LTC Electrical Panel Assemblies

Table of Contents

Safety

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Warnings

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Caution

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Notes

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Introduction

These procedures are documented using a Blue Bird LTC with an Allison B500 World Transmission. The Electrical Panels for the LTC Cummins M11 and the Detroit Diesel engines are shown. (See Schematic 1.) Circuit breaker is located in a side mounted electrical box below the driver's seat. If a short occurs and the circuit breaks, the circuit will reset when the element cools.

A blinking of lights or fluctuating gauges may indicate a short. Always correct the short immediately. (See Table 1— Wiring Circuit Color Quick Reference.)

Troubleshooting

- **For access to the electrical panel.**

1. Disconnect battery and remove all battery ground straps

2. Use proper gauge wiring with high temperature insulation, such as chemically cross-linked polyethylene to meet SAE J-1128.

3. Make sure added circuits are protected by the use of a fuse or circuit breaker.

4. Push-on terminals must be insulated.

- **When installing or replacing wiring, other than ground straps.**

Caution

To avoid pin and harness damage, use test leads when taking a measurement.

1. Always use clamps to secure wires away from sharp objects or moving components.

2. Support wires every 30 inches (762 mm).

3. Provide adequate slack loops to allow for motion in all directions.

4. Clamp at both sides of loop.

5. Ensure there is sufficient length in wires so there is no tension.

6. Secured wires must remain at least four inches (102 mm).

7. Use rubber grommets when wires pass through a hole.

8. Cover all full time hot, accessory or ignition hot wires with approved loom.

9. Avoid routing wires in contact with fuel lines, or plastic components.

10. Make sure that all ground straps are connected when performing work on the engine components.

11. Make sure that the alternator has six gauge strap.

12. Make sure that the engine block and transmission has a ground straps.
13. Connect ground strap to the bolt that mounts transmission to rear face of engine block.

14. Use external star tooth washer between cable and frame.

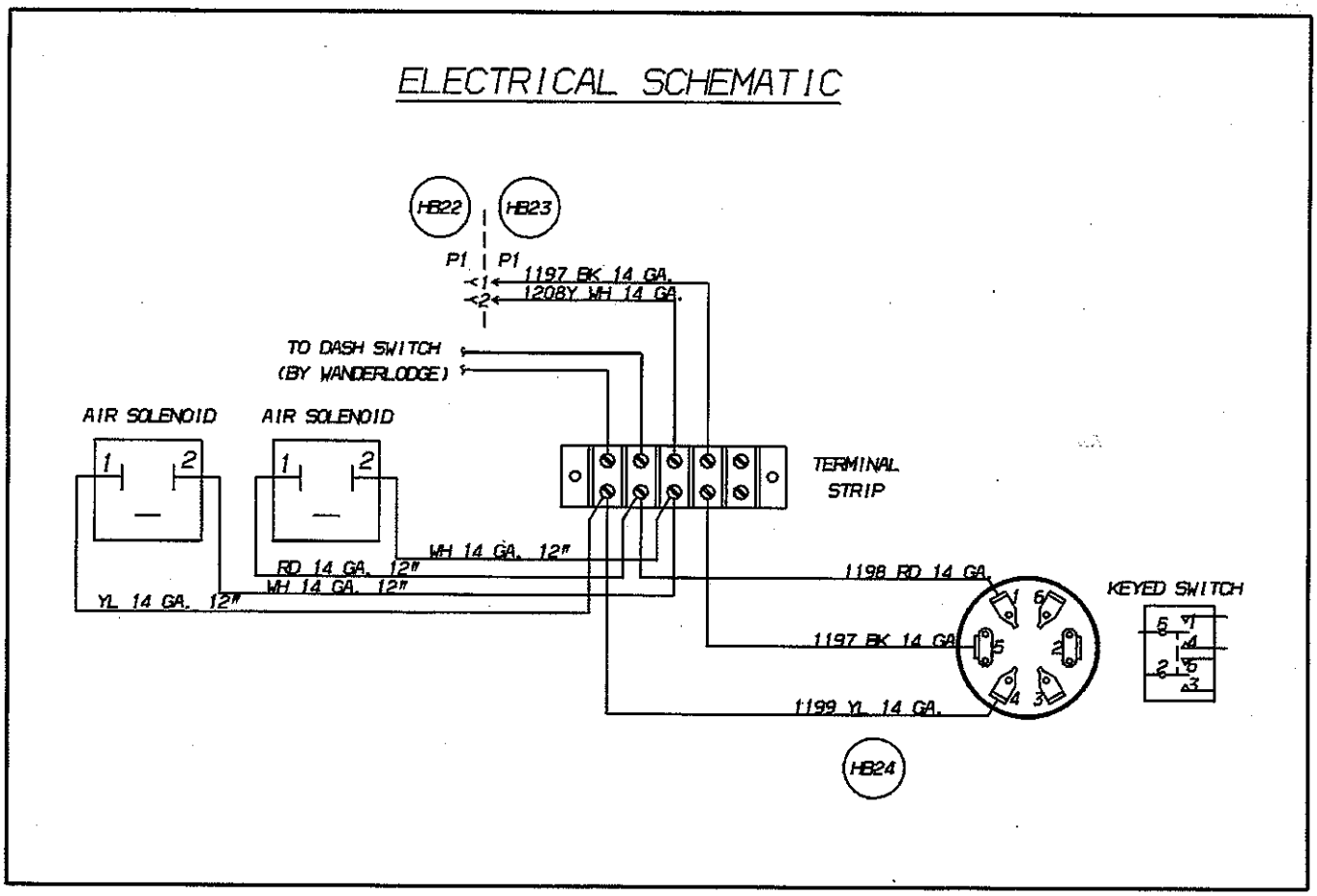
15. Do not splice into existing wires. Install full-length wires.

16. If accessories must be added, relays may be required, check installation instructions. Use a bank of circuit breakers in the electrical panel unless the accessory must be on during starting. In that case, the hot bar should be used.

17. Always use insulated rubber boots over hot six-gauge wiring on the alternator, ammeter shunt, or junction blocks.

Wiring Circuit Color Quick Reference	
Function	**Color**
Left Rear Directional Light	Yellow
Right Rear Directional Light	Dark Green
Stoplights	Red
Back-up Lights	Blue
Tail lights	Brown
Ground	White
Ignition Feed-Primary Feed	Black

Table 1—Wiring Circuit Color Quick Reference



Schematic 1—Electrical Schematic

LTC Frame

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

List of Tables

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Notes
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Introduction
These procedures were documented using a Blue Bird LTC bus with a Cummins ISM engine and the Detroit Diesel Series 60 engine, and an Allison transmission. Vehicles with other engines or transmissions will use similar, and in most cases identical, procedures. For variations, refer to the appropriate installation drawing.

Warning
Use the parking brake. Use wheel chocks at the rear wheel. Make sure the vehicle is stable before moving under the vehicle.

Preparatory Work
Park the vehicle on a level surface. Work under the vehicle would be made easier if a lift of sufficient strength is used. Once the vehicle is parked, set the parking brake and chock the rear wheels.

Configuration Details
All applications are common except the motor mounts for other engine configuration.

Note
When a huckspin is removed, replace with the proper capscrew and a lock nut. Refer to Table 1—Huckspin to Capscrew Conversion.

Frame Components LTC
The two configurations for the LTC frame are the Cummins M11 and the Detroit Diesel Series 60. (See Figure 1—Frame Configuration, Details B and C.)

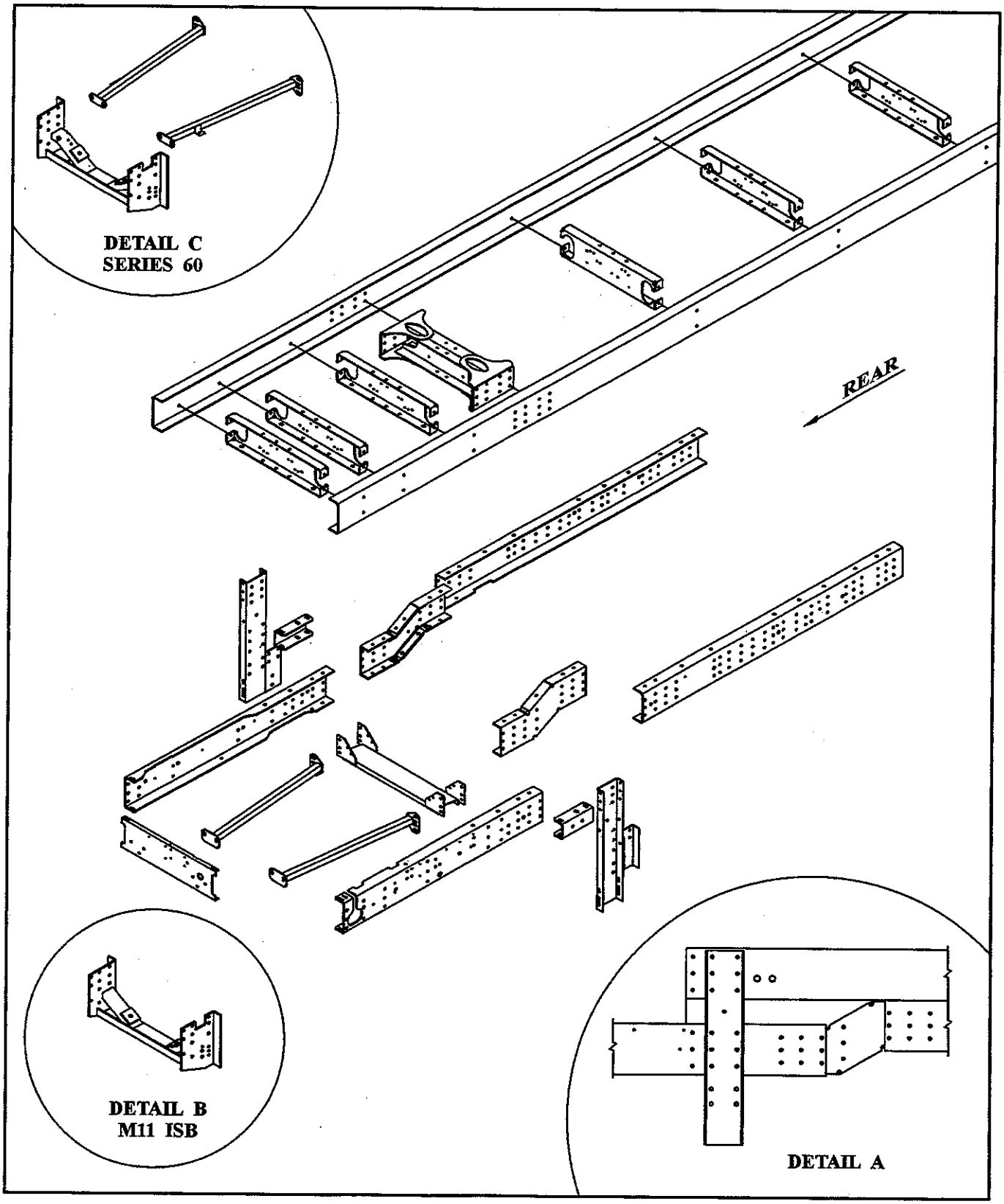

Figure 1—Frame Configuration 1 of 2

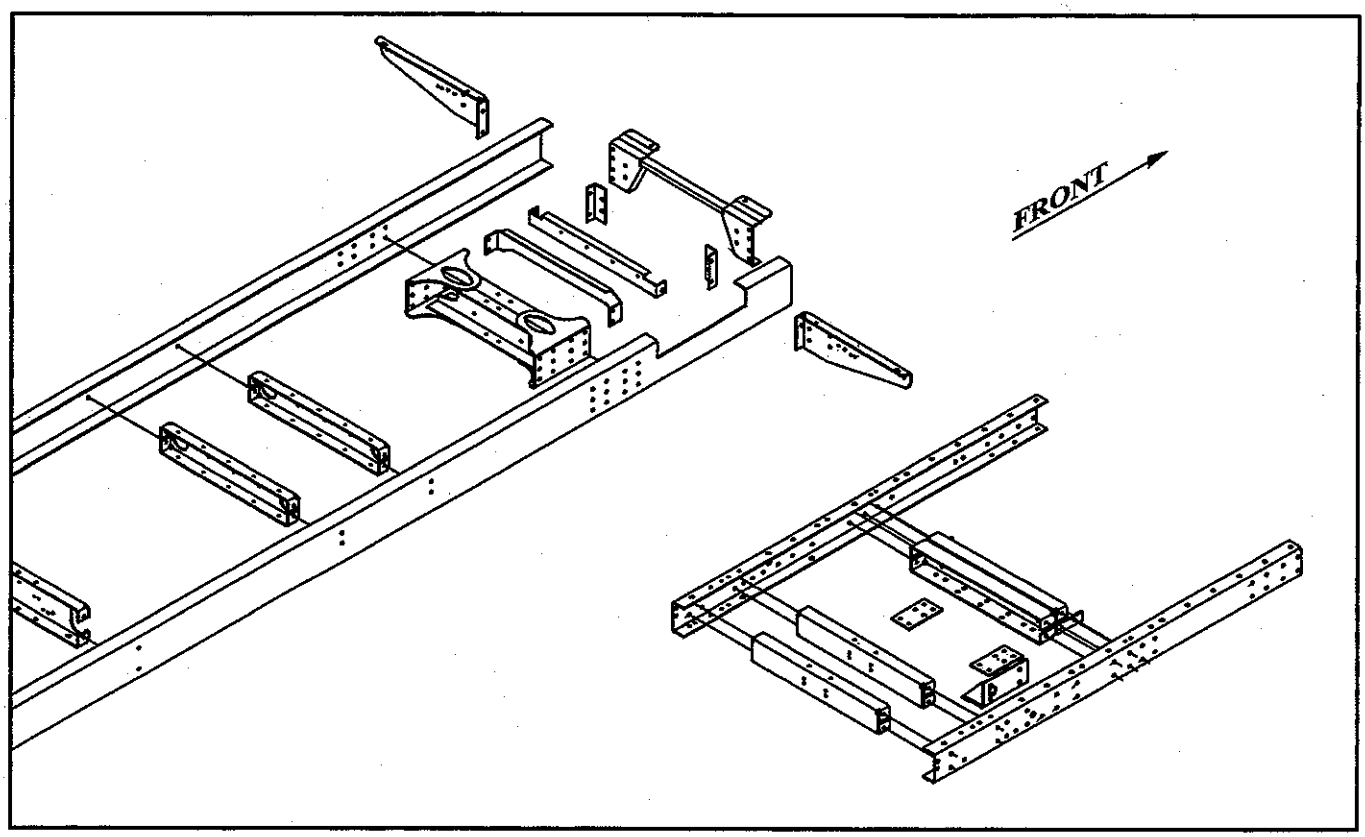

Figure 1—Frame Configuration 2 of 2

Caution

Make sure that a flat washer and a lock nut is used with the capscrew replacing the huckspin.

HUCKSPIN			GRIP RANGE		CAPSCREW GR8		
BB P/N	Huck Number	Nominal Length	Min	Max	Nominal Length	Thread	BB P/N
1636943	-10	2.25	0.43	0.90	1.50	½-13	0803239
1636943	-10	2.25	0.43	0.90	1.75	½-13	0803148
1636950	-16	2.60	0.85	1.25	1.75	½-13	0803148
1636943	-10	2.25	0.43	0.90	1.75	½-20	0959452
1636950	-16	2.60	0.85	1.25	1.75	½-20	0959452
1636950	-16	2.60	0.85	1.25	1.75	½-13	0803205
1746817	-20	2.85	1.09	1.50	2.00	½-13	0803205

CAPSCREW BOLTS THIS MATERIAL THICKNESS		BB P/N	USE FLAT WASHER	USE LOCKING NUT	USE NON-LOCKING NUT
Minimum	Maximum	---	---	---	---
0.25	0.75	0803239	1003045	0850800	½-20 GR8
0.50	1.00	0803148	---	---	---
0.50	1.00	0803148	---	---	---
0.50	1.00	0959452	---	---	---
0.50	1.00	0959452	---	---	---
0.75	1.25	0803205	---	---	---
0.75	1.25	0803205	---	---	---

Table 1—Capscrew to Huckspin Conversion

Front Bumper Removal

- See Figure 2—Front Bumper

1. Remove the nut and the flat washer.
2. Remove the nut, washer and bolt from the bracket (11).

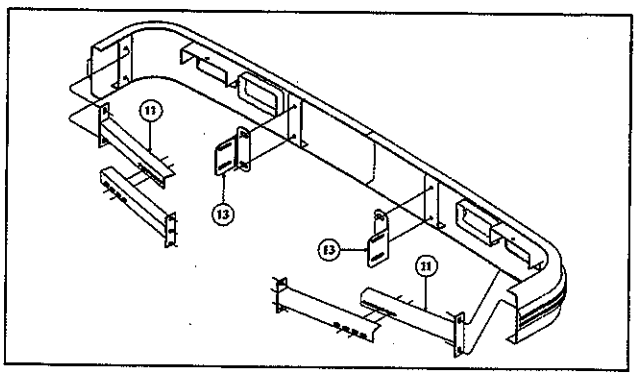

Figure 2—Front Bumper

Front Tow Hook Removal

- See Figure 3—Tow Hook Removal

1. Remove the nut, flat washer, and capscrew (3) from the front bumper support bracket.
2. Remove the nut, flat washer, flat washer and capscrew.

Rear Bumper Removal

1. Remove the nut and flat washer.
2. Remove the bumper plate spacer and bolt from the bracket.

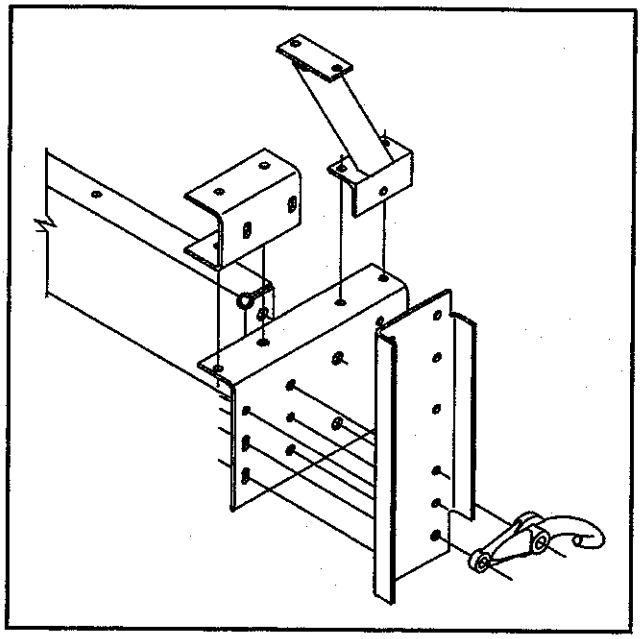

Figure 3—Tow Hook Removal

Frame Repair Preparatory Work

Note
Before welding, disconnect battery cables. If welding is near battery remove battery.

Warning
Do not remove any chassis cross member.

Do not weld on the engine, radiator, fuel tank, transmission or any component mounted on the engine or transmission.

Stable the bus with chocks and jacks.

1. Disconnect the grounding cables.
2. Disconnect ECUs.
3. Attach the welding grounding cable no more than two-feet from the point of weld.
4. Provide the shielding to protect the chassis components from heat damage and welding splatters.
5. After welding, reconnect all ground cables, ECUs and other disconnected components.

Note
Only a current AWS certified welder should weld.

Frame Repair
1. Remove the affected fasteners.

Caution
Frame insert must be 950X HSLA steel or equivalent.

All 0.500-inch (12.7 mm) fasteners should be new coarse thread bolts, hardened washers, one under head, and one under nut. Use new locking nuts. Bolts and nuts to be grade 8 material.

2. Strip and clean the affected area; both sides of the frame.
3. Locate the running tip of weld with a magnifying glass.
4. Stop drill crack. Hole to be 1/8-inch diameter.

Note
Refer to Blue Bird drawing 1746155 for frame insert configuration.

5. Grind crack to 45-degree angle on one side and install 1/16-inch land on opposite side to ensure full penetration.
6. Grind the weld flush to base metal.
7. Install standard LTC 9-5/8-inch rail to be 9.06-inches outside height with 2-3/4 flange and be ¼-inch thick. The inside bend radius is to be 0.37 to 0.50 inches.

Frame Welding

Warning
It may be necessary to remove all fuel from fuel tank (s) and fuel lines. Cover all hydraulic lines and electrical wires.

- Weld procedure using mig (GMAW). (See Figure 4—Frame Weldment.)

- 0.35 inch (8.5 mm) diameter wire
- E70S3 AWS classification.
- 300 – 350 inches per minute
- 90% Argon – 10% CO^2 or 92% Argon – 8% CO^2
- Arc Volts 18 – 21
- Amps 100 – 130
- Weld procedure using stick process (SMAW)
- E7018, E6012, or E6013 electrode, 1/8 to 5/16-inch electrode reverse polarity, AC, or DC, adjust heat to thickness of material.

Caution

Make sure all slag has been removed before coating.

1. Clean the area with a wire brush.
2. Test drive the bus and re-inspect weld area.
3. Coat area with the Blue Bird recommended coating.
4. Inspect the weld area after 1,000 miles (1609 km) of service.

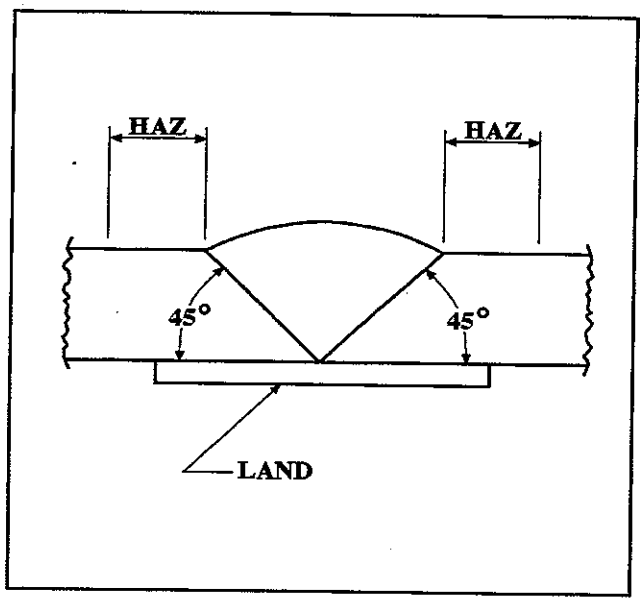

Figure 4—Frame Weldment

LTC Fuel System

Table of Contents

Table of Contents

List of Figures

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Introduction

These procedures were documented using a Blue Bird LTC bus with a Cummins M11 engine and an Allison B500 World Transmission.

