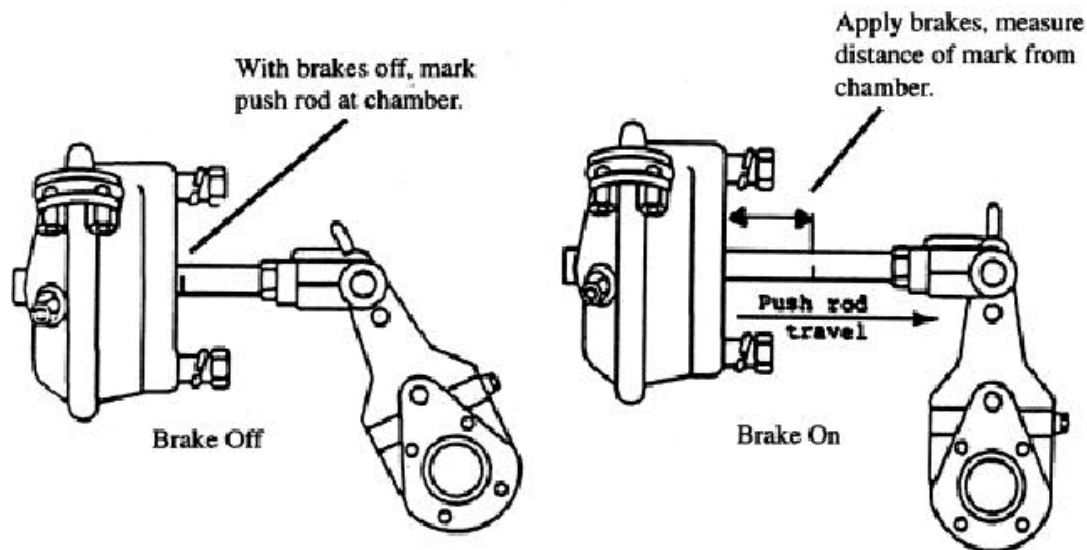
	<u>Road Wheel Diameter</u>
1/4" (6.5 mm)	16" or less
3/8" (9.5 mm)	17"- 18"
1/2" (13 mm)	over 18"

Appendix 3 Slack Adjuster Angle/Push Rod Travel



When brakes are properly adjusted and fully applied, the slack adjuster should be at an angle of 90 degrees or greater, measured from the center line of the push rod.

Measuring push rod travel: Brake chamber push rod travel shall not exceed those specifications relating to maximum stroke at which brakes should be readjusted. Performance of the rake push rod travel inspection should be done with the brake application air pressure in the range of 80 to 90 p.s.i., when measuring total stroke to determine proper brake adjustment. This criteria also applies to all vehicles equipped with S-Cam Air Brakes.