Description of Operation

The LTC has a 176 gallon (666 L) dual fill fuel tank. The fuel system incorporates a Racor 490R-12-10 Fuel Filter/Water Separator.

Warning

Fuel is flammable and toxic to the skin, eyes and respiratory tract. Skin, eye and respiratory tract protection is required. Avoid repeated or prolonged contact. Use in a well-ventilated area.

Make necessary ground connections for fuel tank senders and other electrical components with ground wires.

Fuel Filter/Water Separator Assembly Removal

1. Disconnect the female swivel (8) from the male connector (15). (See Figure 1—Racor 490R-12-10 Filter/Water Separator.)
2. Remove the nut (24), flat washer (23) and capscrew (22).
3. Disconnect the heater from the Filter/Water Separator.
4. Remove the Filter/Water Separator (16).
5. Disconnect the female swivel (8) from the male connector (7) at the fuel and air mounting junction (11). (See Figure 2—Fuel/Air Mounting Junction.)
6. Remove the nut, flat washer, and capscrew from the mounting bracket.

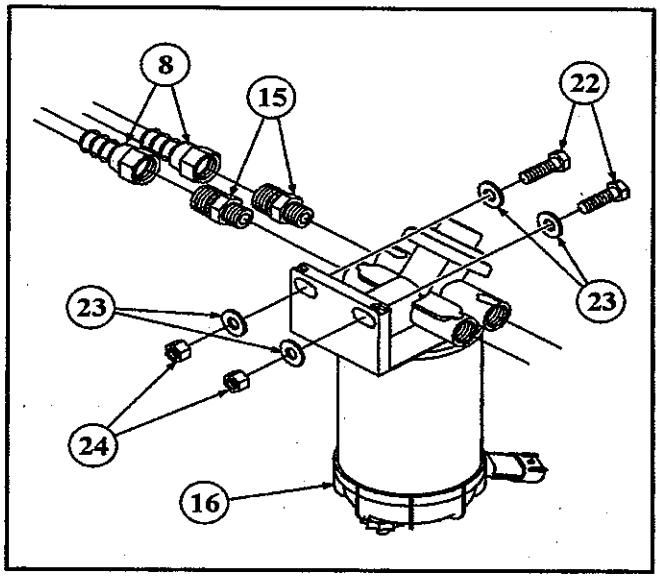

Figure 1—Racor 490R-12-10 Fuel Filter/Water Separator

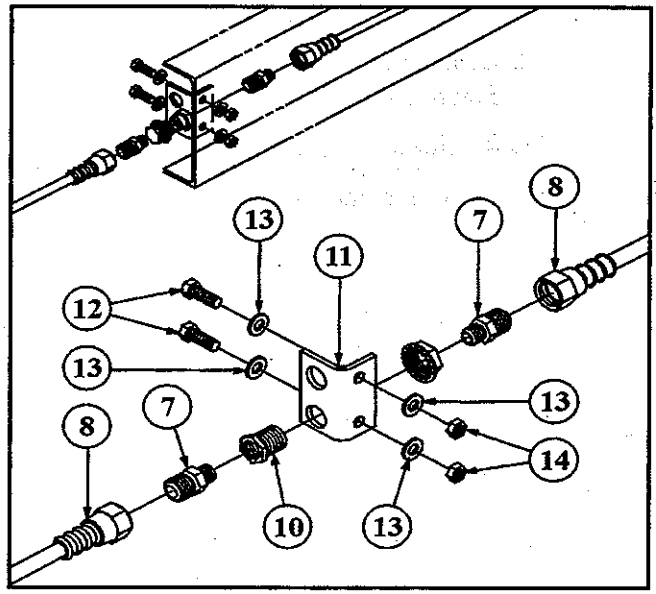

Figure 2—Fuel/Air Mounting Junction

Fuel Tank Removal

Warning

Use correct lifting equipment and techniques. The bus will need to be raised at least 36 inches during tank removal.

1. Remove the access panel (18) from the luggage compartment (11). (See Figure 3—Fuel Tank Fitting Access Panel.)

Note

Access to the fuel sender is through the front luggage compartment on the right hand side of the bus. To access the fuel sender, open up the front right luggage compartment and locate the fuel sender access panel.

2. Raise the bus using jacks capable of loading 40,000 pounds (18144 kg). The weight of the LTC is approximately 40,000 pounds (18144 kg).

Warning

Fuel is flammable and toxic to the skin, eyes, and respiratory tract. Skin, eye, and respiratory tract protection is required. Avoid repeated or prolonged contact. Use in a well-ventilated area.

Caution

Do not reuse fuel because of contamination.

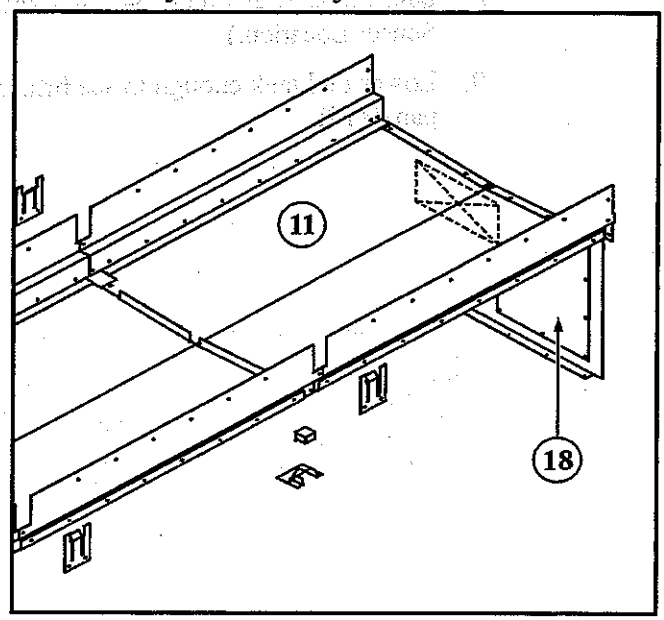

Figure 3—Fuel Tank Fitting Access Panel

3. Drain the fuel tank into suitable containers.
4. Place a jack under the fuel tank.
5. Raise the jack to support the fuel tank.
6. Remove the lock nuts (14), flat washer (13), and capscrew (12) from the angle crossmember (29). (See Figure 4—Fuel Tank Straps and Angle Crossmember.)
7. Move to the front of the fuel tank to remove nylon cable tie (33) from the vent lines (34). (See Figure 5—Fuel Tank Sensor Location.)

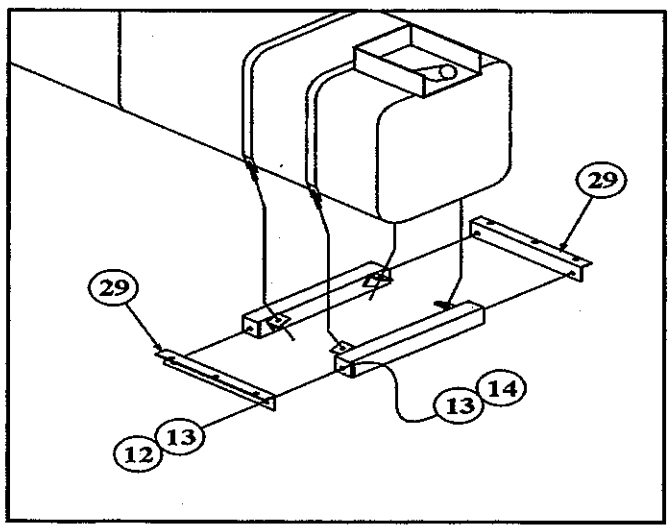

Figure 4—Fuel Tank Straps and Angle Crossmember

8. Remove hose clamps (35) from the fuel tank vents. (See Figure 5—Fuel Tank Sensor Location.)
9. Lower fuel tank enough to see fittings at panel (18).
10. Disconnect fuel lines (5) and (8). (See Figure 5—Fuel Tank Sensor Location.)
11. Re-check all connections and removals.
12. Lower fuel tank and remove.

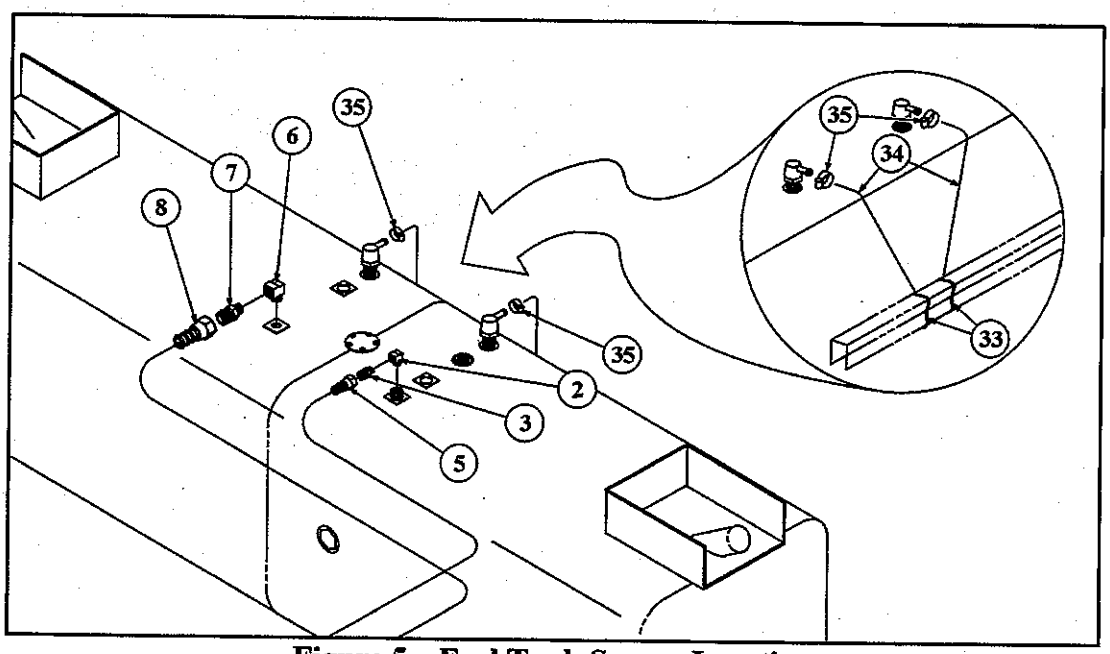

Figure 5—Fuel Tank Sensor Location

LTC Steering

Table of Contents

BLUE BIRD®

Appendix A

TAS Series Exploded View (Typical)

Appendix B

Service Parts List

LTC Steering

Safety
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Disclaimer
Blue Bird Corporation assumes sole responsibility for ensuring that information provided herein is accurate to the best of its knowledge at the time of printing. Blue Bird has a policy of continual product improvement. Blue Bird reserves the right to change product information without notice and without incurring obligation.

Description of Service Manual
This service manual is for the TRW Automotive Steering and Suspension System TAS Steering Gear found on the Blue Bird LTC. These procedures apply to a Blue Bird LTC with a Cummins M11 engine and an Allison B500 World transmission.

General Design

Integral Power Steering
TAS power steering gears are the latest design in the TRW Commercial Steering Division family of integral hydraulic power steering gears. Integral hydraulic power steering means that the gear contains a manual steering mechanism, a hydraulic control valve, and a hydraulic power cylinder, all in a single, compact package.

Rotary Control Valve
The rotary control valve combines simplicity of construction with desirable performance characteristics. The speed at which the driver can turn the steering wheel with power assist is dependent upon the pump flow (measured in gallons per minute or liters per minute) directed to a cylinder cavity. The control valve controls flow through the steering gear.

The pressure (measured in pounds per square inch, or bar) required for the gear to steer the vehicle is created by the power steering pump to overcome resistance at the steered wheels. The control valve senses these requirements and directs fluid to the appropriate cylinder cavity in the steering gear (and in the auxiliary cylinder if it is a dual steering system) at the proper flow rate and pressure.

Pressure Means Work, Flow Means Speed
The higher pressure a steering gear can withstand, the more work it can perform. The maximum operating pressure for all TAS gears is 2,175 psi (150 bar), maximum flow rate for all TAS gears is 8 gal/min (30.3L/min).

LTC Steering

The TAS series gears can steer a vehicle within its front-end weight rating through a turn at low speed and engine idle. As the driver turns the steering wheel faster or slower, more or less fluid will be required by the gear. TAS series vehicle front-end ratings are as follows:

Gear	Front Axle Rating
TAS85	18000 lb. (8200 kg)

The recommended minimum flow at 1 1/2 steering wheel turns per second is as follows:

Gear	Minimum Flow Rate
TAS85	3.6 gal/min (13.6 L/min)

If the steering gear valve is controlling an auxiliary cylinder, increased minimum flow is required (generally at least 75%) based on the size of the auxiliary cylinder and the vehicle's steering geometry.

General Operation

What Happens During a Steering Maneuver

When the driver turns the steering wheel, he transmits force from the steering wheel to the steering gear input shaft. A torsion bar, pinned at its one end to the input shaft and at its other end to the worm shaft, turns with the input shaft and exerts a rotational force on the worm shaft. In response to this rotational force, the worm shaft, acting through the recirculating ball mechanism, tries to move the rack piston axially through the gear housing cylinder bore.

The rack piston's axial movement is resisted by its engagement to the sector shaft, which is connected by linkage to the steered wheels. Because of this resistance, the torsion bar is twisted by the input shaft, thereby actuating the control valve.

Pressurized fluid, directed by the control valve, assists in moving the rack piston axially through the cylinder bore. The rack piston then turns the sector shaft to steer the vehicle.

Shock Loads to the Gear

If the steered wheels receive a shock load, the shock forces are transmitted through the sector shaft to the rack piston, and on to the worm shaft. The internal geometry of the steering gear causes the control valve to send high-pressure fluid to the correct cylinder cavity to resist the shock forces. By absorbing the shock forces hydraulically, the steering gear prevents objectionable kickback at the steering wheel.

Unload (Poppet) Valves

Most TAS gears are equipped with two unloading valves, one at each end of the rack piston. One valve or the other, depending on the direction of turn, will trip as the steered wheels approach the axle stops (which must be set according to manufacturer's specification). The tripped valve reduces pressure in the gear and helps to reduce heat generated by the pump. At the same time, the valves also reduce forces on the steering linkage. These valves are automatically set to axle stops after installation in vehicle at first full right and left turn.

Relief Valve

Some TAS gears (with or without poppets) are supplied with a relief valve. The relief valve limits maximum supply pressure to protect the power steering gear, but it does not reduce pressure as the steered wheels approach the axle stops.

Bleed Systems

Some TAS gears which are mounted with the output shaft above the rack piston bore are equipped with either an automatic bleed system or a manual bleed screw.

The procedure for air bleeding the system is addressed later in this manual. Replacement of damaged automatic bleed plugs and manual bleed screws is described in the back portion of this manual.

Approved Hydraulic Fluids

Automatic Transmission Fluid Dexron II
Automatic Transmission Fluid Type "E" or "F"
Chevron 10W-40
Chevron Custom 10W-40 Motor Oil
Chevron Torque 5 Fluid
Exxon Nuto H32 Hydraulic Fluid
Fleetrite PSF (Can #990625C2)
Ford Spec. M2C138CJ
Mack EO-K2 Engine Oil
Mobil ATF 210
Mobil Super 10W-40 Motor Oil
Shell Rotella T30W
Shell Rotella T SAE 30
Texaco 10W-40
Texaco TL-1833 Power Steering Fluid
Union 10W-40
Union 15W-40
Unocal Guardol 15W-40 Motor Oil

The steering system should be kept filled with one of the above fluids.

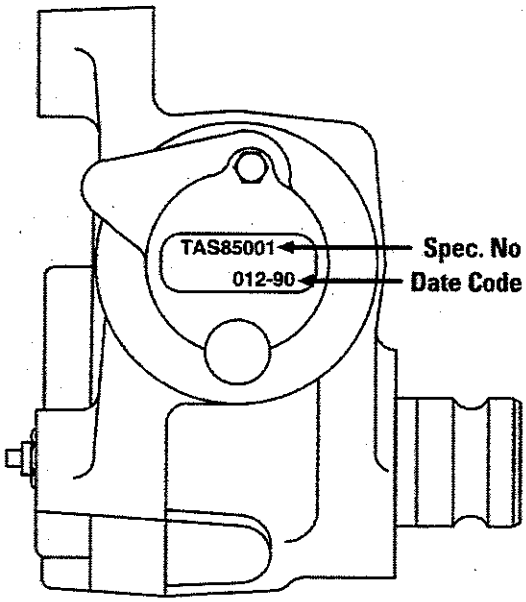
Warning

Completely flush the steering system with one of the recommended fluids above only.

Do not mix oil types. Any mixture or any unapproved oil could lead to seal deterioration and leaks. A leak could ultimately cause the loss of fluid, which could result in a loss of power steering assist.

Specification Numbers

The steering gear specification number and date code are stamped on a machined surface opposite the input shaft of every TAS gear. An example date code would be 012-90; this means the gear was built on the 12th day of 1990.



Item numbers referenced below are shown on the exploded view.

After tightening to this torque value, the adjuster must be backed off 1/4 to 1/2 of a turn as described in Step 22 of "Valve Housing/Worm Screw Disassembly.

Torque value indicated is using recommended tools.

Note

Special tools can be purchased through:

Kent Moore
Heavy Duty Division
SPX Corporation
29784 Little Mack
Roseville, MI 48066-2298
1-800-328-6657

Part Name	Item #	Torque Range Dry	Torque Range Lubricated
Auxiliary cylinder plug	54	25-35 lbf-ft (34-48 N-m)	
Ball return guide cap bolts	31	14-22 lbf-ft (19-29 N-m)	
Ball return guide clip bolts	33	14-22 lbf-ft (19-29 N-m)	
Bearing Adjuster	17		11-15 lbf-ft (15-20 N-m)*
Locknut	18		101-122 lbf-ft (137-165 N-m)**
Manual bleed screw	50	27-33 lbf-in (3.1-3.7 N-m)	
Plug, auto bleed	51	38-58 lbf-ft (52-79 N-m)	
Poppet sleeve assembly	22	16-20 lbf-ft (22-27 N-m)	
Poppet sealing nut, service	60	33-37 lbf-ft (45-50 N-m)	
Poppet fixed stop screw	52	38-42 lbf-ft (52-57 N-m)	
Poppet fixed stop screw	52A	38-58 lbf-ft (52-79 N-m)	
Relief Valve Cap	56	25-35 lbf-ft (34-48 N-m)	
Sector Shaft adjusting screw jam nut	47	40-45 lbf-ft (54-61 N-m)	
Side cover bolts (TAS40)	48		108-128 lbf-ft (147-174 N-m)
Side cover bolts (TAS55, 65, 85)	48		160-180 lbf-ft (147-174 N-m)
Valve housing bolts (TAS40, 55, 65)	1		75-85 lbf-ft (102-115 N-m)
Valve housing bolts	1		108-128 lbf-ft (147-174 N-m)

Torque Chart

Initial TAS Installation

1. Bolt gear to frame, torque to vehicle manufacturer's recommendation.
2. Connect return line to TAS return port.
3. Connect hydraulic line from pump to pressure port in TAS unit.
4. Connect steering column to input shaft, torque pinch bolt to vehicle manufacturer's recommendation.
5. Install pitman arm on output shaft, torque bolt to vehicle manufacturer's recommendation.

Initial Poppet Setting

For this procedure to work correctly, you must have a new gear received from TRW or your vehicle manufacturer's aftermarket system, or a used gear on which poppet seats have been replaced or reset during gear disassembly procedures. Also: Fixed stop screw installed in housing, or poppet adjusting screw installed so that it duplicates fixed stop screw length.

Caution

The axle stops and all steering linkage must be set according to vehicle manufacturer's specifications, and the pitman arm must be correctly aligned on the sector shaft for poppets to be set correctly.

1. With the engine at idle and the vehicle unloaded, turn steering wheel to full travel in one direction until axle stop contact is made. Maximum input torque to be applied during this procedure is 40 lb rim pull (178 N) on a 20 in. (508mm) diameter steering wheel.

Note

If you encounter excess rim pull effort, allow vehicle to roll forward or jack up the vehicle at the front axle.

2. Follow the same procedure while turning the steering wheel in the other direction. The poppets are now positioned to trip and reduce pressure as the steered wheels approach the axle stops in either direction.

Maintenance Tips

Never high-pressure wash or steam clean a power steering gear while on or off the vehicle. Doing so could force contaminants inside the gear and cause it to malfunction.

Make sure vehicle wheel cut or clearances meet manufacturer's specifications, and make sure pitman arm timing marks are aligned properly to **prevent internal bottoming** of the steering gear.

Regularly check the fluid and the fluid level in the power steering reservoir.

Keep tires inflated to correct pressure.

Never use a torch to remove pitman arm.

Investigate and immediately **correct the cause of any play, rattle, or shimmy** in any part of the steering system.

Make sure the steering column is aligned properly.

Encourage drivers to report any malfunctions or accidents that could have damaged steering components.

Do not attempt to weld any broken steering components. Replace the component with original equipment only.

Do not cold straighten, hot straighten, or bend any steering component.

Always **clean off around the reservoir filler cap** before you remove it. Prevent dirt or other foreign matter from entering the hydraulic system.

Investigate and correct any external leaks, no matter how minor.

Replace reservoir filters according to requirements.

If you feel the vehicle is developing excessively **high hydraulic fluid temperatures,** consult with your vehicle manufacturer for recommendations.

Maintain grease pack behind the output shaft dirt and water seal as a general maintenance procedure at least twice a year, in Spring and Fall. Grease fitting is provided in housing trunnion. Use only NLGI grade 2 or 3 multipurpose chassis lube, and use only a hand operated grease gun on fitting. Add grease until it begins to extrude past the sector shaft dirt and water seal.

Filling and Air Bleeding the System

Tools Required	Materials Required
5/16 inch Socket	Hydraulic Fluid
Lbf•in. Torque wrench	

Caution

Make sure poppets are set correctly before beginning this procedure.

1. Fill the reservoir nearly full. Do not steer. Start and run the engine for 10 seconds, then shut it off. Check and refill the reservoir. Repeat at least three times, checking the reservoir each time.

Caution

Do not allow the fluid level to drop significantly or run out of the reservoir. This may induce air into the system.

2. Start the engine and let it idle for 2 minutes. Do not steer. Shut off the engine and check the fluid level in the reservoir. Refill as required.
3. Start the engine again. Steer the vehicle from full left to full right several times. Add fluid, as necessary, to the full line on the dip stick. Automatic bleed systems should now be free from trapped air. Manual bleed systems continue with step 4. (Do not remove Auto Bleed Plug.)
4. With engine idling, steer from full left turn to full right turn several times. Stop steering and loosen the manual bleed screw about one turn. Allow air and aerated fluid to "bleed out" until only clear fluid is seen. Close the bleed screw, refill the reservoir if required. Repeat this step three to four times until all the air is discharged. Torque manual bleed screw to 30 lbf•in.

Caution

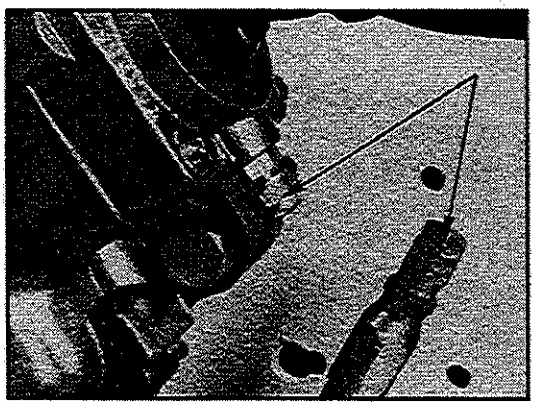
Do not turn steering wheel with bleed screw loosened.

Input Shaft Seal Replacement

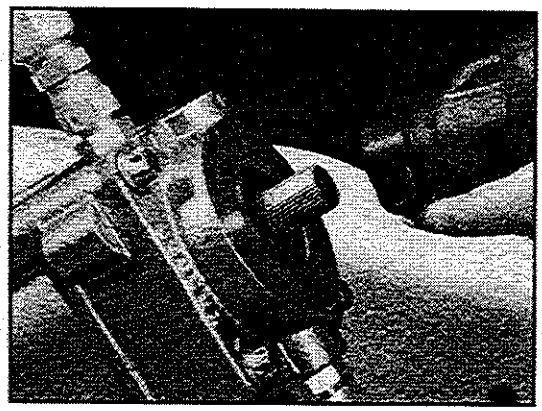
Tools Required	Materials Required
Hammer	Clean Cloth
J37073	Drip Pan
Screwdriver	High pressure fitting
	Hydraulic fluid
	Plug
	Shop towel

This procedure uses the vehicle's power steering pump to force out the input shaft seal. To use this procedure, the power steering pump should have a minimum of 1,500 psi available.

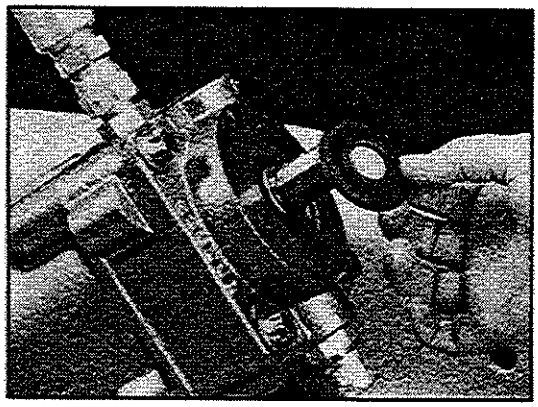
1. Disconnect return line from the steering gear and plug the line. Also, cap the return port of the gear with a high pressure fitting.



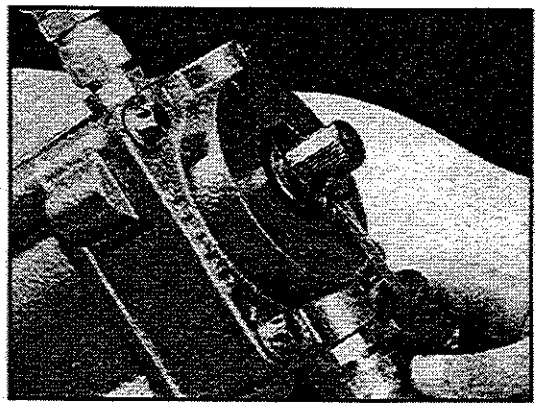
2. Remove the steering column from the gear input shaft.



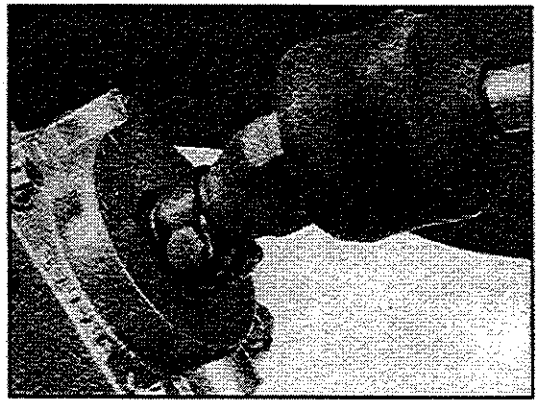
3. Remove the dirt and water seal from the steering gear.



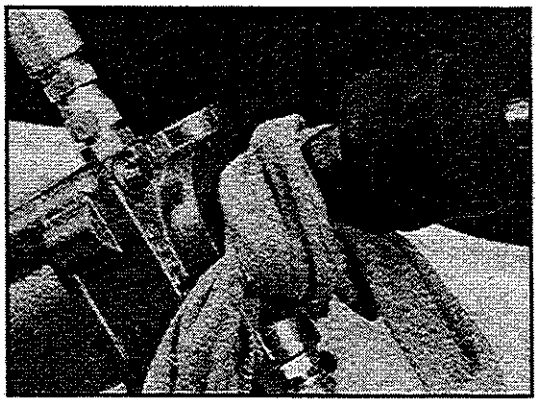
4. Wipe out the grease and then remove the spiral retaining ring. Use a screwdriver inserted into the notch formed in the end of the ring. Be careful not to scratch the bore with the screwdriver.



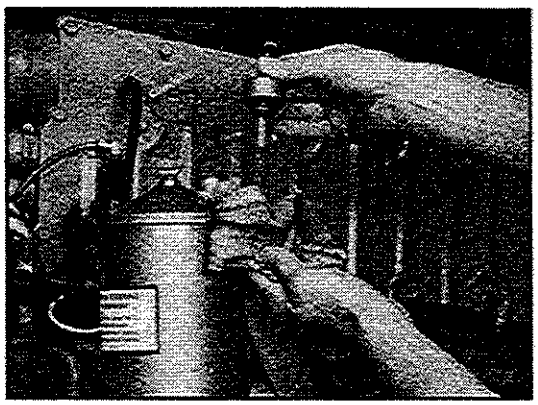
5. Slip the steering column back onto the input shaft with the pinch bolt installed, but not tightened.



6. Tie or wrap a shop towel around the input shaft area and place a drip pan under the vehicle to catch the oil.

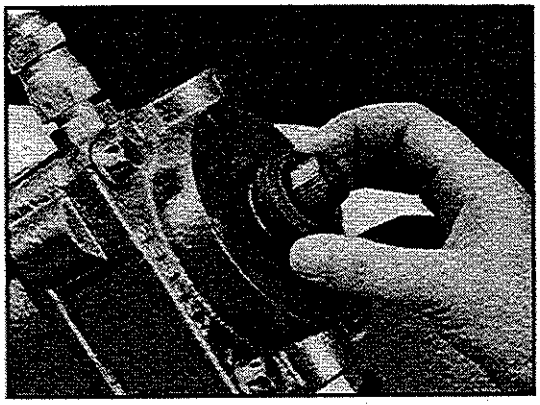


7. Add fluid as necessary, to the full line on the dipstick. Do not mix fluid types.

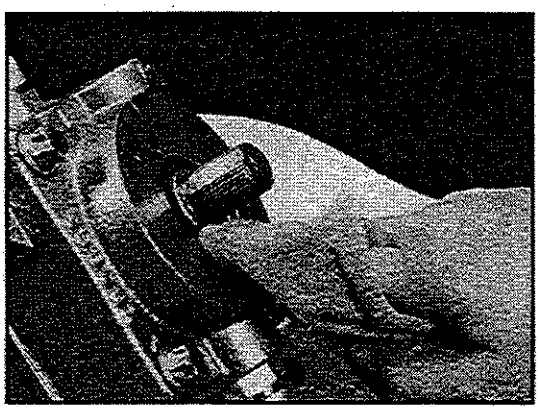


8. With the vehicle in neutral, momentarily turn the starter (quickly turn off the engine if it starts).

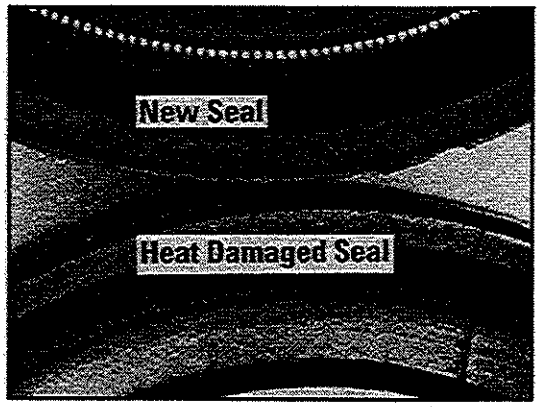
9. Remove the shop towel. Disconnect the steering column, and remove the input shaft seal.



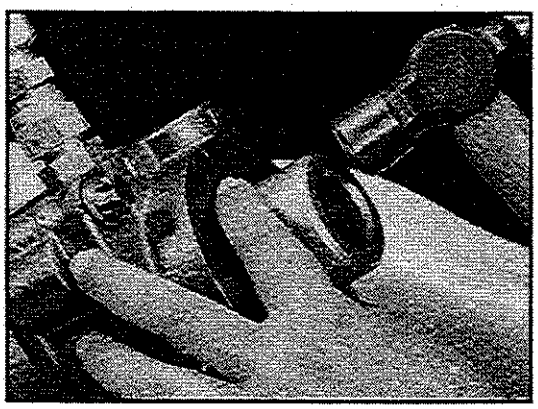
10. Check the seal area of the valve housing for any seal fragments. Remove any that are found.



11. Check the seal for heat damage. If the seal is stiff and brittle, and not pliable like the new seal, it is probably heat damaged. Determine and fix the cause of the excessive heat in the vehicle.



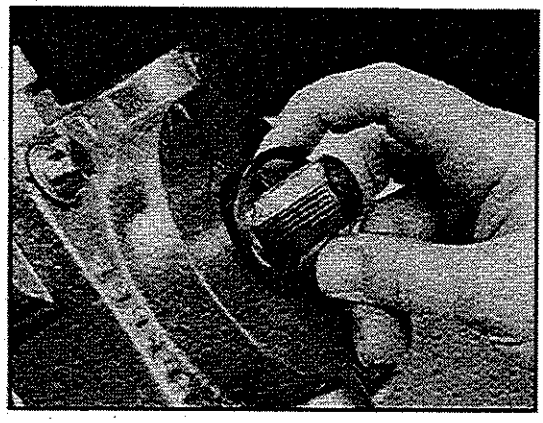
12. Put clean grease (Mobil Temp™ 1 or 2 or equivalent) on the inside dia of the new input shaft seal, and place it over the input shaft. With the small dia of tool J37073 against the seal, tap the tool until the tool shoulder is square against the valve housing. Remove any seal material that may have sheared off in the seal bore or retaining ring groove.



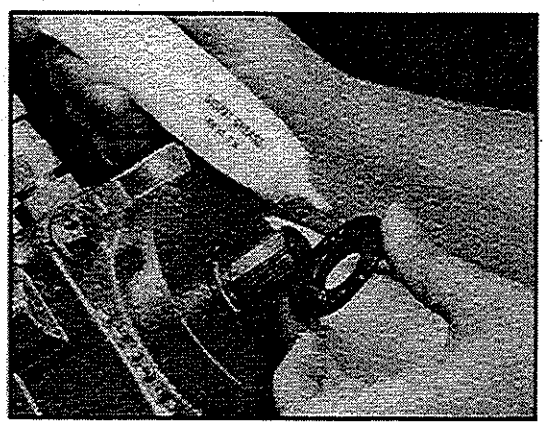
Caution

Do not use a socket to install this seal because you will not be able to control seal installation depth, possibly causing a leak.

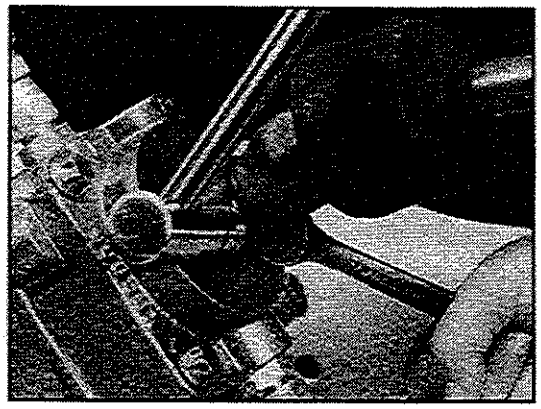
13. Insert new retaining ring into the groove.



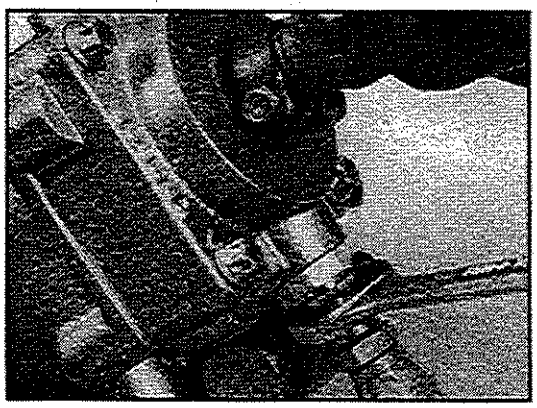
14. Pack the end of the valve housing bore around the input shaft with clean, high temperature industrial grease (Mobil Temp™ 1 or 2 or equivalent). Apply more of the grease to a new dirt and water seal and install it over the input shaft. Seat it in the groove behind the serrations and against the valve housing.



15. Reconnect the steering column to the input shaft and tighten the pinch bolt to torque level specified.



16. Reconnect the return line to the steering gear return port.



17. Air bleed the system using the procedure under the section entitled "Filling and Air Bleeding the System".

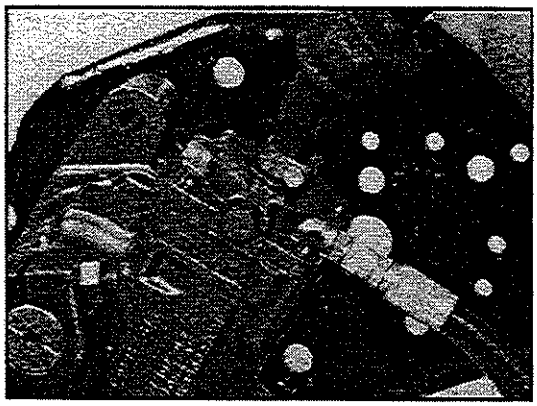
Sector Shaft Adjustment

Tools Required	Materials Required
Screwdriver	
3/4 inch Socket	
3/4 inch Open-end wrench	

This adjustment can only be completed on the vehicle if the adjusting screw jam nut is accessible. This nut is located on the side cover.

Photos in this section were taken on a mock frame rail for clarity.

1. With the engine off, rotate the steering wheel (input shaft) until the timing mark on the sector shaft lines up with the mark on the housing. The line on the sector shaft should be at a 90° angle from the input shaft. The sector shaft is now on its "center of travel".

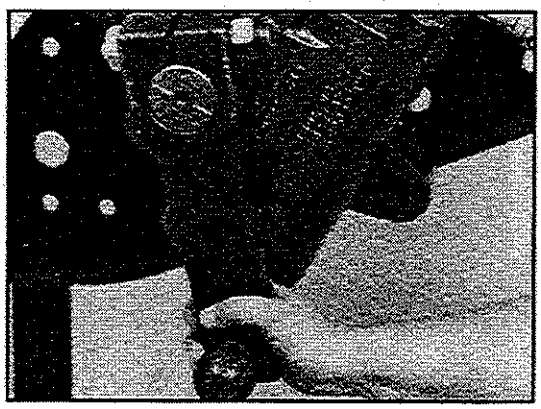


2. Remove the drag link from the pitman arm.

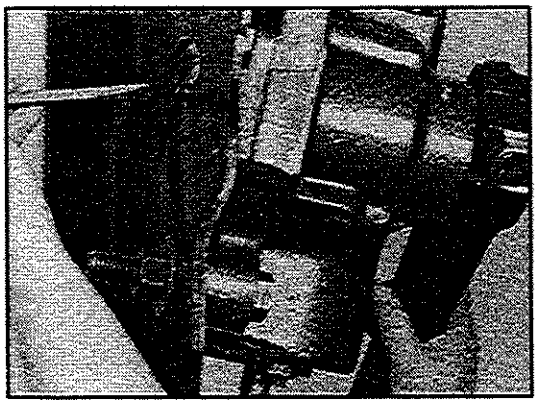
Caution

To avoid resetting the poppets, do not rotate the input shaft more than 1 1/2 turns from the "center of travel" position while the drag link is disconnected.

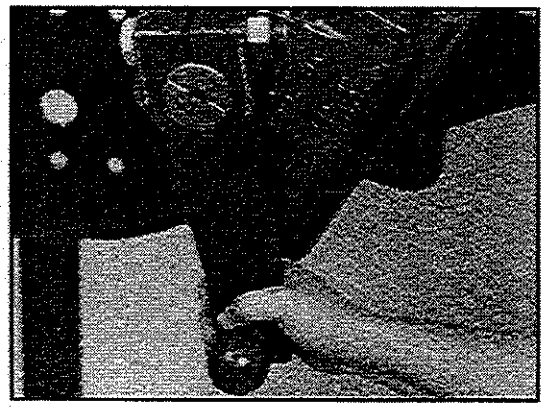
3. From the "center of travel" position, grasp the pitman arm and gently try to rotate it. If looseness or lash is felt at this point, the sector shaft is out of adjustment.



4. Loosen the jam nut.
5. If no lash was detected in step 3, turn the shaft adjusting screw counterclockwise until you feel lash at the output shaft.
6. Slowly turn the shaft adjusting screw clockwise until you feel no lash at the output shaft without using more than 10 lbf•ft (14 N•m) of torque. From this position, turn the screw clockwise 1/8 to 3/16 of a turn more. Hold the adjusting screw in place, and tighten the jam nut. Final torque 43 lbf•ft (58 N•m). (Use 3/4 inch wrench.)



7. Turn the steering wheel 1/4 turn each side of center, then back to center and recheck the pitman arm for lash. You should feel no lash. If there is lash, repeat steps 4, 6, and 7.



8. Reconnect the drag link to the pitman arm according to manufacturer's specifications.

Caution

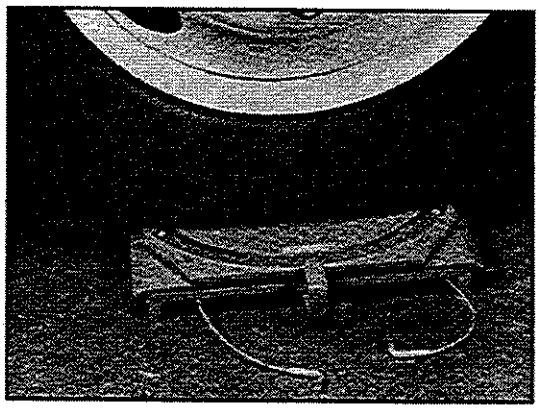
Maintain grease in the sector shaft bearing through the grease fitting in the housing using only a hand operated grease gun. Add grease until it begins to extrude past the dirt and water seal. Do not use a power grease gun because it will supply grease to fast; this could adversely affect the high pressure seal and contaminate the hydraulic fluid.

Poppet Readjustment

Tools Required	Material Required
7/32 inch Allen wrench	Hydraulic fluid
5/8 inch Open end wrench	Jack
3/4 inch Open end wrench	
3/4 inch Socket	
Lbf•lb Torque wrench	

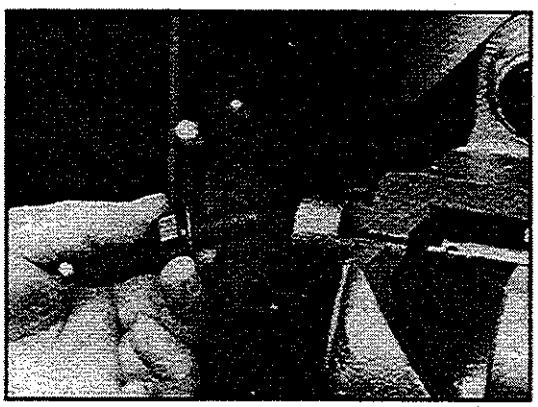
This resetting procedure will work in most cases with at least 1 3/4 hand-wheel-turns from each side of center. If you're making a large reduction in wheelcut and this procedure does not work, you may have to replace or internally reset the poppets using the procedure described in the Poppet Component section of this service manual.

1. Set the axle stops to vehicle manufacturer's wheelcut or clearance specifications. Start the engine and allow the vehicle to idle for 5 - 10 minutes to warm the hydraulic fluid. Shut off the engine.

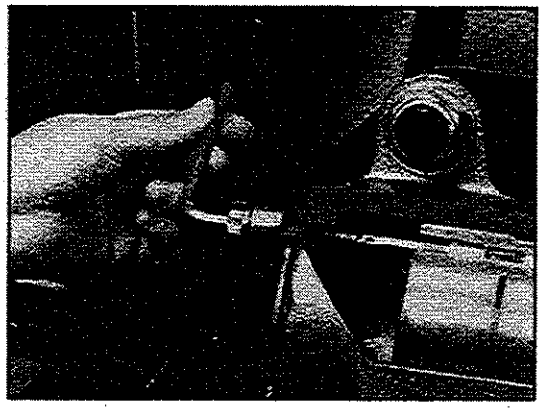


2. If a new poppet adjusting screw and nut are being used, turn the screw into the non-sealing end of the jam nut until the drive end of screw is flush with the nut. Your steering gear will have either a fixed stop bolt or an adjusting screw. If the adjusting screw is already part of the steering gear, back the nut off of the adjusting screw until it is flush with the end of the adjusting screw.

3. Make sure the engine is off and the road wheels are in straight ahead position. Remove and discard the poppet fixed stop bolt (if equipped) and washer (if equipped) from the lower end of the housing. If the unit has a poppet adjusting screw and sealing nut that need to be replaced, remove and discard them. (Use 5/8 inch Open end wrench.)