Appendix 3 cont.
PROCEDURE FOR MEASURING PUSH ROD TRAVEL

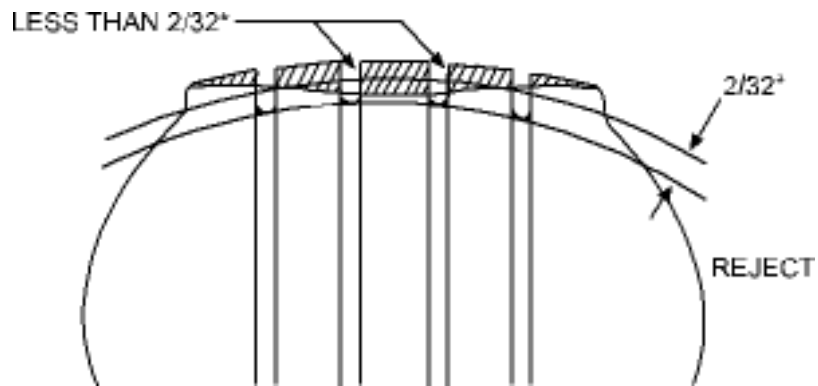
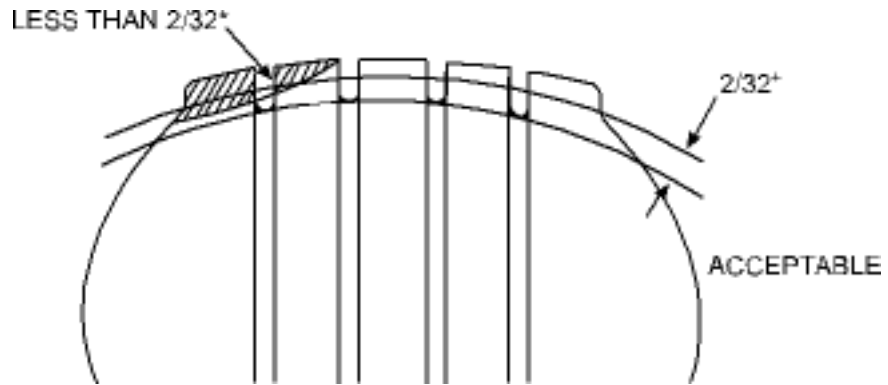
Brake chamber push rod travel shall not exceed those specifications relating to maximum stroke at which brakes should be readjusted. Performance of the brake push rod travel inspection should be done with the brake application air pressure in the range of 80 - 90 p.s.i., when measuring total stroke to determine proper brake adjustment.

CAUTION: *Chock wheels before commencing this inspection as vehicle emergency brake(s) must be off.*

Chart 13, Maximum Pushrod Travel

CLAMP TYPE CHAMBER	Type	Maximum Stroke	Maximum stroke with brakes adjusted	Maximum stroke at which Brakes should be adjusted
	6	1-5/8	Should	1-1/4
	9	1-3/4	be as	1-3/8
	12	1-3/4	short as	1-3/8
	16	2-1/4	possible	1-3/4
	20	2-1/4	without	1-3/4
	24	2-1/4	brakes	1-3/4
	30	2-1/2	dragging	2
	36	3		2-1/4
ROTO CHAMBER	9	2	Should	1-5/8
	12	2	be as	1-5/8
	16	2-1/2	short as	2
	20	2-1/2	possible	2
	24	2-1/2	without	2
	30	3	brakes	2-1/2
	36	3-1/2	dragging	2-3/4
	50	4		3-1/4
AIR DISC BRAKES	12	1-3/8	Should be as	1-3/8
	16	1-1/2	short as	1-3/4
	20	1-5/8	possible without	1-3/4
	24	1-3/4	brakes	1-3/4
	30	1-7/8	dragging	2

Appendix 4 Tires



Appendix 5

STEERING WHEEL PLAY (LASH) MEASUREMENTS

Steering Wheel Size

15 inches - 1 3/4" (4.4 cm)

16 inches - 2" (5.1 cm)

18 inches - 2 1/4" (5.7 cm)

20 inches - 2 1/2" (6.4 cm)

22 inches - 2 3/4" (7.0 cm)

Wheel Size:

16 inches or less - 1/4" (6.5 mm)

17 to 18 inches - 3/8" (9.5 mm)

Over 18 inches - 1/2" (13 mm)

Appendix 6

PROPANE CONVERSIONS

Oregon Administrative Rule 581-53-002 (5), adopted under the authority of Oregon Revised Statute 820.100, “Any additions of school bus equipment or alterations in the bus construction not provided for in the applicable Minimum Standards for Oregon School Buses are prohibited without prior approval from the Oregon Department of Education. Other pupil transporting vehicles shall not be modified or changed to affect the safe operating condition of the vehicles.”

OAR 581-53-512 through 581-53-527 details the minimum Standards for Oregon School Buses Anyone who is planning to convert a school bus to use propane fuel should be aware that there are approvals and permits to be obtained prior to the actual conversion and that both the State Fire Marshal and the Department of Education have standards which apply to this type of conversion.

Be sure you have the proper information before any conversion is started. This may help to alleviate any problems of obtaining necessary approvals.