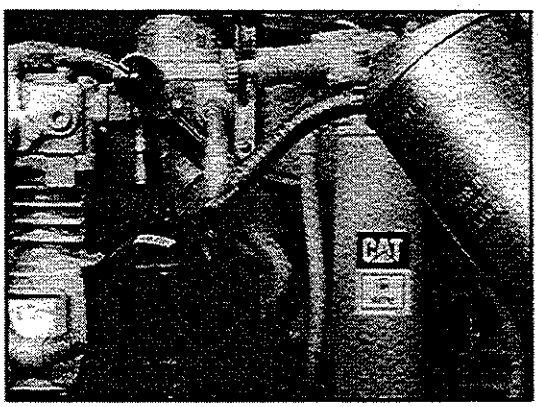
4. Turn the adjusting screw and sealing nut assembly, without rotating the nut on the screw, into the housing until the nut is firmly against the housing using a 7/32 inch Allen wrench. Tighten the sealing nut against the housing.



Caution

If the drive end of the screw is below the face of the nut, the poppet seat flange will break during step 7d.

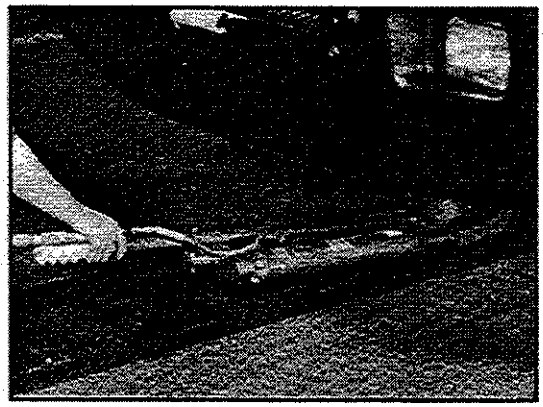
5. Refill the system reservoir with approved hydraulic fluid.



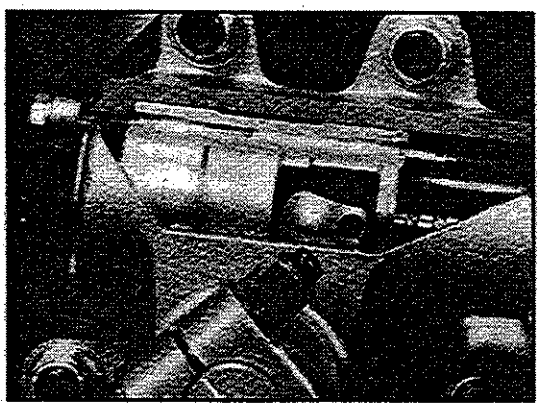
Caution

Do not mix fluid types. Mixing of transmission fluid, motor oil, or other hydraulic fluids will cause seals to deteriorate faster.

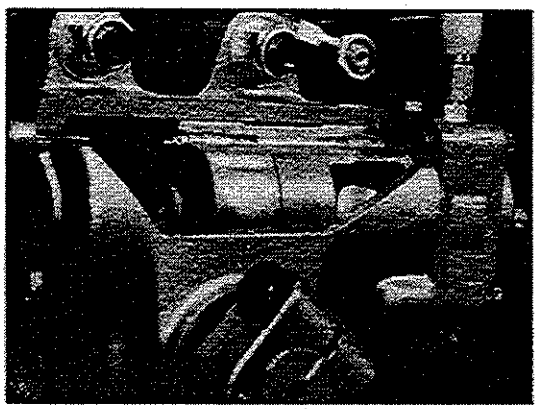
6. Place a jack under the center of the front axle and jack up the front end of the vehicle so the steer axle tires are off the ground.



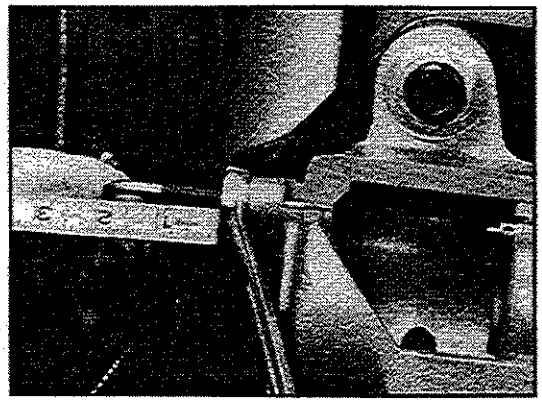
7. Start the engine and let it run at idle speed. Note which output shaft timing mark is nearest the housing piston bore. Turn the steering wheel in the direction that makes this timing mark move toward the adjusting screw just installed. Turn in this direction until axle stop contact is made. Pull hard on the steering wheel (put up to 40 lb rim pull on a 20 inch dia steering wheel) after the axle stop is contacted.



8. Turn the steering wheel in the opposite direction (end of timing mark away from adjusting screw) until the other axle stop is contacted. Pull hard on the steering wheel (put up to 40 lb rim pull on a 20 inch dia steering wheel). Release the steering wheel and shut off the engine.



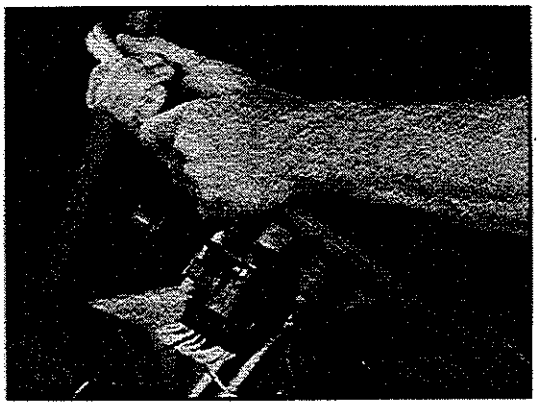
9. Loosen the sealing nut and back out the adjusting screw until 1 inch is past the nut. Tighten the sealing nut against the housing.



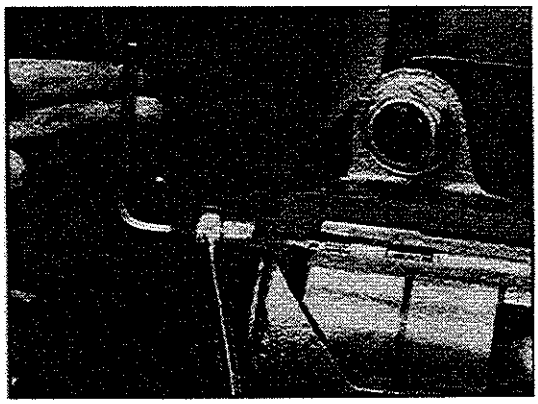
Caution

Do not hold the steering wheel at full turn for more than 10 seconds at a time; the heat build-up at pump relief pressure may damage components.

10. Start the engine and let it die. Turn the steering wheel in the original direction (end of timing mark toward adjusting screw), until axle stop contact is made. Hold the steering wheel in this position (with up to 40 lb rim pull) for 10 seconds, then release. Repeat this hold and release process as many times as necessary while completing step 11.



11. With steering wheel held tightly at full turn loosen the jam nut and hold it in place with a wrench. Turn the adjusting screw in (clockwise) using finger-pressure only (don't use a ratchet), until the Allen wrench stops. Do not attempt to turn it in further. Pause the turning-in process each time the driver releases the steering wheel; continue turning only while the wheel is held at full turn. Back off the adjusting screw 3 1/4 turns and tighten the sealing nut. Torque sealing nut to 35 lbf•ft.



12. The poppets have now been completely reset. Lower the vehicle. Check the reservoir and fill if required.

Warning

The length of the adjusting screw beyond the nut must be no more than 1 1/16 inch for proper thread engagement.

Note

The length of adjusting screw beyond the sealing nut may be different for each vehicle.

Dual System

TAS Gear with Linear Cylinder

Reset the TAS gear using the procedures described above.

TAS Gear with Rotary Cylinder

Back out the poppet adjusting screws (leave any fixed stop bolts in place) on the assist cylinder as follows:

RCS Rotary - 1 inch to 1 1/6 inch of poppet adjusting screw protruding beyond the nut.

RCB Rotary - Back both screws out completely, then screw back in 10 - 12 turns.

Set the main TAS gear using the procedures described above. Leave adjusting screws on rotary cylinders in place as described above after poppets on main gear have been reset.

Reseal and Repair

Disassembly Preparation

Stop the vehicle with wheels pointed straight ahead.

Clean off all outside dirt from around fittings and hose connections before you remove the gear.

Remove the input and output shaft connections per vehicle manufacturer's instructions.

Warning

When using a chisel to spread a pinch bolt-type pitman arm boss for assembly or removal from the shaft, maintain a firm grip on the chisel at all times. Failure to do this may result in the chisel flying loose which could cause an injury. Never leave the chisel wedged in the pitman arm boss. If you cannot remove the pitman arm from the shaft with a chisel and your hands, remove the chisel from the arm boss and use a puller only to remove pitman arm.

Caution

Do not use a hammer on the pitman arm to remove it from sector shaft as internal damage to steering gear could result. Be sure there is no spreading wedge left in the pitman arm boss before tightening pitman arm clamp bolt after assembly on sector shaft. Do not pound the universal joint or input shaft coupling on or off the input shaft as internal damage to the steering gear can result.

Caution

Unless the poppet adjuster seat and sleeve assemblies (22) are to be removed and replaced or reset for automatic poppet adjustment, or a manual adjustment with a service poppet adjuster screw (59) and nut (60) is anticipated, do not allow the input shaft on a steering gear with the automatic poppet adjustment feature to rotate more than 1.5 input shaft revolutions from "straight ahead position" when the output shaft is disconnected from the vehicle steering linkage. This could disrupt the poppet setting achieved at initial installation. The steering gear is in the "straight ahead position" when the timing marks on the end of the housing trunnion and sector shaft are aligned.

Remove the supply and return lines from the gear, and immediately plug all port holes and fluid lines.

Warning

TAS steering gears can weigh up to 110 pounds dry. Exercise caution when you remove, lift, carry or fix in a bench vise.

Remove the steering gear from the vehicle and take it to a clean work surface.

Clean and dry the gear before you disassemble it.

As you disassemble the gear, clean all parts in clean, OSHA approved solvent, and air blow-dry them only.

Warning

Because they are flammable, be extremely careful when using any solvents. Even a small explosion or fire could cause injury or death.

Warning

Wear eye protection and be sure to comply with OSHA or other maximum air pressure requirements.

Caution

Never steam clean or high-pressure wash hydraulic steering components. Do not force or abuse closely fitted parts. Use care that bearing and sealing surfaces are not damaged by the assembly and disassembly procedures.

Keep each part separate to avoid nicks and burrs.

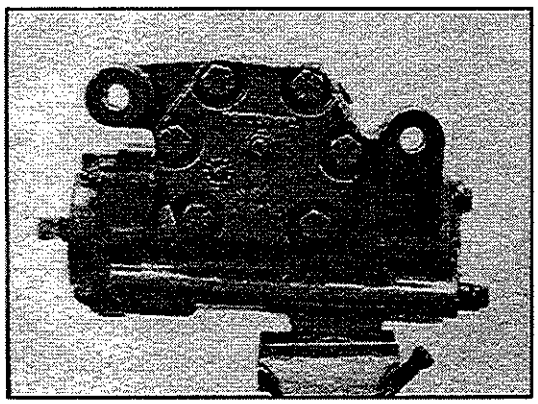
Discard all seals, o-rings, and gaskets removed from the gear. Replace them with new parts only.

The steering gear should be identified to the vehicle from which it was removed. The poppet adjuster seat and sleeve assemblies are set for that particular vehicle only.

Disassembly

Tools Required	Materials Required
Allen wrenches	Emery cloth
Pocket knife	Standard sockets
Ratchet	Torx socket
Rolling head pry bar	Vise
Rubber Mallet	

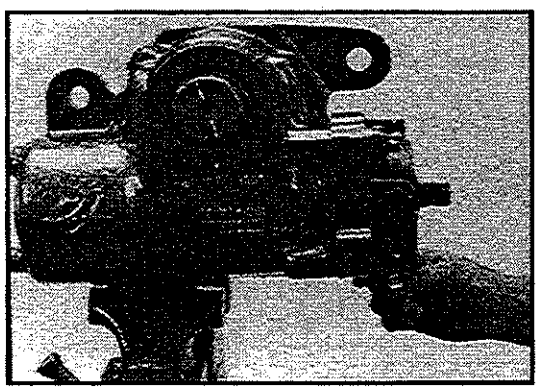
1. Put the steering gear in a vise, clamping firmly against the housing mounting flange or boss. Input shaft should be horizontal; size cover and valve housing are accessible for disassembly.



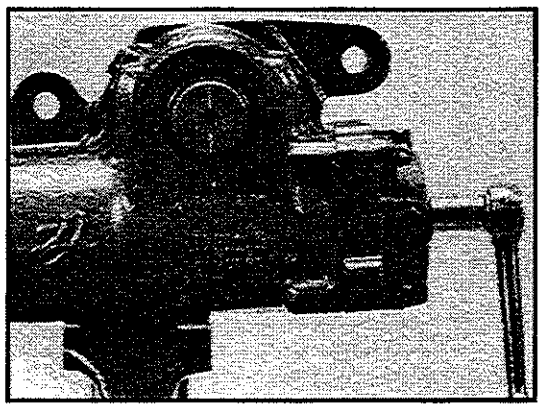
Caution

Do not clamp against body of housing. If mounting boss or flange is not accessible, fabricate and attach a mounting plate to the housing mounting bosses.

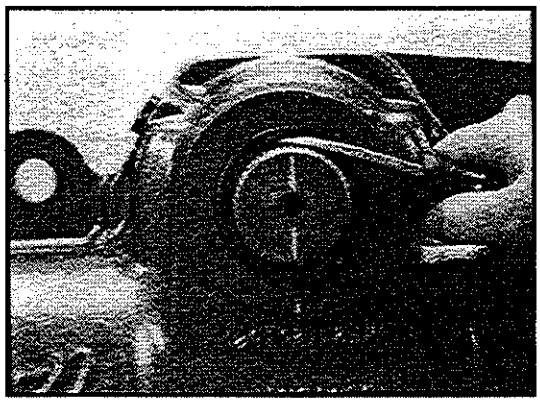
2. Prepare for fluid draining and unplug hydraulic ports.



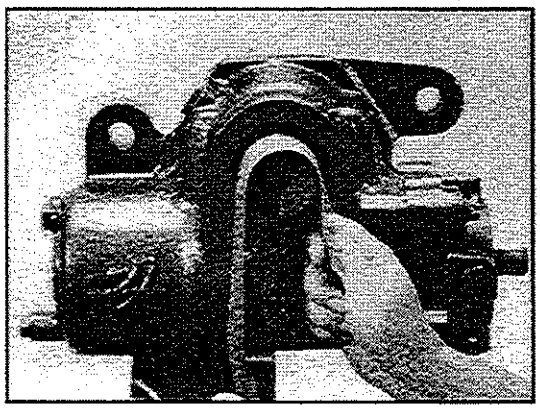
3. Rotate the input shaft until the timing mark on the end of the sector shaft is in line with the timing mark on the end of the housing. This will position the sector shaft for removal.



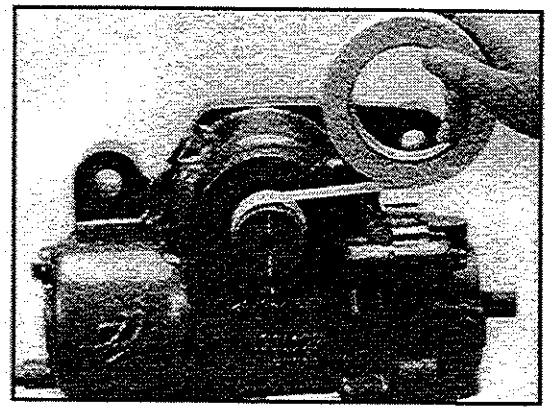
4. Remove and discard dirt and water seal from the housing trunnion.



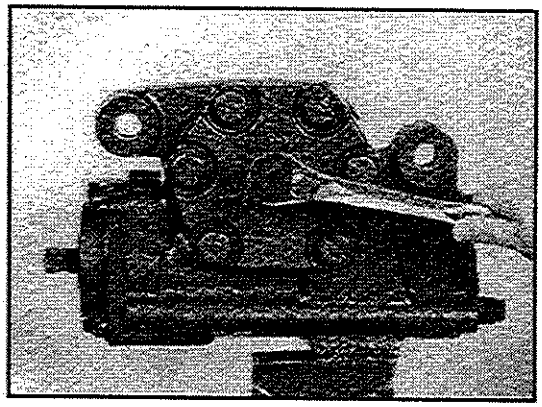
5. Remove any paint or corrosion from the exposed are of the sector shaft.



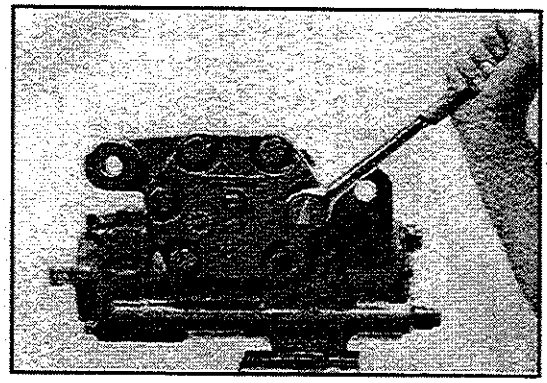
6. Tape the serrations and bolt groove of the sector shaft with one layer of masking tape. The tape should not extend onto the sector shaft bearing diameter.



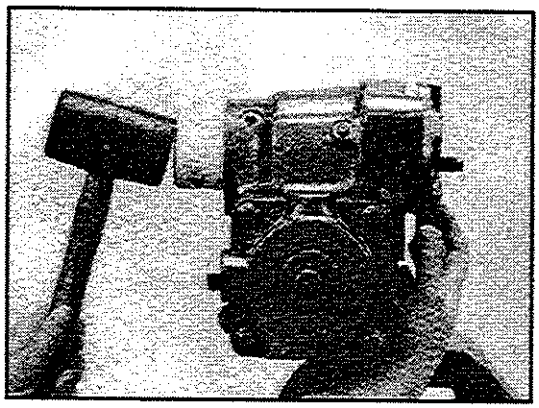
7. Remove the sector shaft adjusting screw jam nut. (Use the 3/4 inch socket)



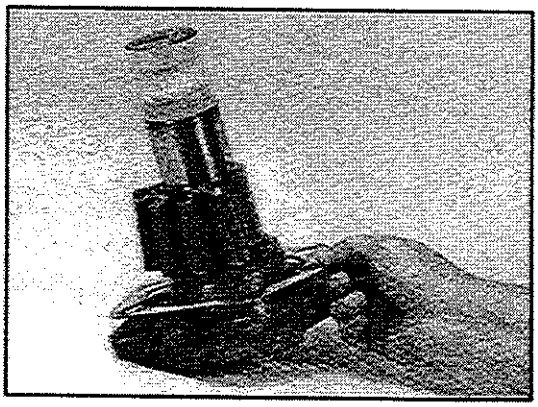
8. Be prepared for more fluid drainage and remove the six or eight special bolts from the side cover.



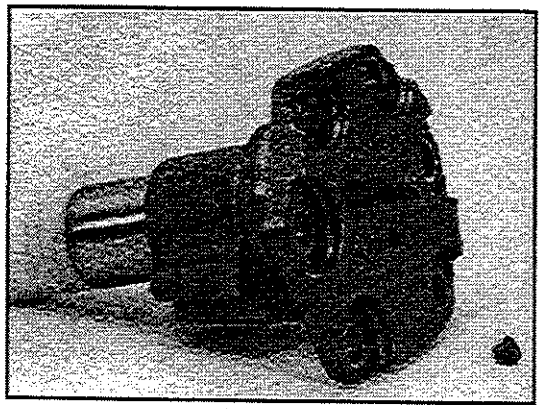
9. Be prepared for more fluid drainage and remove the side cover and sector shaft assembly from the gear. You may start the shaft and cover assembly removal by tapping the end of the shaft lightly with a soft mallet or wooden hammer handle.



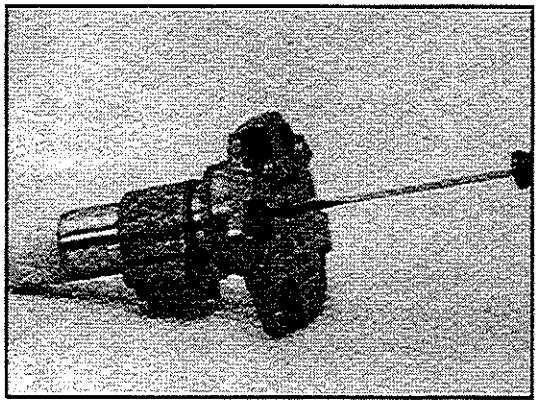
10. Remove and discard the side cover gasket.



11. Remove and discard the vent plug.



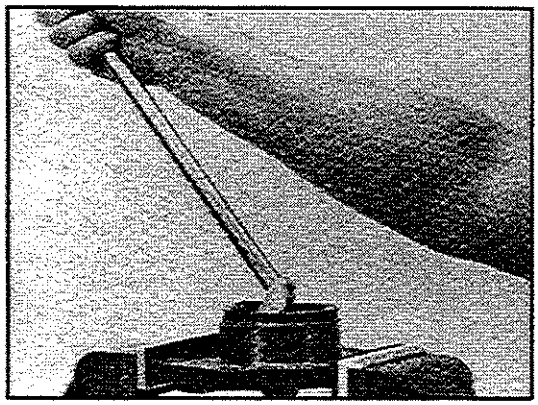
12. Screw sector shaft adjusting screw clockwise through the side cover and pull the sector shaft out of the side cover.



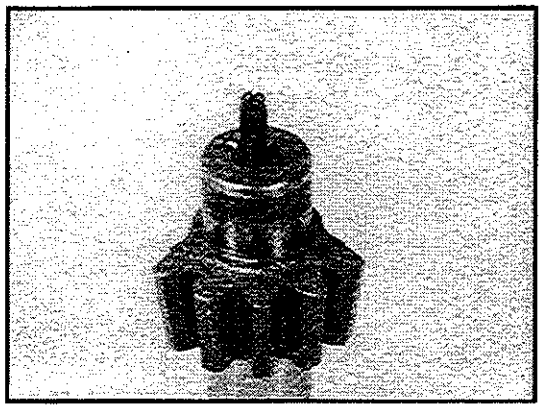
Caution

Don't damage the bore or DU bushing when removing the seal. TAS85 gears are not equipped with the DU bushing.