A. GENERAL

- 1. All installations shall comply with the applicable provisions of Standard 58, 1983 Edition of the National Fire Protections Association. The following recommended practices are interpreted by the Department of Education as meeting the minimum requirements of NFPA 58.**
- 2. Maintenance personnel, procedures and equipment for installing and maintaining L.P. gas school buses shall meet the requirements promulgated by the Oregon Department of Commerce, Office of the State Fire Marshal.**
- 3. The propane equipment supplier shall provide training for fleet mechanics who will be maintaining propane-equipped vehicles. The supplier shall certify or provide documentation that mechanics have received adequate instruction for maintenance of propane equipment.**
- 4. L.P. gas motor fuel conversion equipment installed on school buses is permitted by the State Department of Education. School districts converting school buses to L.P. gas carburetion are required to obtain approval from the Department of Education.**

Appendix 6 cont.

Propane Conversions

- 5. Installations of L.P. gas conversion equipment (carburetion, lines, tanks, fittings, etc.) shall meet or exceed all of the safety specifications set forth in the National Fire Protection Association, Inc. Standard 58, 1983 Edition.**

B. INSTALLATION OF EQUIPMENT

- 1. The gasoline tank shall be removed from the bus when converting to propane.**
- 2. The Federal D.O.T. fuel tank guard required by provisions of FMVSS 301 is not required to be used with an L.P. gas tank.**
- 3. Holes in top or bottom flanges of frame side rails shall not be permitted except as provided in original chassis frame. There shall be no welding to frame side rails except by chassis or body manufacturer. Holes in side rails shall be drilled. (Cutting torch not acceptable.)**
- 4. The heat shield must be installed between the L.P. tank, connections and the exhaust pipe at any point where tank is 12 inches or less from the exhaust pipe or muffler.**
- 5. L.P. tank(s) shall be securely mounted directly to vehicle mainframe rail in such a manner as to prevent jarring loose, slipping or rotating. Fastening shall be adequate to withstand static loading in any direction equal to four times the weight of the filled tank without permanent visible deformation. Tanks mounted behind the rear wheels shall comply with the 1983 NFPA 3-6.2.6 Standard. Tank mounting to any body component is not permitted.**
- 6. Tank(s) shall be installed in accordance with provisions of NFPA 58. Tank mounting shall conform to one of the following options.**
 - a. Tank brackets shall be bolted directly to the vehicle mainframe rail. Brackets shall be supplied by the tank manufacturer and conform to the contour of the tank. Steel straps, of at least 3/8" thickness, adequate for holding tank firmly and securely in the brackets shall attach to the brackets with at least two 5/8" bolts per strap. All bolts used in tank mounting shall be SAE grade eight.**

Appendix 6 cont.

Propane Conversions

- b. Relief valve adaptors installed directly in the relief valve to deflect the flow upward shall be metallic and have a melting point over 700 degrees F (371 degrees C).
 - c. The discharge port shall be mounted in a recess in the lower part of the left side body skirt at an angle of 45 degrees upward, 36" below any window opening.
 - d. The discharge port shall be fitted with a rain cap to prevent moisture from entering the discharge port, and in its full open position minimize fuel vapors from impinging upon the body, or other adjacent traffic, and as far as practical from sources of ignition.
 - e. The recess discharge port box shall be covered with a protective mesh to discourage vandalism.
12. The Liquid Level Gauge (80% Manual Bleeder Valve) shall be fitted with a tamper proof head. **EXCEPTION:** See remote fill system.
13. There shall be hydrostatic relief valve installed between the tank manual shut off valve and the fuel lock off unit. It must be installed in a bulkhead, pointed down with a rubber cap (NFPA 58).
14. An opening in the skirt shall be made to provide adequate access to direct filling of the tank.
- OPTIONAL:** The remote fill box with Liquid Level Gauge in a closed compartment with a locking door is permitted. Mounting must be in a bus body skirt. Check valve shall not be removed from filler valve at remote fill to eliminate any fuel trapped from tank fill valve and remote fill valve.
15. On a remote fill system, the remote Liquid Level Gauge (80% valve) must be equipped with a manual shut off valve where the line connects with the container or fitting with a No. 54 drill size hole shall be installed in the 80% tank outage connection, in addition to the Fixed Liquid Level Gauge at the remote location.
16. The opening in the skirt to the direct tank fill valve shall be fitted with a door.
17. There shall be a decal-listing tank filling instructions affixed to the school bus body within two inches of the fill door.