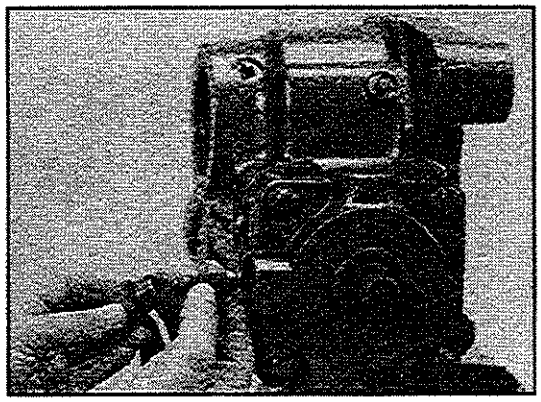
13. Clamp the side cover in a vise. Place a standard 5/8 inch or 11/16 inch - 3/8 inch drive socket in the center of the side cover. Pry the seal out with a rolling head pry bar, using the socket for support. Discard the seal and remove the socket.



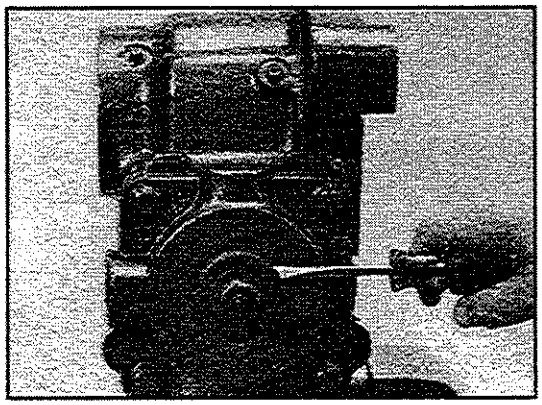
14. Inspect the sector shaft assembly for damaged adjusting screw threads. The retainer must be securely staked in place. The adjusting screw must rotate by hand with no perceptible end play (lash).



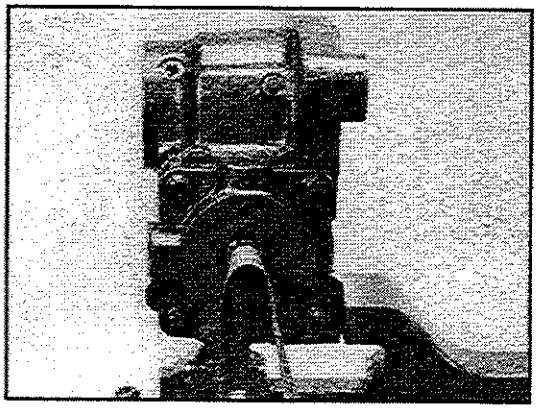
15. If equipped, remove relief valve cap, o-ring and two-piece relief valve from the valve housing. Discard the o-ring.



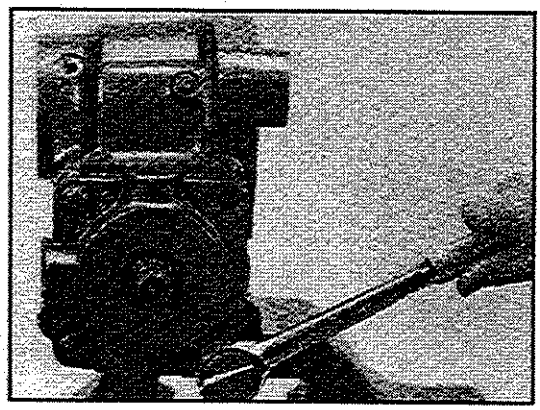
16. Remove and discard the dirt and washer seal from the input shaft.



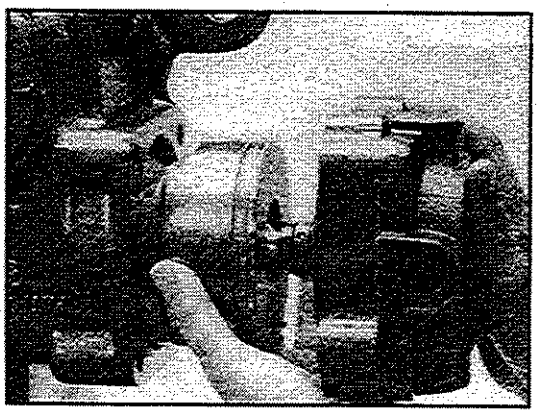
17. Clean any paint or corrosion from the exposed area of the input shaft.



18. Remove the four torx head valve housing bolts.



19. Be prepared for more fluid drainage and remove the rack piston subassembly. Place the assembly on a clean cloth. For the TAS85 it may help to rotate the input shaft to move the rack piston toward the lower end of the housing. This will force the valve housing to exit the main housing.

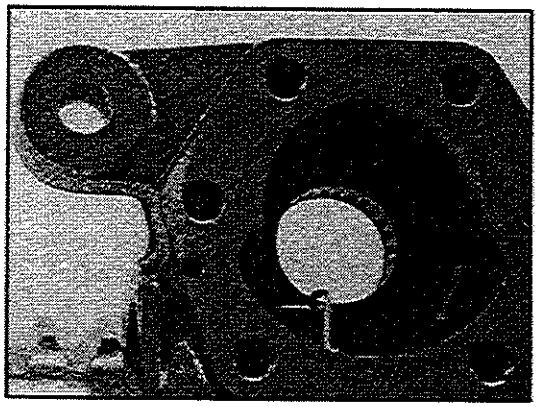


Caution

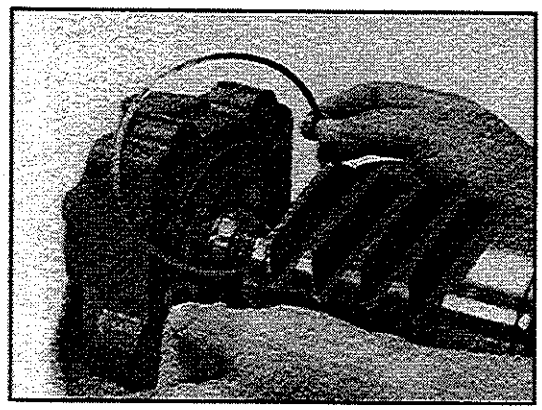
The set position of poppet seat and sleeve assemblies must not be disturbed if the poppets are not going to be replaced or reset during disassembly.

Note

If your gear is short "V" construction, the rack piston seal is on the end of the rack piston farthest from the input shaft. Remove the seal before removing the valve housing assembly to prevent the Teflon rack piston seal ring from "hanging up" when it exits the housing. Expose the seal through the sector shaft cavity, then cut and remove the seal ring from the rack piston.



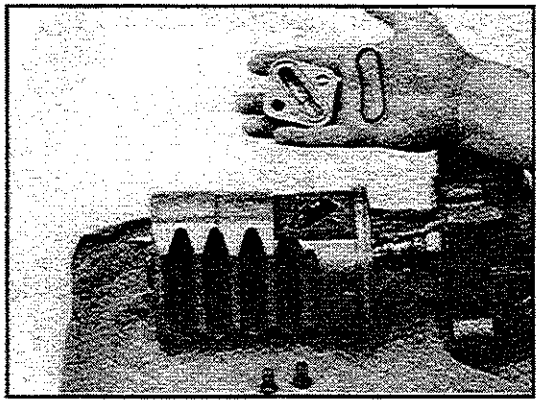
20. Remove and discard the valve housing seal rings.



Caution

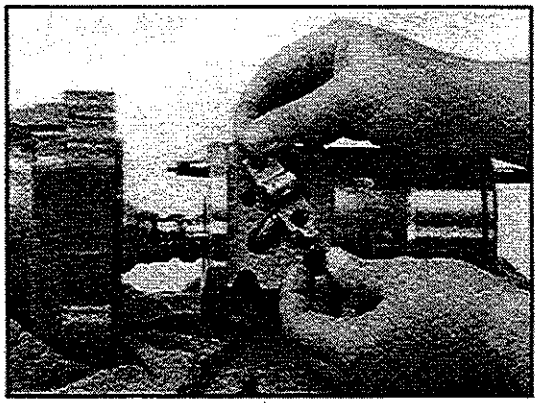
Do not remove the input shaft, valve worn assembly or balls from the rack piston until the ball return guides are removed as damage to the ball guides will occur.

21. Remove and discard the two special sealing screws. Remove the ball return cap and cap seal; discard the seal.

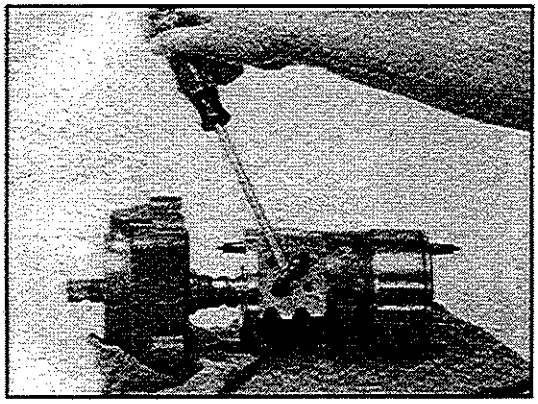


OR

Bend down the two tabs (tangs) that are against the hex head bolts. Remove two bolts and the clip; discard the clip.



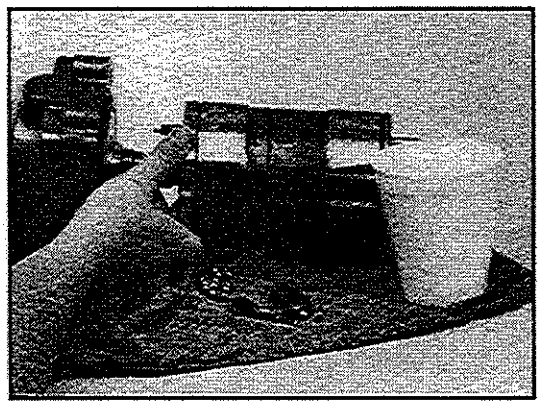
22. Make sure the rack piston is on a cloth so the steel balls that fall out won't roll very far. Remove ball return guide halves by carefully inserting a screwdriver between thee rack piston and guides.



Note

Left hand ball return guide halves are copper plated for identification and right hand guides are not plated.

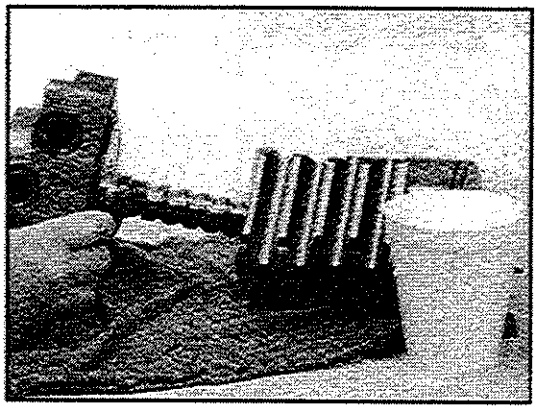
23. Remove the steel balls from the rack piston by rotating the input shaft, valve worm assembly until the balls fall out. Place the balls and return guides in a cup or other container. Count the balls, and make sure all have been removed.



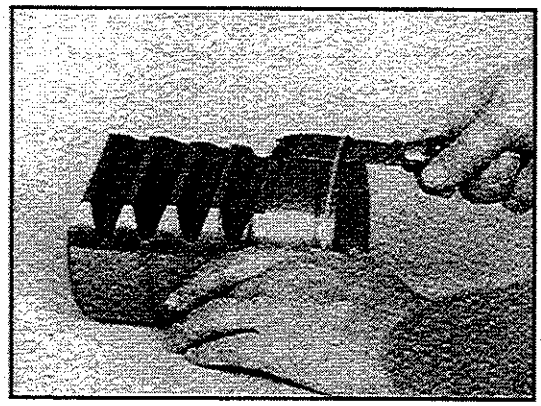
Note

The steel balls are a matched set. If any are lost, the set must be replaced by service balls. Number of factory balls installed: TAS85-34.

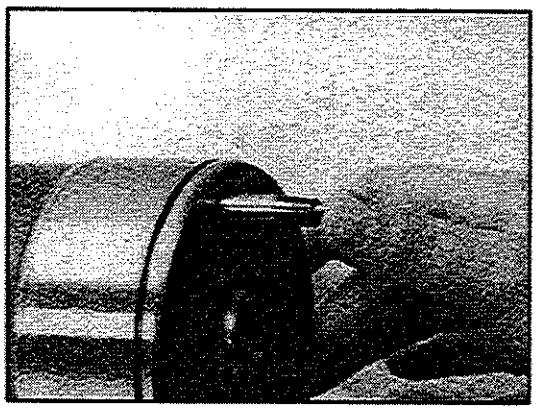
24. Remove the input shaft, valve/worm, valve housing subassembly from the rack piston.



25. Cut and remove the Teflon seal ring and o-ring from the rack piston if not removed during disassembly in the "Note" following step 19.



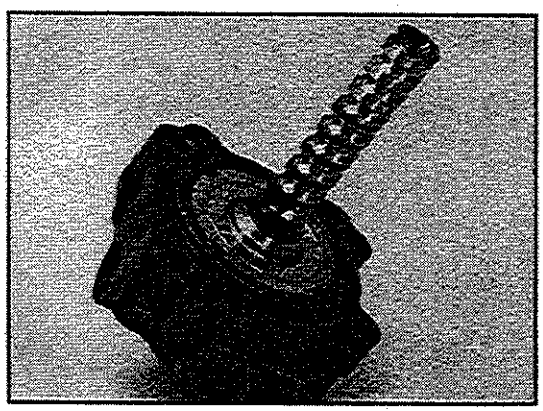
26. Push poppet stems, they should spring back. Push poppet seat, it should not move by hand. If components are bent or broken, poppet stems don't spring back, or poppet seat moves by hand, go to Poppet Component Replacement section. Otherwise, proceed to step 27.



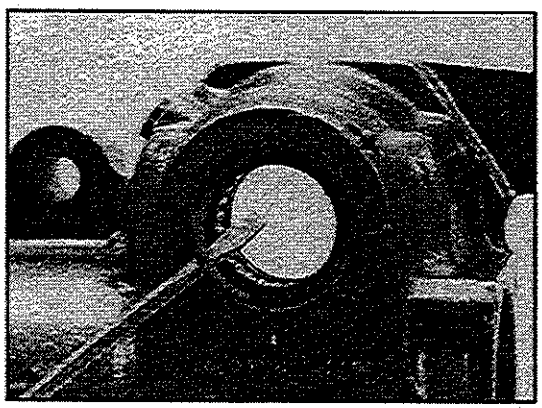
Note

TRW recommends the poppet adjuster seat and sleeve assemblies not be removed unless replacement of poppet components is required.

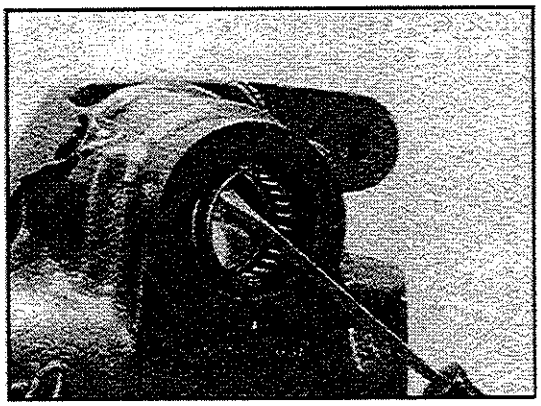
27. Inspect valve housing/worm screw subassembly for heat damage or bearing roughness. If these conditions are present, or if there was excessive internal leakage, or if preload adjustment is required, go to Valve housing/Worm Screw Disassembly procedures.



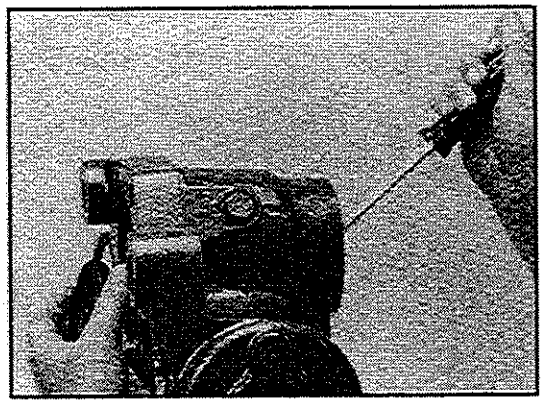
28. Remove the retaining ring that is closest to the output end of the housing trunnion.



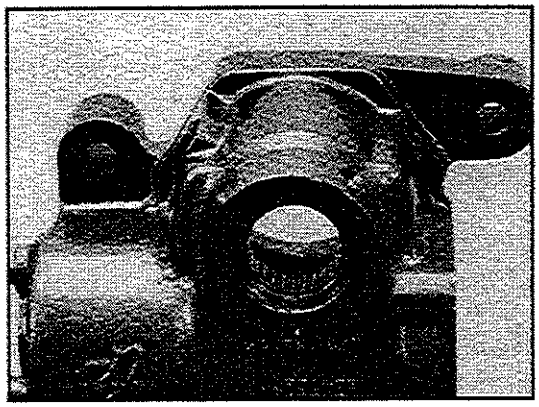
29. Remove and discard dirt seal.



30. Insert a screwdriver into housing bearing bore from the trunnion end and carefully push seal and spacer washer out of the other end of bearing bore without damaging the sealing area of the bore or the spacer washer. Discard the seal.



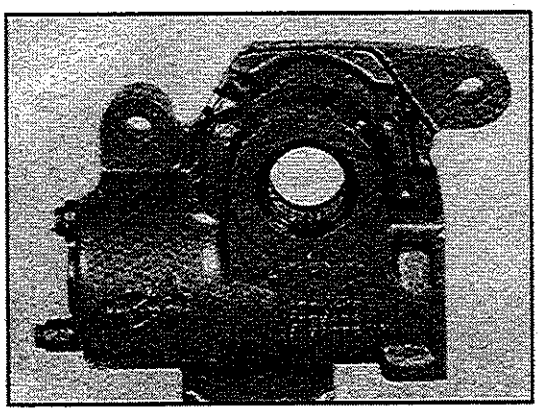
31. Inspect roller bearing in the housing for brinelling or spalling. Inspect retaining ring for damage. If replacement of either part is required, go to Roller Bearing or Retaining Ring Replacement. If not, proceed to step 32.



32. Inspect the following for damage:

Poppet fixed stop screw and washer, if equipped
Poppet adjusting screw and sealing nut.
Auto-bleed plug
Manual bleed screw
Auxiliary port plugs and o-rings

If any are damaged, go to Replace Housing Ports, Plugs and Screws. If not, proceed to the Inspection Section.



Inspection

Make sure all sealing surfaces and seal cavities are free from nicks and corrosion. Any nicked or corroded surface requires part replacement to ensure proper sealing.

Wash all parts in clean, OSHA approved solvent. Air blow them dry only.

Warning

Because they are flammable, be extremely careful when using any solvents. Even a small explosion or fire could cause injury or death.

Warning

Wear eye protection and be sure to comply with OSHA or other maximum air pressure requirements.

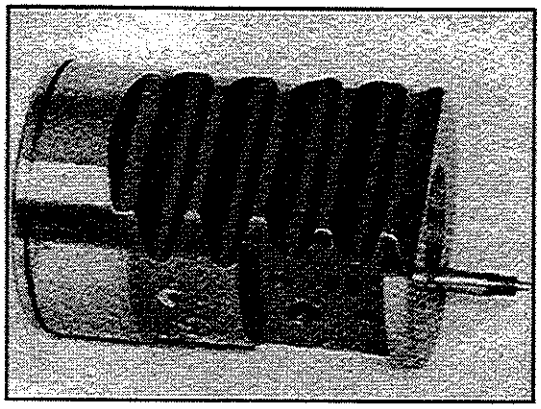
Warning

Any of the following conditions present in the steering gear indicates impact damage.

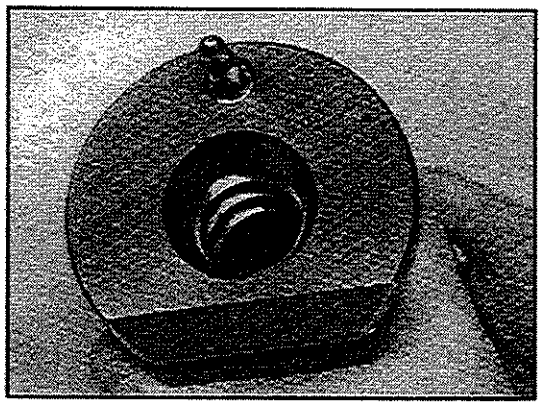
Condition	Area
Brinelling	Ball track grooves of rack piston
	Ball track grooves of worm screw
	Bearing area of sector shaft
	Thrust washers and bearings in valve housing
Cracks or Breaks	Bearing area of sector shaft
	Sector shaft teeth
	Rack piston teeth
	Housing
	Thrust washers and bearings in valve housing
	Worm screw
Twisted serrations	Output shaft serrations

If one of these conditions is found in one component, be sure to inspect all components carefully for signs of impact damage. Replace components noted in individuals inspection steps below if you suspect impact damage. Failure to replace all damaged components could result in a serious vehicle accident.

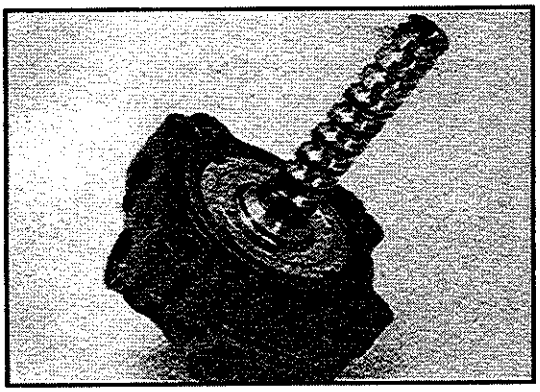
1. Inspect the rack piston teeth for cracks or obvious damage. If teeth are damaged, replace the rack piston, sector shaft and set of balls.