Appendix 6 cont.

Propane Conversions

18. **Wiring and control cables routed through any body or chassis panel or structural member shall be properly grommited. Any electrical circuit shall be fused.**

C. CARBURETION

1. **The fuel system shall be equipped with at least three positive shut off devices between the fuel supply and the engine.**
 - a. **There shall be a manual shut off at the tank.**
 - b. **An automatic fuel lock off between the fuel tank and the converter may be one of the following: (NFPA58)**
 - i. **a vacuum fuel lock off. (U.L. Listed)**
 - ii. **an electric fuel lock off used in conjunction with a low-pressure switch. (BOTH MUST BE U.L. LISTED)**
 - c. **Automatic fuel shut off system within the converter unit. (U.L. LISTED)**
2. **All fuel lines shall be stainless steel wire braid reinforced and comply with NFPA 58. All fuel lines shall be U.L. Listed for L.P. gas, 1,750 lb. Burst pressure. (EXCEPT THE FUEL LINES BETWEEN THE CONVERTER AND THE CARBURETOR)**
3. **Hose ends and connections shall be of the same make (brand name) as the hoses for compatibility. Where fuel lines or vent lines pass through a bulkhead, a bulkhead fitting shall be used. (U.L. LISTED)**
4. **All brass components where high-pressure liquid propane is transferred shall bear the U.L. label**
5. **Mounting of the carburetion system shall be done in a manner, which will provide a solid vibration free system. The converter shall not be mounted on the fender panels or radiator supports.**
6. **Sealant to be used shall be U.L. Listed sealant for L.P. gas.**

D. FUELING PROCEDURES

1. **No passengers may be aboard the school bus while it is being fueled.**
2. **The engine must be shut off while the bus is being fueled.**

Appendix 6 cont.

Propane Conversions

- 3. There shall be no source of ignition within 50 feet of the bus while fueling.**
- 4. Gloves shall be provided and shall be worn by the person performing the filling of the fuel tank.**
- 5. The attendant shall be instructed in proper fueling procedures.**
- 6. Filling level shall not exceed 80 percent tank capacity.**

E. STORAGE AND MAINTENANCE FACILITIES

- 1. If buses are stored in an enclosed garage, the building shall be vented at the floor level.**
- 2. Buses garaged for maintenance or repair shall have the propane supply shut off at the tank unless supply is necessary for actual maintenance.**

PROPANE CONVERSION INSPECTION

Date _____ 200_____ Bus Number _____ License Number _____
 District _____ Contractor _____
 Variance approved _____ Date _____
 Conversion equipment installed by _____
 Gas tank removed Yes _____ No _____

	<u>O.K.</u>	<u>Does not meet standards</u>
Fuel tank shield per standards	_____	_____
Fuel tank mounting to frame rail	_____	_____
Fuel tank mounting brackets	_____	_____
Fuel tank mounting bolts (Grade 8)	_____	_____
Fuel tank ground clearance (13 inches)	_____	_____
Fuel tank P.S.I. rating (312)	_____	_____
Fuel tank relief valve	_____	_____
No fuel lines at or under tank	_____	_____
Relief valve rating (312)	_____	_____
Relief valve venting (lines & port)	_____	_____
Vent-screen and rain cap.	_____	_____
80% bleeder valve (tamper proof head)	_____	_____
Hydrostatic relief valve	_____	_____
Type of fill – remote – direct	_____	_____
Remote system shut off at tank	_____	_____
Skirt door	_____	_____
Wiring grommeted and fused properly	_____	_____
Three positive shut off devices between fuel supply and engine (manual at tank – auto. fuel lock off – converter lock off)	_____	_____
Fuel lines (U.L. appr. For L.P. gas 1750 burst pr.)	_____	_____
Lines through bulkhead (bulkhead fitting)	_____	_____
Converter mounting (not to fender panel)	_____	_____
Filling instructions installed within 2” of fill door	_____	_____
Closed storage area vented	_____	_____
Mechanic certification	_____	_____

PROPANE CONVERSION INSPECTION CONT.