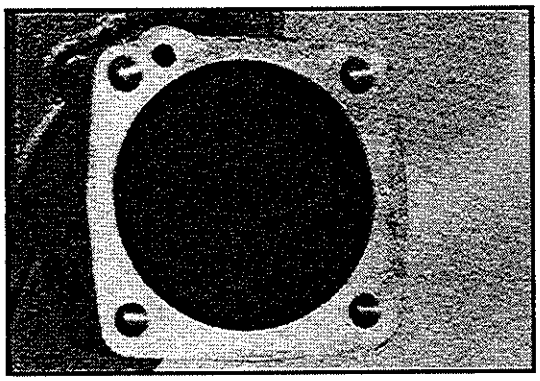
2. Inspect the rack piston ball track grooves for brinelling or spalling. If either condition exists, replace the input shaft, valve/worm assembly, valve housing, rack piston subassembly and balls.



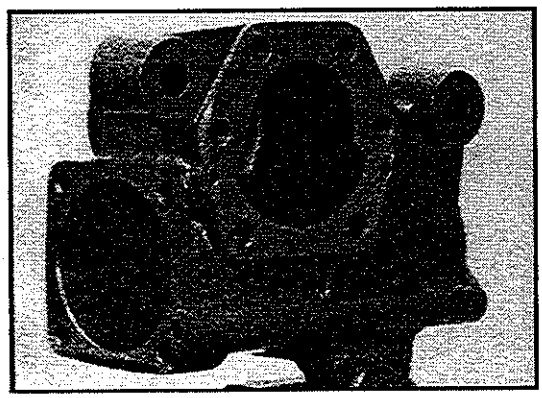
3. Inspect the sealing area of input shaft and valve for nicks and damage. Inspect for discoloration from excess heat. Inspect input shaft ball-track grooves for brinelling or spalling. If any of these conditions exist, replace the input shaft, valve worm assembly, valve housing and balls. Also replace rack piston if brinelling or spalling is found.



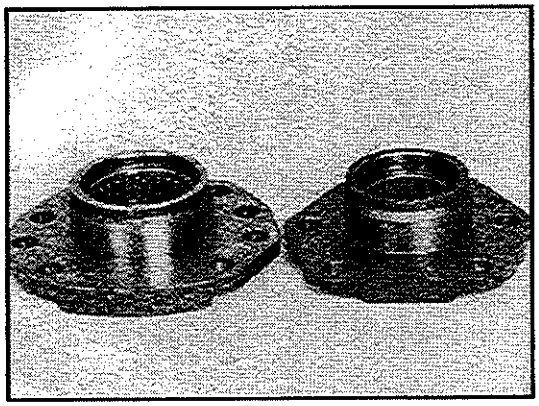
4. Inspect the housing cylinder bore. Some scoring marks are normal. If there was internal leakage greater than 1 gal/min, make sure there are no damaged seals before replacing the housing.



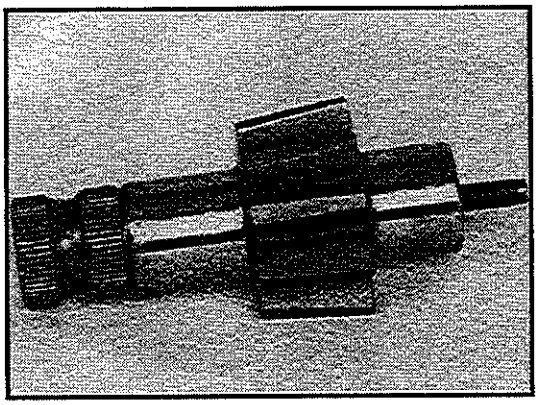
5. Inspect to housing faces for nicks that would prevent proper sealing. Replace the gear housing if these nicks are present and cannot be easily removed with a fine-tooth flat file without changing the dimensional characteristics.



6. For TAS85, inspect roller bearing in side cover assembly for brinelling or spalling. If either condition exists, replace the side cover and bearing assembly.



7. Inspect the sector shaft bearing and sealing areas and sector teeth contact surfaces for brinelling, spalling or cracks. Run your fingernail edge across these areas to detect steps. Remove masking tape from the shaft and inspect for twisted or otherwise damaged serration. If any of these conditions exist, replace the sector shaft.



Note

A service sector shaft will come assembled with the adjusting screw and retainer.

Assembly Preparation

Wash all parts in clean, OSHA approved solvent. Air blow-dry them only.

Warning

Because they are flammable, be extremely careful when using any solvents. Even a small explosion or fire could cause injury or death.

Warning

Wear eye protection and be sure to comply with OSHA or other maximum air pressure requirements.

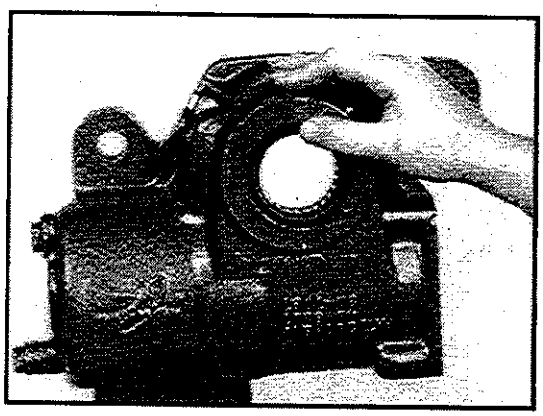
Replace all seals, seal rings and gaskets with new ones each time you disassemble the gear.

TRW Commercial Steering Division does provide individual seals, seal rings and gaskets, as well as complete seal kits. These parts should be available through most OEM parts distributors. Contact your local dealer for availability.

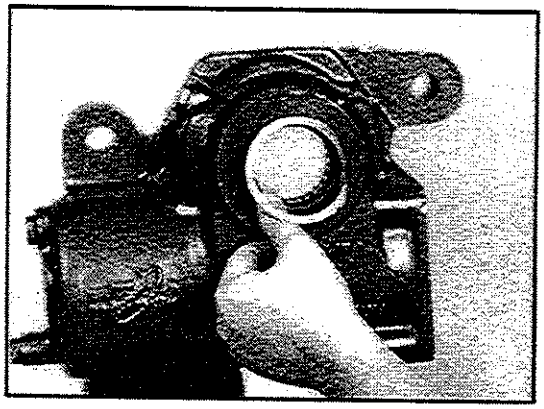
Assembly

Tools Required	Materials Required
5/32 inch Allen wrench	ATF Oil
Lbf•ft Torque wrench	Grease (Mobil Temp™ 1 or 2 or equivalent
Hammer	Masking tape
J38779 (TAS85)	7/16 inch-14 x 7 1/4 inch All Thread
Press	Seal kit: Ross TAS850002
Punch	
Ratchet	
Screwdriver	
Sockets	
Torx sockets	
Vise	

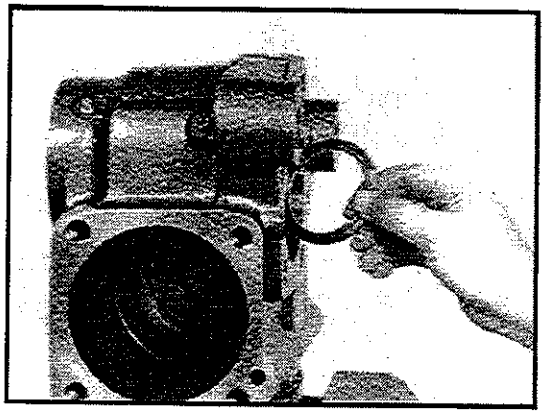
1. Install new dirt seal into the trunnion end of housing sector shaft bore and against bearing with the seal lip out.



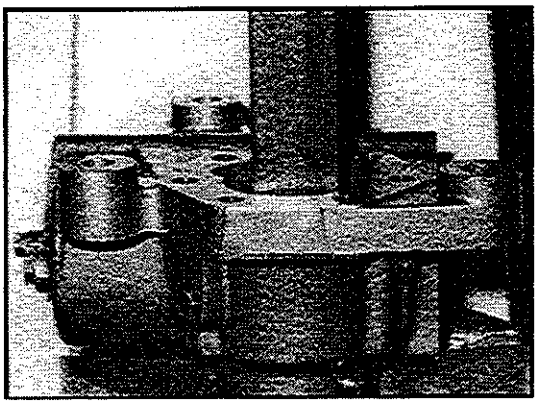
2. Install the second retaining ring seating it firmly in the housing retaining ring groove.



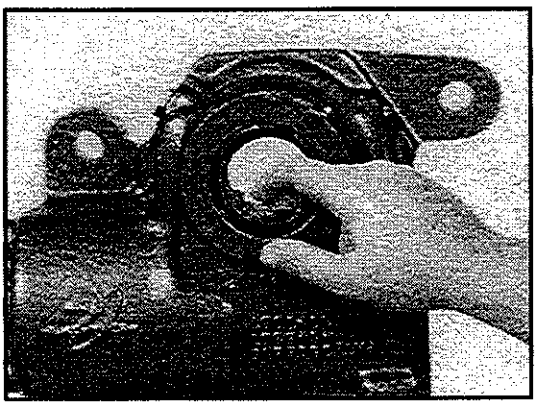
3. Install washer into the side cover side of housing seal bore with small diameter piloted into retaining ring.



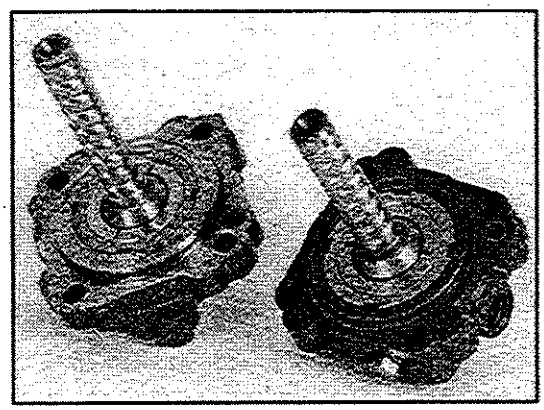
4. Assemble new seal onto bearing and seal tool so the lip with the garter spring is toward the shoulder of the tool. Working from the side cover of the housing, pilot the seal tool into the washer and bearing and press with a force of 100-800 lb (445-3, 560 N) until the seal is seated against washer (TAS85 - J38779).



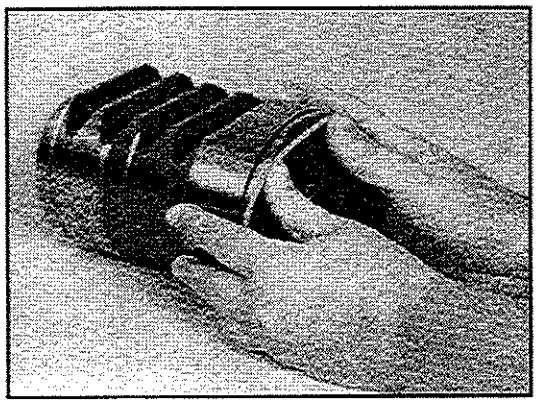
5. Liberally pack the area between dirt seal and pressure seal including roller bearing with clean, high temperature industrial grease, Mobil Temp™ 1 or 2 or equivalent.



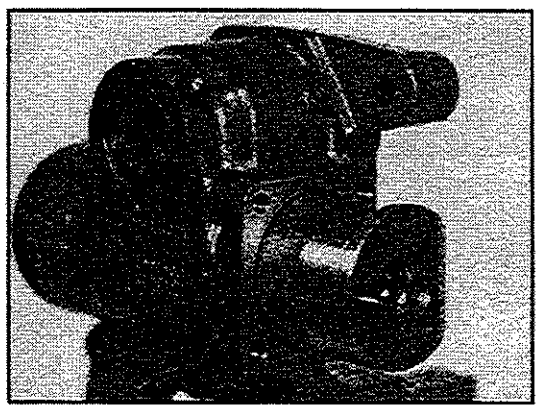
6. Lightly oil new seal ring and assemble in valve housing mounting face groove. For TAS85, oil new seal ring and assemble in valve housing pilot groove.



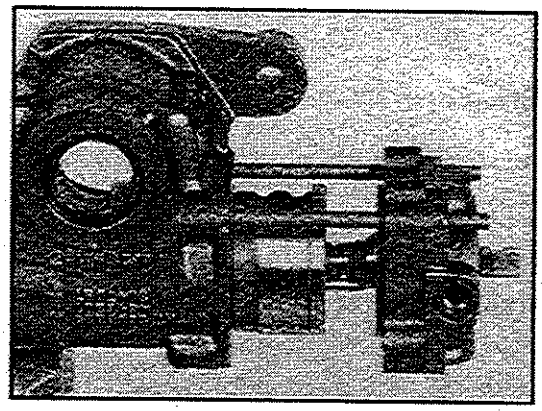
7. Install a new backup o-ring and then a new Teflon seal ring on rack piston. Do not over-stretch these rings as you install them. Do not allow the Teflon seal ring to be twisted.



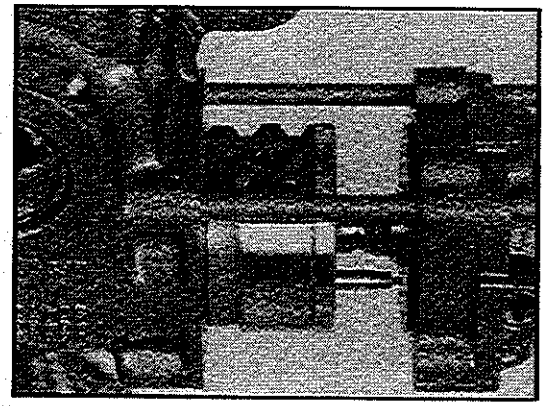
8. Apply clean oil to housing cylinder bore. Place the rack piston in the housing piston bore with ball return guide holes up.



9. Insert the worm screw into the rack piston close to maximum depth, without the valve housing making contact with the poppet stem. Insert two 7/16 inch - 14 All threads through valve housing bolt holes and tighten into housing to support the worm screw. Line up rack piston ball guide holes with the worm ball track grooves by rack piston ball guide holes with the worm ball track grooves by rotating the input shaft.



10. Compare the new guides with the guides removed from the gear, use the ones that look the same. Left hand guides are copper plated, right hand guides are unplated. Assemble the new ball return guide halves into the rack piston until seated, rotate the input shaft slightly if necessary.



Warning

Do not seat guides with a hammer. Damage to guides can result in subsequent lockup or loss of steering.

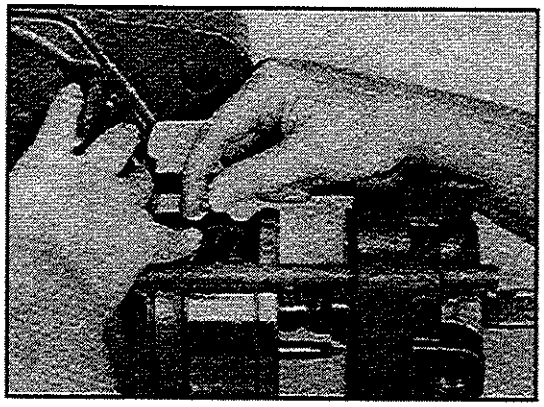
Caution

If a new rack piston or a new input shaft, valve, worm subassembly is being assembled, the balls removed from the unit must be discarded and a service ball kit utilized. The balls in a service ball kit are sized to function in the ball track guide path as altered by component replacement.

Caution

When using the service ball kit, use the correct quantity of service balls: TAS85-34.

11. Hold the ball return guides firmly in place during this entire procedure. Insert as many of the steel balls as you can through the hole in the top of the ball return guides. Rotate the input shaft to pull the balls down and around the ball track guide path. Continue until the correct number of balls are in the ball track guide path.



Warning

Hold down the ball return guides until cap or clip is reinstalled. Failure to hold the guides will result in a trapped ball or balls, which could cause a vehicle accident. If the ball guides become unseated (raise up) at any time, repeat the procedure starting at step 9.

Warning

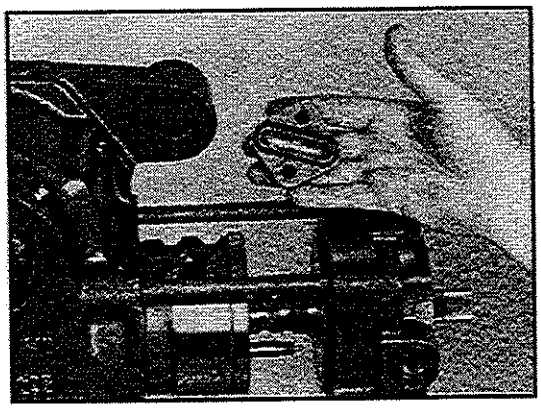
The correct number of balls are required for proper gear operation. Count the balls and insert each carefully as in step 11.

TAS85	
Original	34
Service	34

Caution

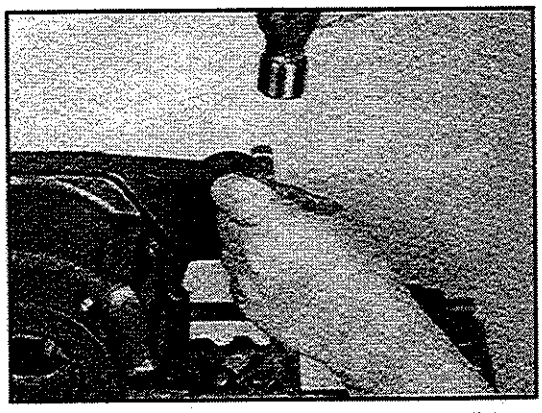
Do not allow valve housing to contact the poppet stem or move more than 2 1/2 inches (69.1 mm) from upper end of rack piston during these procedures. This could incorrectly reset the poppet, or back out worm beyond closed ball loop, trapping balls.

12. If your gear is equipped with the ball return guide cap, grease a new ball return guide cap seal and place it in the seal groove of the cap. Assemble the cap so the seal makes full contact with the rack piston surface. Install two new Allen or Torx head screws and torque each screw alternately until a final torque of 18 lbf•ft (24.5 N•m) is achieved.

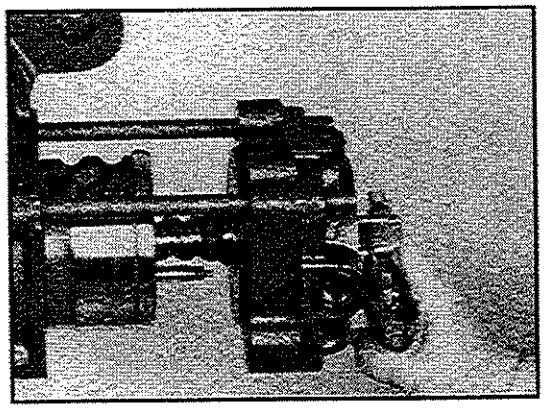


OR

13. If your gear is equipped with a ball return guide clip, instead of a cap, install a new clip so both bolt hole faces are in full contact with the rack piston surface. Install the two hex head bolts. Torque the bolts to 18 lbf•ft (24.5 N•m). Finish by bending the guide clip locking tabs up against the bolt head flats.



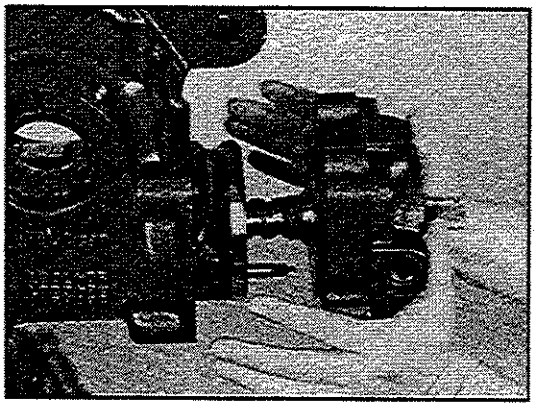
14. Rotate the input shaft from one end of travel to the other without contacting the poppet stem to the valve housing, and without moving the valve housing face more than 2 1/2 inch (69.1 mm) from input end (upper end) of rack piston. If you cannot rotate the input shaft, remove the balls and reassemble them.



Warning

If you install a gear on a vehicle with the worm shaft unable to rotate, the gear will not function correctly. Steering and gear failure may result.

15. Apply clean oil to Teflon seal ring on rack piston. Make sure there is a space of 3/8 to 1/2 inch (10.0 - 13.00 mm) between valve housing and poppet stem to prevent poppet contact at either end. Remove the All Threads, and push the rack piston assembly into the housing with the rack piston teeth toward the sector shaft cavity. Line up the valve housing cylinder feed hole with the gear housing feed hole. Make sure both o-rings in the valve housing remain in position.



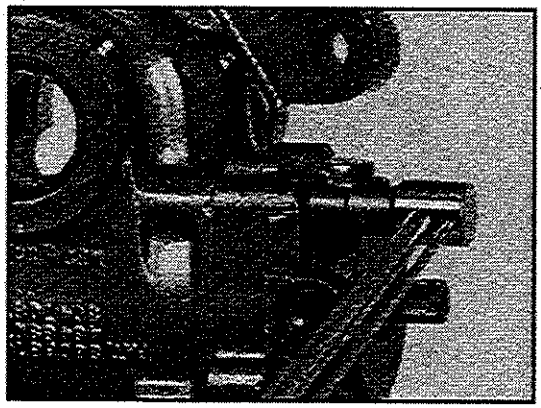
Caution

Do not damage the seal ring while installing the rack piston into housing. If the seal ring end of rack piston enters the housing first, the seal ring will be destroyed when the rack is removed.

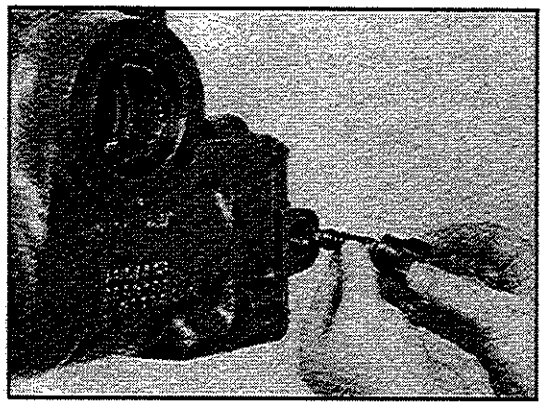
Caution

The poppet seat and sleeve assemblies must not bottom against the internal poppet stops in the steering gear until the gear is installed on the vehicle and the poppet adjustment procedures are performed.

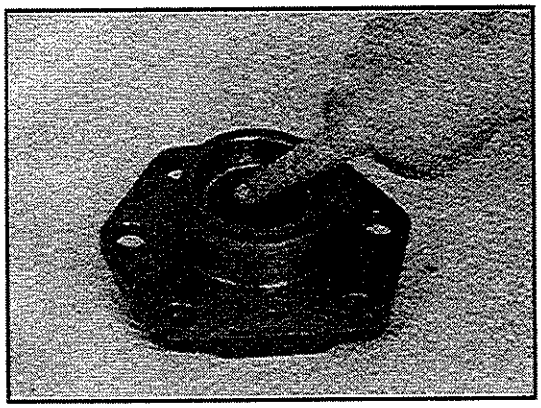
16. Lubricate and install the four valve housing bolts into the housing. Torque the TAS85 bolts to 118 lbf•ft (160 N•m).



17. If the gear is equipped with a relief valve, assemble a new o-ring on relief valve cap. Assemble the small end of tapered spring onto the pin on the relief valve cartridge and insert the assembly, (large end of tapered spring end first) into the relief valve cap cavity. Turn the relief valve cap as assembled into the valve housing and torque to 30 lbg•ft (41 N•m).



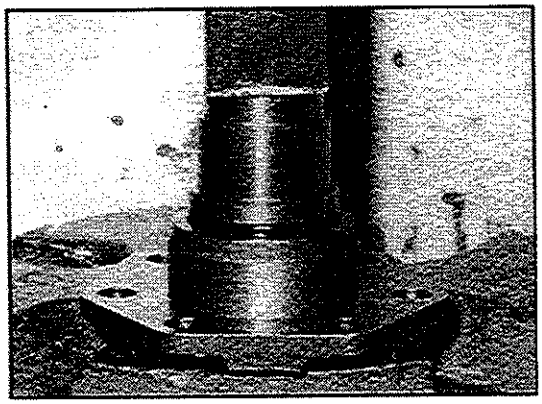
18. For TAS85, apply a generous amount of Mobil Temp™ 1 or 2 (do not substitute another type of grease) to the caged bearing assembly inside the side cover.



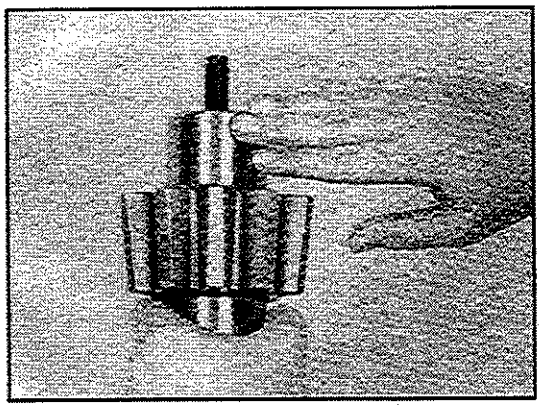
Caution

This bearing is sealed and will receive no lubrication from the hydraulic fluid in the gear. Failure to use the proper grease could result in premature bearing wear.

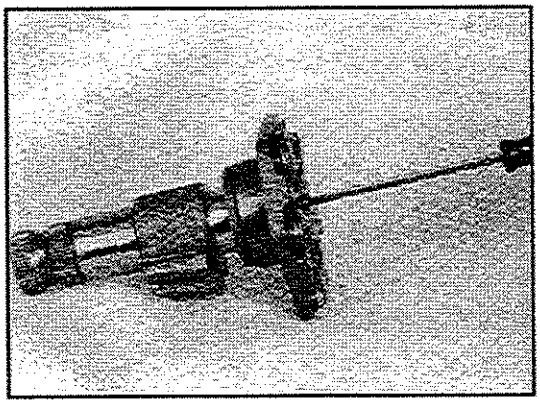
19. Grease and assemble new seal onto installation tool so the side with the garter spring is against the should of the tool. Pilot the tool into the side cover with a force of 100-800 lb (445-3560 N) until it is seated against the bearing or bushing.



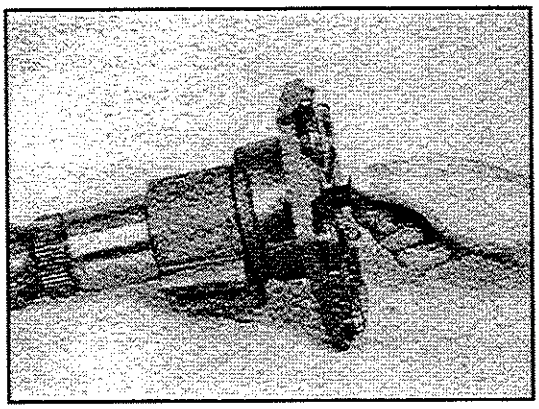
20. For TAS85, apply a generous amount of Mobil Temp™ 1 or 2 or equivalent to the short bearing area of the sector shaft.



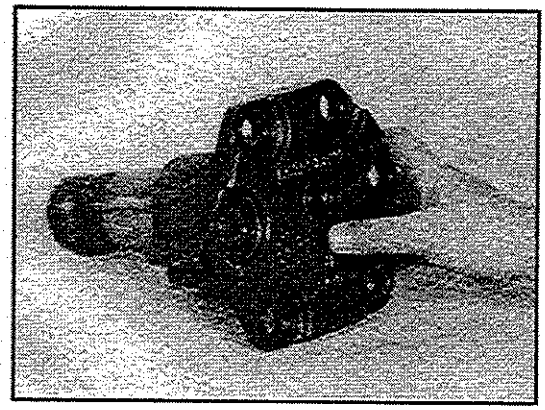
21. Insert the sector shaft into the side cover subassembly, and screw the sector shaft adjusting screw counterclockwise into the side cover until the screw reaches solid height. Rotate the adjusting screw clockwise one half turn so the side cover will rotate freely on the sector shaft.



22. Install the sector shaft adjusting screw jam nut onto the sector shaft adjusting screw a few threads. Final adjustment will be made later.



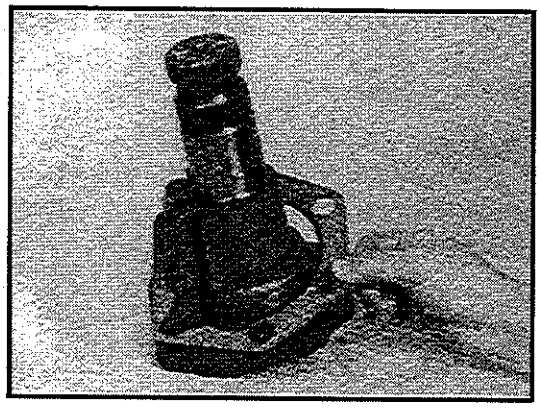
23. Press the new vent plug into the hole provided in the side cover until the plug is bottomed.



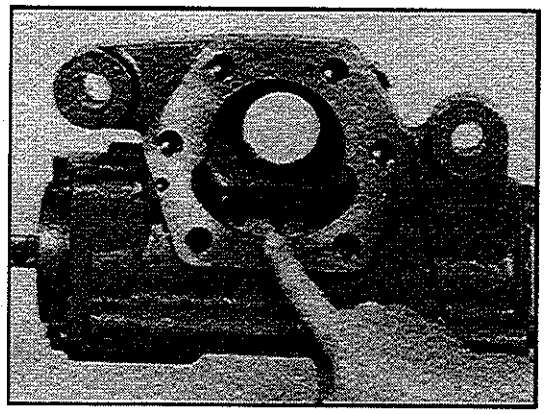
Warning

Do not weld or otherwise plug this hole in any permanent manner. This is a safety vent which functions only if the side covered seal fails. If the seal fails and the plug cannot vent, the steering gear may lock up or otherwise malfunction.

24. Apply clean grease to the new side cover gasket to hold it in place and assemble it onto the side cover.



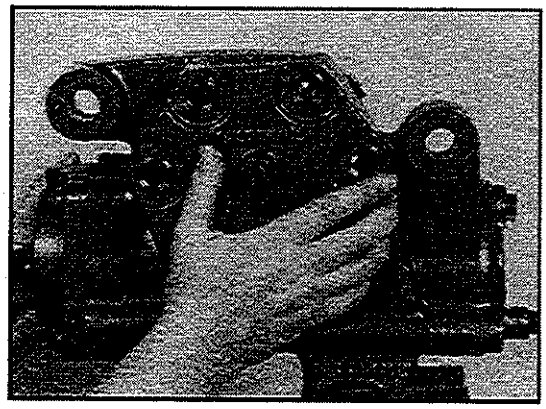
25. There are four teeth on the rack piston. Rotate input shaft to position the rack piston so the space between the second and third tooth is in the center of the sector shaft opening. This will center the rack piston for assembly of sector shaft.



Warning

If the rack piston is not centered when sector shaft is installed, gear travel will be severely limited in one direction. This could result in an accident.

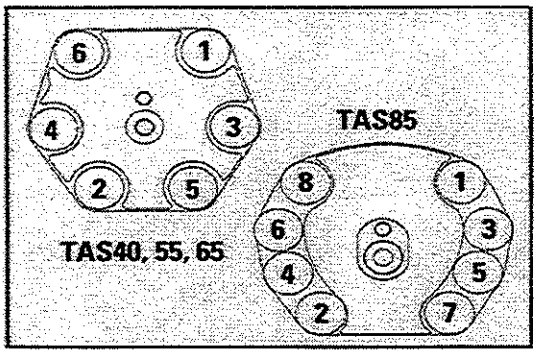
26. Clean off any old tape on the serrations. Reapply one layer of masking tape. Install the sector shaft assembly into the housing. The center tooth of the sector shaft must engage the center space (between the second and third tooth) of the rack piston, with side cover gasket in place.



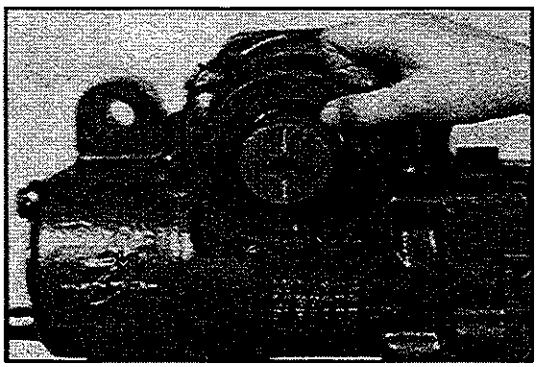
Caution

If the serrations are not properly taped, they will damage the output seal in housing, causing the seal to leak.

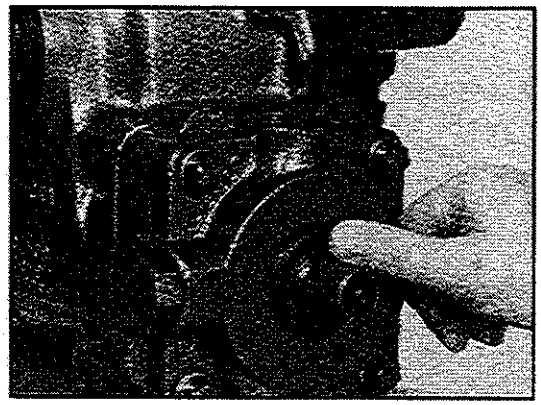
27. Install the special side cover bolts into the side cover and torque them in the sequence shown. If bolts must be replaced, use bolts of the same design, type and length as those you removed. Do not use a substitute. Lubricate side cover bolts and torque TTA85 bolts to 170 lbf•ft (230 N•m).



1. Remove tape from sector shaft and pack the end of housing trunnion area at the sector shaft with clean, high temperature industrial grease, Mobil Temp™ 1 or 2 or equivalent. Apply more of the grease to inside of the new trunnion dirt seal and assemble it over the sector shaft and into the trunnion bore.



29. Pack the end of the valve housing bore around the input shaft with clean, high temperature industrial grease, Mobil Temp™ 1 or 2 or equivalent. Apply more of the grease to the inside of a new dirt and water seal and install it over the input shaft and seat it in the groove behind the serrations and against the valve housing.

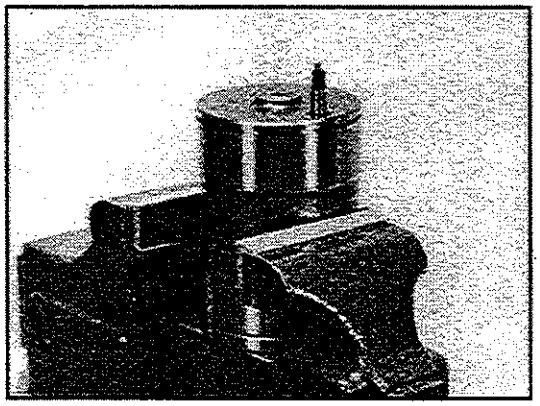


Proceed to Final Adjustments.

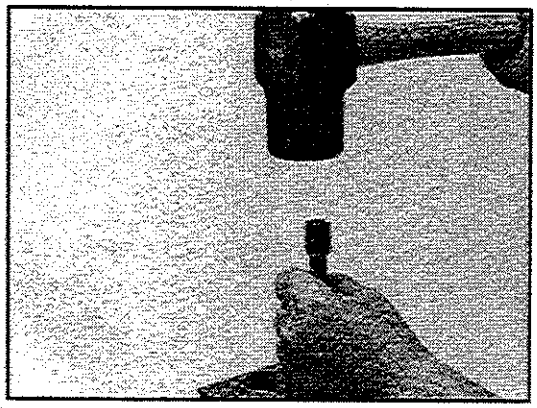
Poppet Component Replacement

Tools Required	Materials Required
2 lb Sledge	Locquic "T" primer
Lbf•ft Torque wrench	Loctite RC680
J36452-A	
Press	
3/8 inch x 6 inch drill rod	
Rachet	
Soft-jawed vise	

1. If the poppet assemblies are to be removed for replacement, place rack piston in a soft-jawed vise.



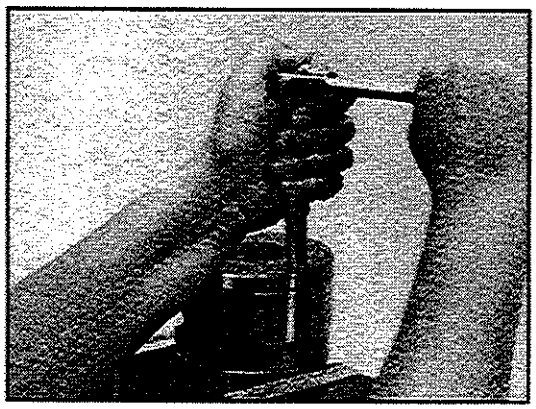
2. Slide special tool #J36452-A over the seat of poppet adjuster seat and sleeve assembly and engage tool in the slots in the threaded sleeve. Hit the end of the tool firmly four or five times with a 2 lb sledge hammer to loosen Loctite.



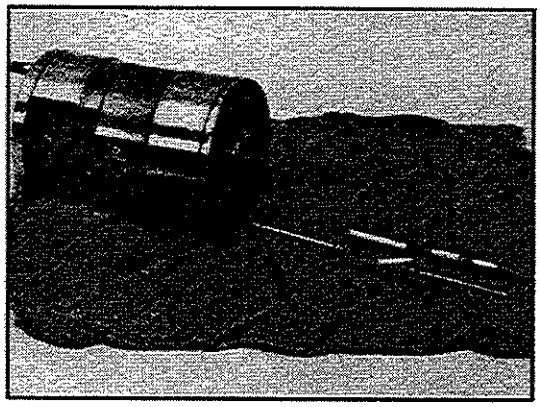
Caution

Poppet adjuster seat and sleeve assemblies are retained by Loctite applied to the threads which makes the assemblies difficult to move.

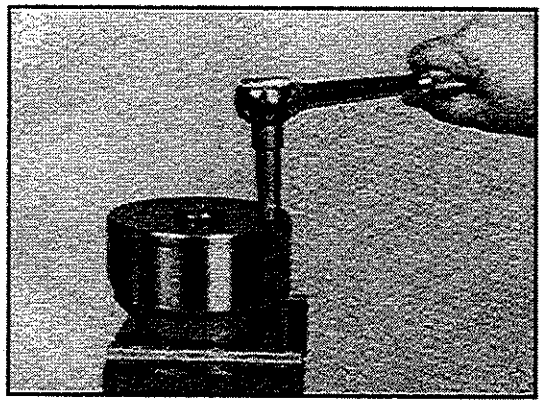
3. With a ratchet applied to the tool, turn one adjuster seat and sleeve assembly out of the rack piston. If the ratchet does not turn easily, strike the adjuster removal tool again with a hammer. If the engaging tangs won't stay in place with torquing, it might be necessary to hold in place with an arbor press while applying loosening torque. Discard poppet seat and sleeve assembly.



4. Remove the two poppets, spring, spacer rod and push tube.



5. Remove and discard remaining poppet seat and sleeve assembly only if required.

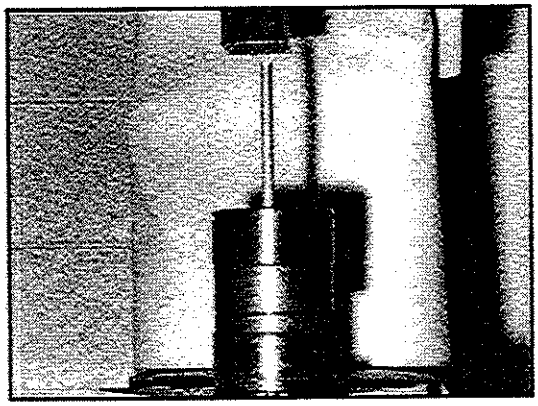


Note

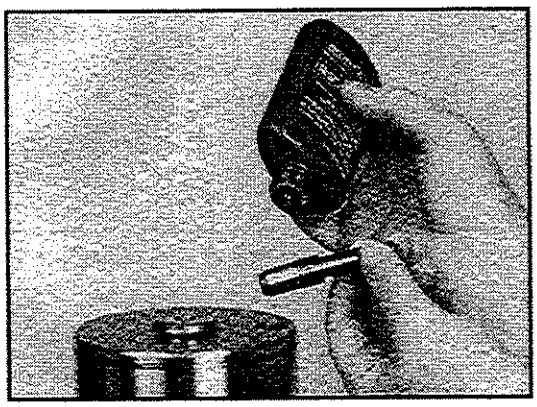
It is possible to reset one poppet adjuster seat and sleeve assembly for automatic poppet adjustment while it is in the rack piston if one adjuster seat and sleeve assembly and the poppets, spring, spacer road and push tube are removed.

6. If one poppet seat and sleeve assembly was left in rack piston, it can be reset for automatic poppet adjustment by inserting a 3/8 inch (9.52 mm) diameter x 6 inch (152.4 mm) drill rod down through the poppet seat hole at the opposite end of the rack piston and against the adjuster seat to press the seat

in until it bottoms against the adjuster sleeve.



7. Carefully apply Locquic "T" primer to the threads in poppet holes, and threads on the new seat and sleeve assemblies. Allow to dry for ten minutes; then carefully apply Loctite RC680 to same threads.



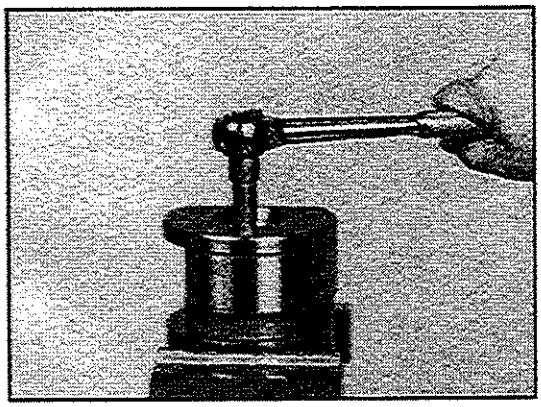
Caution

Do not allow Loctite of Locquic to get on the adjuster seat component of the adjuster seat and sleeve assembly. The poppets will not function properly.

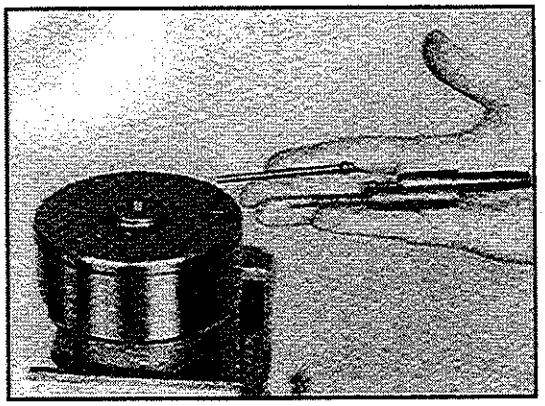
Warning

Wear eye protection while assembling poppets, as spring loaded poppets could eject and cause eye injury.

8. Place rack piston in a soft-jawed vise and turn one new poppet adjuster seat and sleeve assembly (slotted end out) into the poppet hole in one end of rack piston.



9. From the other end of the poppet hole in the rack piston, install: one poppet, poppet spring, nylon spacer rod, push tube, other poppet, and the other new poppet adjuster seat and sleeve assembly.



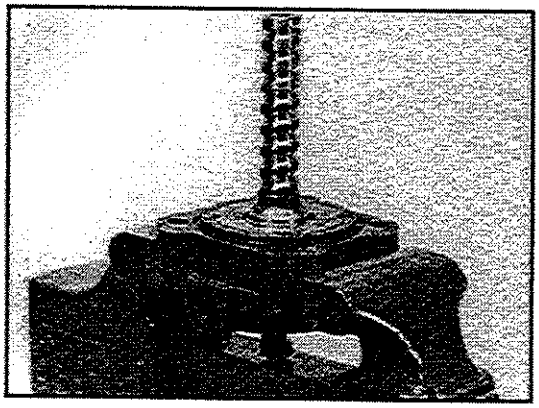
Torque both poppet seat and sleeve assemblies to 18 lbf•ft (25 N•m).

Return to Step 27 under "Disassembly".