Fire Marshall inspection date _____

This is a visual inspection only without disassembly or road test

Inspected by _____

I certify the items marked "Does not meet standard" have been corrected as required by the Department of Education specifications. _____

Repairs must be completed within 30 days unless bus is "grounded" at time of inspection

Appendix 7

SYSTEM VOLTAGE	RATED OUTPUT IN AMPERES	RECOMMENDED MINIMUM CHARGING CABLE GAUGE SIZE							
		UP TO 4 FT.	4 TO 7 FT.	7 TO 10 FT.	10 TO 13 FT.	13 TO 16 FT.	16 TO 19 FT.	19 TO 22 FT.	22 TO 28 FT.
12 VOLT	0 - 20	14	12	12	10	10	8	8	8
	20 - 35	12	10	8	8	6	6	6	4
	35 - 50	10	8	8	6	6	4	4	4
	50 - 65	8	8	6	4	4	4	4	2
	65 - 85	6	6	4	4	2	2	2	0
	85 - 105	6	6	4	2	2	2	2	0
	105 - 125	4	4	4	2	2	0	0	0
	125 - 150	2	2	2	2	0	0	0	00

MAXIMUM DIFFERENCE BETWEEN BATTERY VOLTAGE AND ALTERNATOR VOLTAGE IS 0.5 VOLTS FOR 12 VOLT SYSTEMS AT FULL RATED OUTPUT.

MAXIMUM VOLTAGE DROP IN THE SENSE (#2-TERMINAL-LEAD) MUST NOT EXCEED 0.2 VOLT FOR 12 VOLT 3-WIRE SYSTEMS.

CABLE GAUGE SIZE CALCULATION TAKES INTO ACCOUNT TERMINAL CONNECTION RESISTANCE.

WHEN AN INSULATED (NO FRAME GROUND) CHARGING SYSTEM IS INSTALLED, LENGTH OF RETURN CIRCUIT MUST BE INCLUDED TO OBTAIN TOTAL CIRCUIT LENGTH TO DETERMINE PROPER WIRE SIZE.

Appendix 7 Cont.

BATTERY TEST

Remove surface-charge:

Perform test appropriate for battery size.

TEST

Measure electrolyte temperature. Discharge at ½ the CCA rating of the battery for 15 seconds.

Battery voltage must not drop below the listed values during the 15 second test.

Degrees in F	Min. Voltage
70 or over	9.6
60	9.5
50	9.4
40	9.3
30	9.1
20	8.9
10	8.7
0	8.5

Appendix 8

PROPER WIRING GAUGE USAGE

MAXIMUM LENGTH OF CONDUCTOR IN FEET FROM POWER SOURCE TO LOAD

SAE Wire Size	20	18	16	14	12	10
Circuit Current in AMPS	Ft	Ft	Ft	Ft	Ft	Ft
1	36.4	52.3	78.0			
2	18.2	26.1	39.0	63.0	99.0	
3	12.2	17.4	26.0	42.0	66.0	
4	9.1	13.1	19.5	31.5	49.5	78.8
5	7.3	10.4	15.6	25.2	39.6	63.0
6	6.1	8.7	13.0	21.0	33.0	52.5
7	5.2	7.4	11.1	18.0	28.2	45.0
8		6.5	9.8	15.8	24.8	39.4
9		5.8	8.6	14.0	22.0	35.0
10		5.2	7.8	12.6	19.8	31.5
15			5.2	8.4	13.2	21.0
20				6.3	9.9	15.8
20					6.6	10.5

Appendix 9

First Aid Contents

- One 1" adhesive compress – 16 per unit
- Two 2" bandage compress -- 4 per unit
- Two 3" bandage compress -- 2 per unit
- Two 4" bandage compress – 1 per unit
- Two 3" X 3" plain gauze pads – 4 per unit
- Two 2" X 6 yards gauze roller bandage – 1 per unit
- Three 1/2 square yard gauze
- Three 24" X 72" gauze
- Four triangular bandage
- One 1/2 X 5 yard adhesive tape – 1 per unit
- One round nose scissors and tweezers, Latex gloves –one pair
- One microshield for mouth-to-mouth airway

Appendix 10

Body Fluid Clean Up Kit Contents

- Two pair rubber/latex gloves
- Two four-ounce packages of stabilized chlorine absorbent deodorant (or equivalent) capable of stabilizing at least 1 litre/36 fl. Oz. of body fluids.
- One spatula for pick up of congealed fluid
- One plastic bag in which to place congealed fluid
- One red plastic bag with tie, identified for infectious waste and as a biohazard
- One two-ounce bottle of germicidal detergent to apply to a contaminated area
- Four paper towels to wipe up contaminated area
- One one-ounce antiseptic alcohol hand rinse (or equivalent)
- One placard of step-by-step use instructions

Germicidal detergents, stabilized chlorine absorbent deodorant, alcohol hand rinse, or their equivalents shall provide documentation of EPA approval regarding their microbiological efficacy for at least the following:

- Staphylococcus aureus;
- Pseudomonas aeruginosa;
- Salmonella choleraesuis;
- Streptococcus species;
- Herpes simplex Type II;
- HIV (associated with AIDS);
- Fungi (athlete's foot);
- Poliovirus; and
- Tuberculosis

Documentation of efficacy for Hepatitis B may be hospital or test studies. The certified effective shelf life of these products shall be a minimum of 12 months. Product expiration date shall be clearly displayed on all time-sensitive products.

Appendix 11

Brake Failure Warning System

WARNING LIGHTS/BUZZER				
Normal Operation				
	MODE	Indicator		
		Brake Lamp	Brk. Elec. Mtr. Lamp	Buzzer
FORD	1a. Engine Off/Ignition Off no brake applied	Off	Off	Off
	1b. Engine Off/Ignition Off brake applied	Off	On	On
	2. Engine Off/Ignition On or START with or without brake applied	On	On	On
	3. Engine On with or without brake applied	Off	Off	Off

Normal Operation				
	MODE	Brake Warning Light	Brk. Elec. Hyd. Boost Warning Light	Tone Alarm
		GMC	1. Engine off-ignition off A. No brake applied B. Brake apply	Off On
2. Engine off-ignition on with or without brake applied (bulb check).	On		On	On
3. Engine off-ignition on start with or w/out brake applied.	On		Off	On
4. Engine on with or without brake applied.	Off		Off	Off

Appendix 12

Brake Failure Warning System

- Brake Failure Warning System Checks	
NAVISTAR	
CONDITION	NORMAL OPERATION
PARK BRAKE LIGHT	
Key switch in START position w/park brake released - (Bulb check).	Light ON
Key switch ON w/park brake applied.	Light ON
BRAKE PRESSURE LIGHT	
Key switch OFF.	Light OFF, electric hydraulic pump operates when service brakes are applied.
Key switch in ON position. Engine not operating (pump and bulb check).	Light ON and electric hydraulic pump operation (some vehicles) SEE NAVISTAR MANUAL
	Light ON and electric hydraulic pump operates when service brakes are applied.
Key switch in ON position and Engine operating with service brakes applied.	Light OFF
Key switch in START position.	Light ON momentarily and electric hydraulic pump operates.
Key switch in ON position and engine operating with service brakes applied.	Light OFF

Appendix 13
FORD HYDRAULIC, MAXI BRAKE SYSTEM
NORMAL BRAKE SYSTEM CONDITIONS

Controls												Controls									
Engine		Ignition			Service Brake		Parking Brake				Service Brake		Electric* Pump				Parking Brake				
							Off		On		Light		Light		Buzzer		Light		Buzzer**		
Off	On	Off	On	Start	Off	On	Part Rel	Full Rel	Part Set	Full Set	Off	On	Off	On	Off	On	Off	On	Off	On	
X		X			X			X	OR	X	X		X		X		X		X		
X		X				X		X	OR	X	X			X		X	X		X		
X				X	X or X					X		X		X		X		X		X	
	X		X		X or X					X	X		X		X			X	X		
	X		X		X or X		X				X		X		X			X	X		
	X		X		X or X			X			X		X		X		X		X		
	X		X		X or X				X		X		X		X		X			X	
	X		X		X or X					X	X		X		X				X		

* Whenever the ignition switch is in the START position, the Hydro-Max electric pump will cycle momentarily.

** Parking brake buzzer will sound momentarily during application of the parking brake in cold ambient conditions.

Appendix 14

Hydraulic Brake System , Bendix (Freightliner)

Brake Control Module – The brake control module, which operates on 9 to 16 volts DC is active under any of the following conditions: (1) – when the ignition is on; (2) when the brake pedal switch is powered; (3) if the ignition is off, but the driver’s door is open and the parking brake is not applied.

When the ignition is turned on, the control module starts a self-test mode, which lasts from about one to three seconds. The warning lights and buzzer come on, and then go off if the system is working all right.

The module then goes into the active mode, monitoring the hydraulic brake system. If a problem is detected, the applicable input or output terminal is activated, and a warning light and buzzer come on.

The output terminals are activated as follows:

The “R” light (brake pressure – number 4 on Fig. 2.9) is activated when any of the following conditions exist:

- the flow switch on the power booster closes, due to a reduced flow of power steering fluid;
- the pressure differential switch on the master cylinder closes, due to a drop in pressure in either the front or rear brake system;
- the fluid level switch on the master cylinder reservoir closes, due to a drop in the fluid level;
- too much electrical resistance is in the backup pump motor.

The “P” light (parking brake – number 13 on Fig. 2.9) is activated when any of the following conditions exist;

- the parking brake is applied, and the ignition is on;
- the driver’s door is open, the parking brake is not applied, and the ignition is off. This condition will also cause the control module buzzer to come on.

NOTE: The vehicle is equipped with two dash buzzers: one on the control module itself, which comes on when the “P” light (parking brake) is activated due to the driver’s door being open and the parking brake not applied: and one mounted separately from the control module, which comes on when the “R” light (brake system pressure) is activated.

(Information reprinted with permission of Freightliner)

Appendix 15

Handrail inspection

String and Nut Test

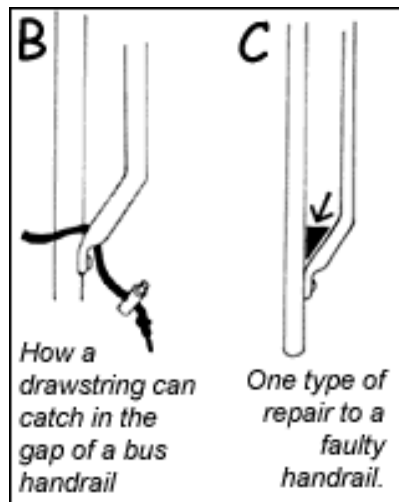


Figure 6
The Tool



The Handrail Inspection Tool and Procedure

Figure 6) is inexpensive and the procedure for detecting potentially fatal handrail designs is quite simple. The inspection tool is a standard 1/2" hex nut measuring 3/4" across the flats. This nut is tied to 1/8" thick cotton cord measuring 36" in length with overhand knots. The drawstring should have a minimum length of 30" when tied to the nut and attached so that a pull of at least ten pounds does not separate the nut from or break the drawstring.

Steps to conduct a handrail inspection are:

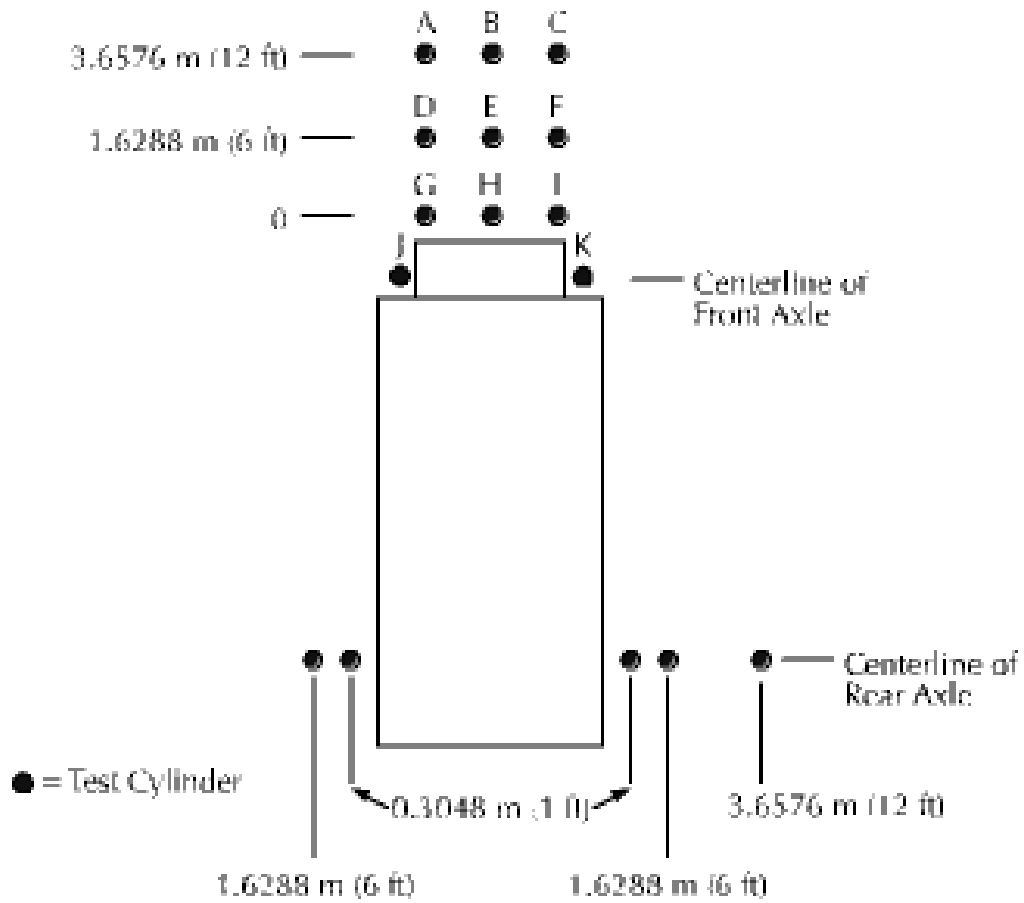
- Stand on the ground outside of the bus
- Drop the inspection tool between the handrail and step well wall, simulating the typical way students exit the bus
- Draw the inspection tool through the handrail in a smooth, continuous slow motion
- Repeat this procedure several times (minimum of three times)

Note: It is important to drop the inspection tool over the handrail in such a way as to simulate a child exiting the bus. This is a **drop and drag** test. Do not create a snagging situation by placing the nut in an area that would not be exposed to a drawstring or other articles.

Inspection Results

- Take the bus out of service and repair it if the inspection tool catches or snags anywhere on the handrail.
- If the nut separates from the drawstring or the drawstring breaks, reassemble the tool and retest. If the inspection tool pulls freely without catching or snagging, the bus should not be rejected.

Appendix 16 Mirror Diagram



Appendix 17
Guidelines for Brake and Bearing inspection

1. **Vehicles with inboard brake drums** (brake drums that can not be pulled without pulling wheel hub).

Wheels need to be pulled every year to inspect brakes and bearings.

2. **Vehicles with grease type wheel bearings.**

Wheels need to be pulled every year to inspect brakes and re-pack bearings.

3. **Vehicles with outboard brake drums** (brake drums that can be pulled without pulling wheel hub).

Brake drums need to be pulled every year to inspect brakes, wheel hub needs to be pulled to inspect bearings every 50,000 miles or two years which ever comes first.