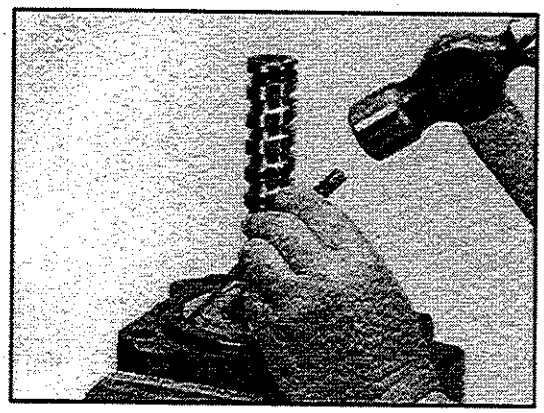
Valve Housing/Worm Screw Disassembly

Tools Required	
Hammer	
Lbf•ft Torque wrench	
Punch, center	
Punch, roll pin	
Lbf•in Torque wrench	
J37464	
J37070	
J37073	
Screwdriver	
Small probe or pick	
Sockets	
12-point sockets	

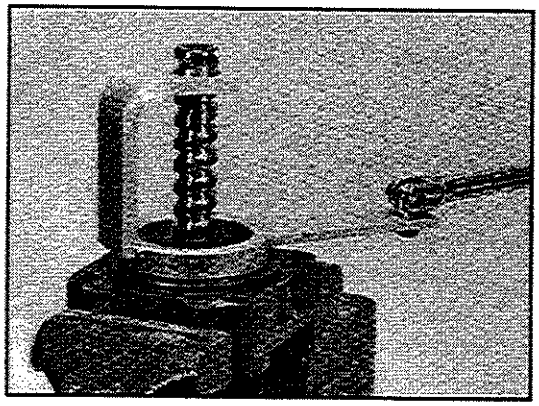
1. With worm vertical, place the valve housing, input shaft, valve/worm assembly in a vise.



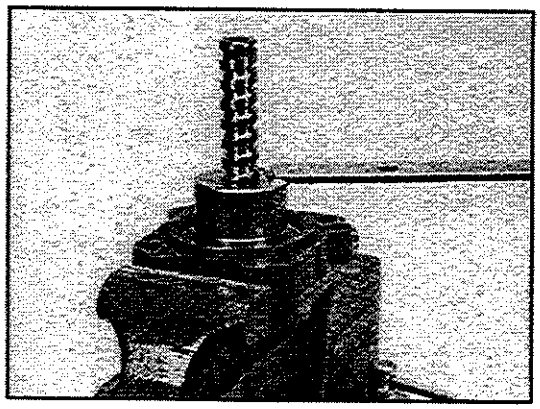
2. Unstake the valve housing where it was upset into the adjuster locknut slot. Also unstake adjuster nut from adjuster.



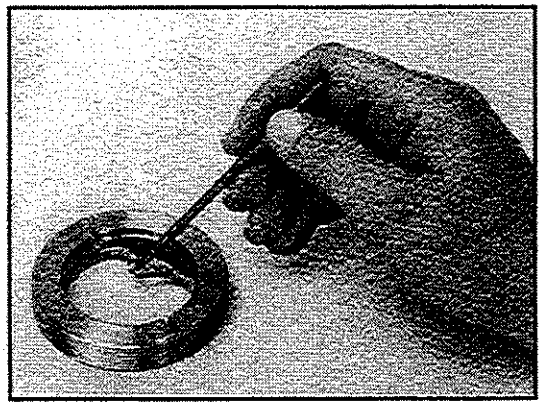
3. Turn bearing adjuster locknut out of the valve housing.



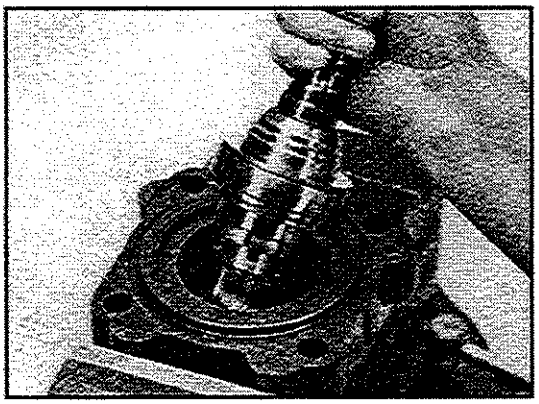
4. Turn bearing adjuster out of the valve housing.



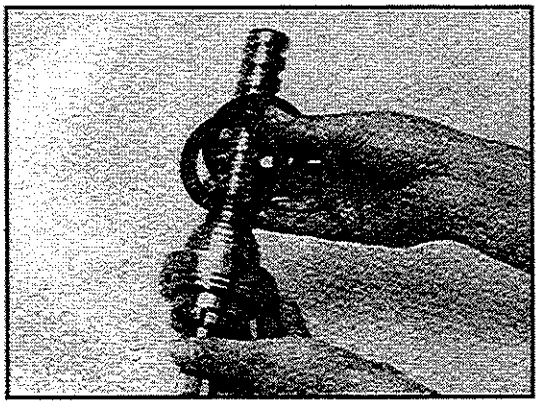
5. Remove and discard seal ring and o-ring from bearing adjuster.



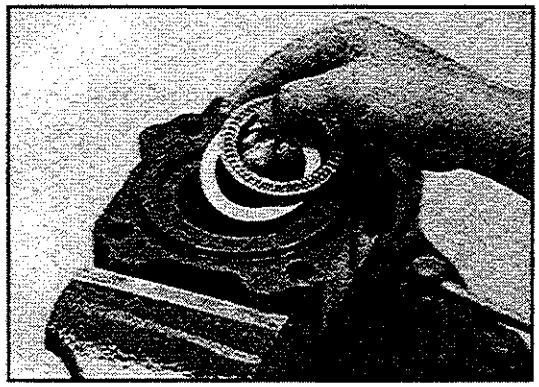
6. Remove the input shaft, valve/worm assembly from the valve housing.



7. Remove thin thrust washer and thrust bearing from input shaft.



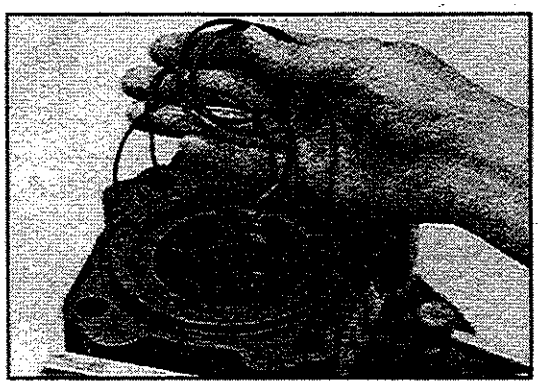
8. Remove thick thrust washer and thrust bearing from valve housing.



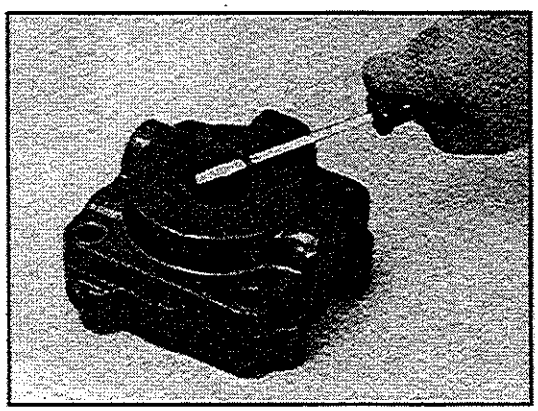
Caution

Input shaft, valve worm assembly must not be disassembled further. The components were a select fit at assembly and are available only as part of this subassembly. If disassembled further, the subassembly must be replaced.

9. Remove and discard seal rings and o-rings and from valve housing.



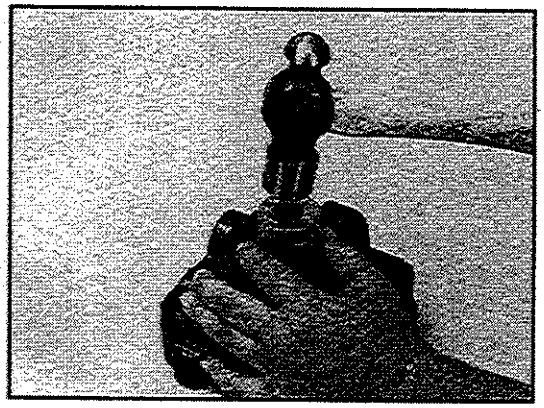
10. Turn over valve housing and remove retaining ring.



Caution

Exercise special care when removing seal to prevent damaging the valve housing seal bore.

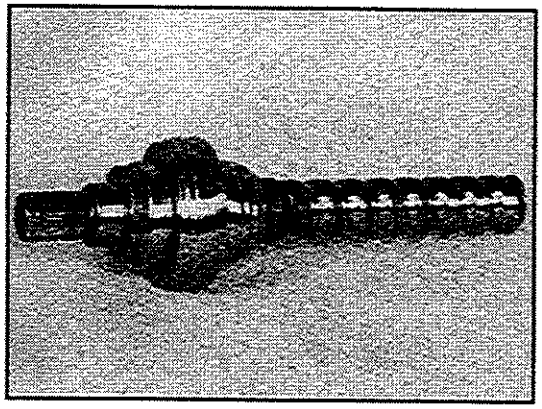
11. Tap input shaft seal out of valve housing. Discard seal.



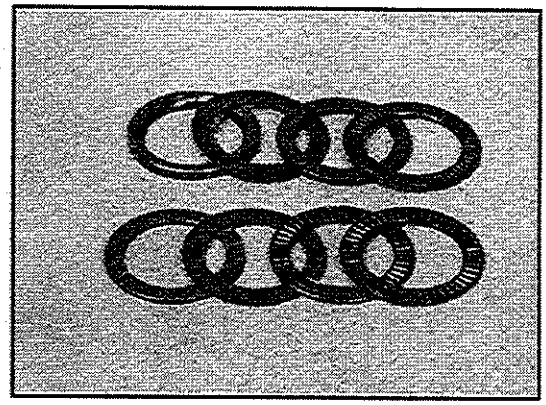
Note

The valve housing also utilizes a ball plug for manufacturing purposes that must not be removed.

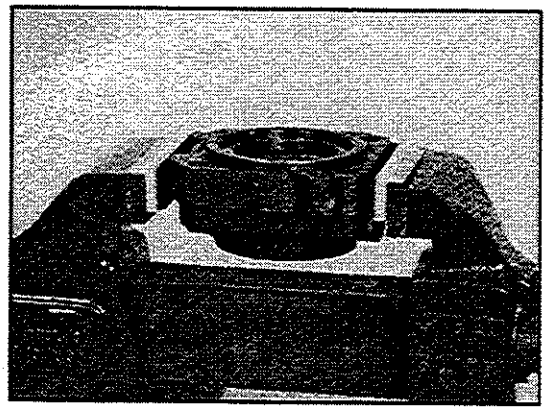
12. Inspect the sealing areas or input shaft and valve for nicks and run your fingernail edge across the sealing surfaces to detect steps. Inspect for discoloration from excess heat. Inspect input shaft ball-track grooves for brinelling or spalling. If any of these conditions exist, you must replace the input shaft, valve/worm assembly, valve housing and balls. Also replace rack piston if brinelling or spalling is found.



13. Inspect the thrust bearing rollers for any deterioration. Inspect thrust washers for brinelling, spalling or cracks. Replace any part with these conditions.



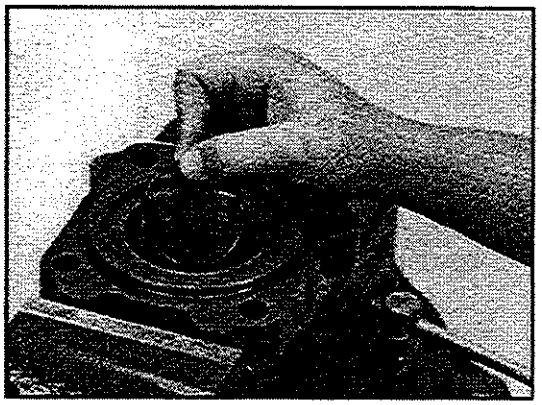
14. Place valve housing firmly in a vise so the input shaft, valve/worm assembly can be assembled vertically with the worm end up.



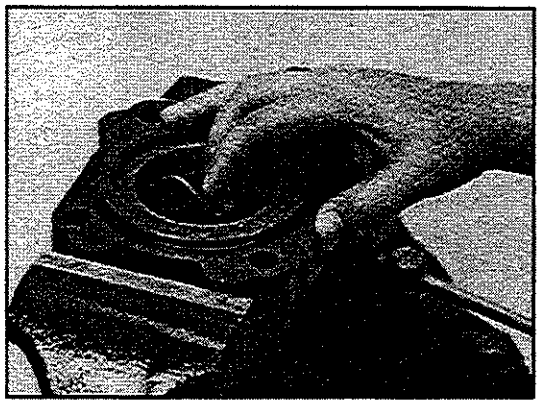
Caution

Do not clamp against threaded port hole or relief valve hole sealing faces when placing valve housing in vise.

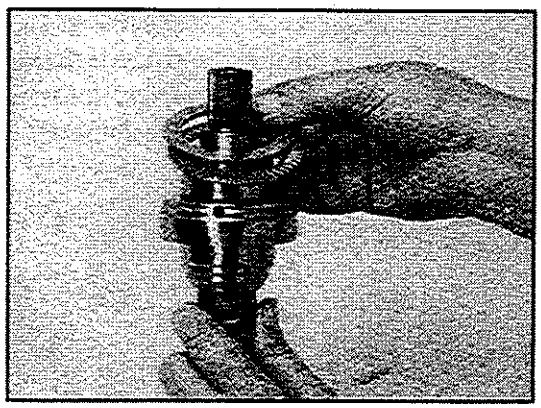
15. Oil and assemble a new o-ring into its counterbore in valve housing.



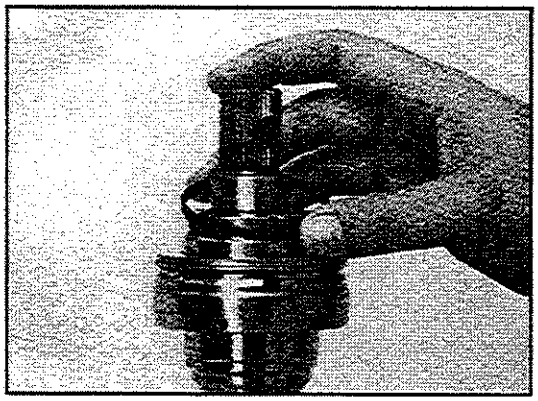
16. Lightly oil and assemble new o-ring and new seal ring into the large diameter seal ring groove in valve housing, bending and working them in and smoothing them out as necessary.



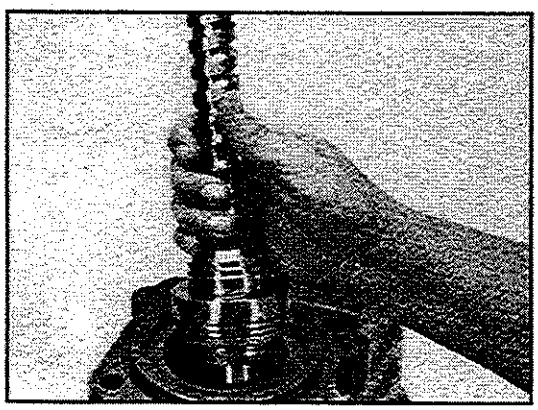
17. Install roller thrust bearing and then the thick washer (square side out) onto input shaft end of input shaft, valve, worm subassembly, seating them against the input shaft thrust face.



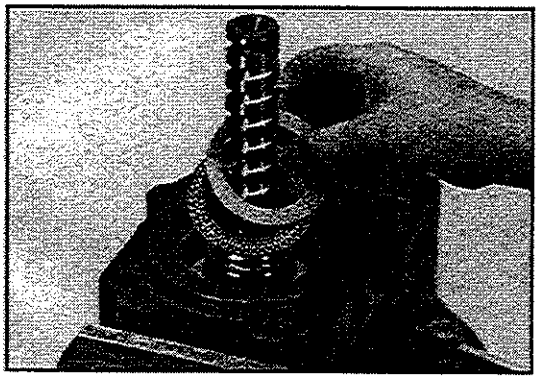
18. Lightly oil and assemble new seal ring onto input shaft and against the thick thrust washer to hold the bearing components in place.



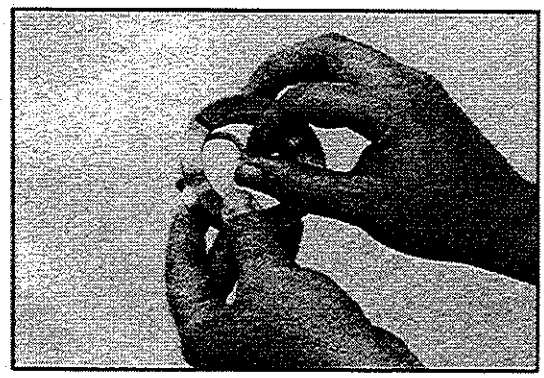
19. Dip the input end of the input shaft, valve, worm assembly into oil up to the worm lead. Assemble the input shaft end of the assembly into the valve housing until it is firmly seated.



20. Apply oil and assemble the other thrust bearing then the thin thrust washer over the ball groove end of worm, and seat them against the shoulder of input shaft, valve, worm assembly.



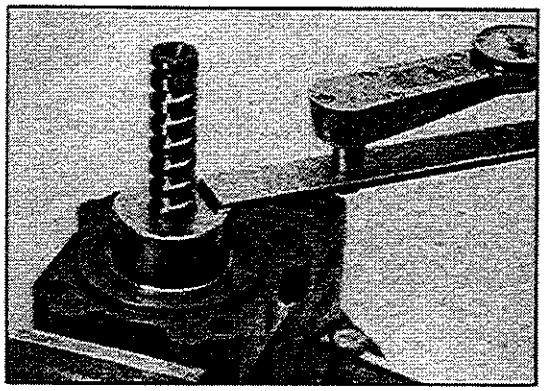
21. Lightly oil a new o-ring and assemble into the seal groove in bearing adjuster. Oil and work a new seal ring into the same groove and smooth it out.



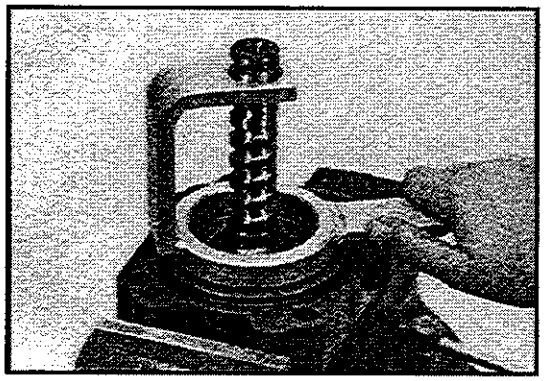
Note

Be sure the valve housing, adjuster locknut and bearing adjuster threads are clean and free of any staking burrs that would impede the locknut from turning freely on adjuster or the adjuster turning freely in valve housing.

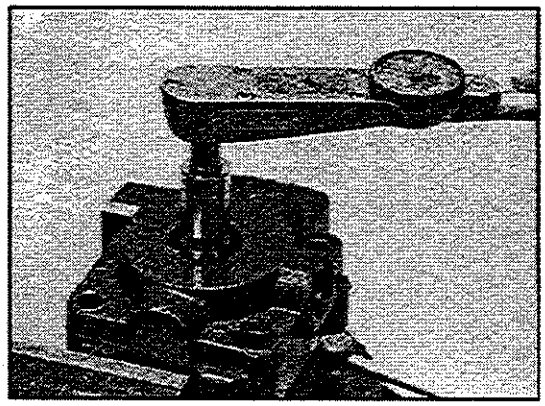
22. Lightly oil and assemble bearing adjuster over worm and into valve housing. Torque adjuster to 13 lbf•ft (18 N•m) indicated torque using a torque wrench inserted in adjuster tool #J37070. This will seat the components. Back off adjuster 1/4 to 1/2 of a turn.



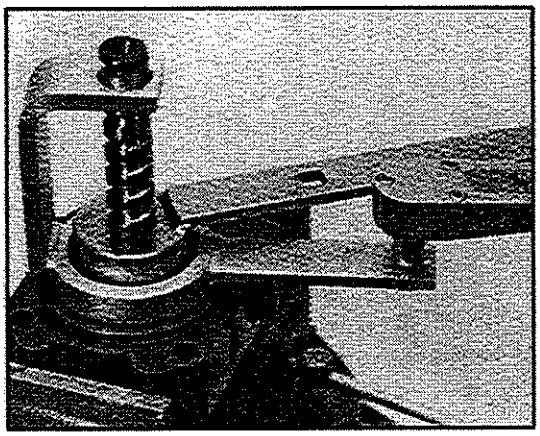
23. Lightly oil and assemble new locknut onto bearing adjuster with radius side down. Tighten slightly to keep the bearing adjuster in place.



24. Reverse assembly in vise so the worm end is down. With an inch pound torque wrench on the input shaft, note torque required to rotate the input shaft 360° in each direction. Tighten the bearing adjuster to increase the maximum torque at the input shaft 5-10 lbf•in (.5-1.0 N•m) over that which was noted prior.



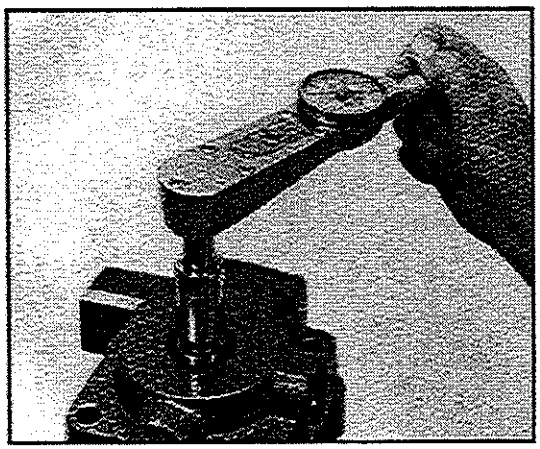
25. Again reverse the assembly in vise. Torque locknut while holding bearing adjuster in position established in step 24 with appropriate adjuster tool. When using a torque wrench in locknut tool J37464, the torque wrench reading should be 112 lbf•ft (152 N•m).



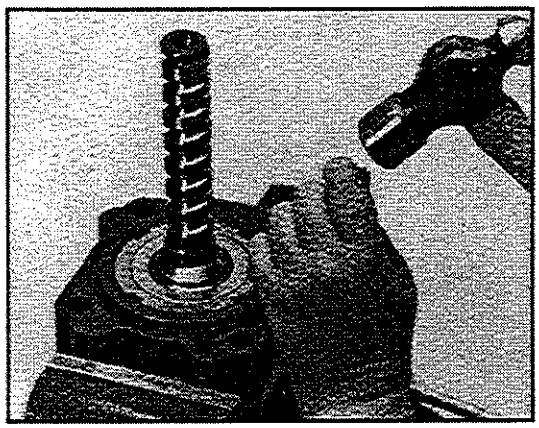
Note

The bearing adjuster, locknut and valve housing flange should be flush. If not, the seal ring or o-ring may be out of position, which will result in axial lash.

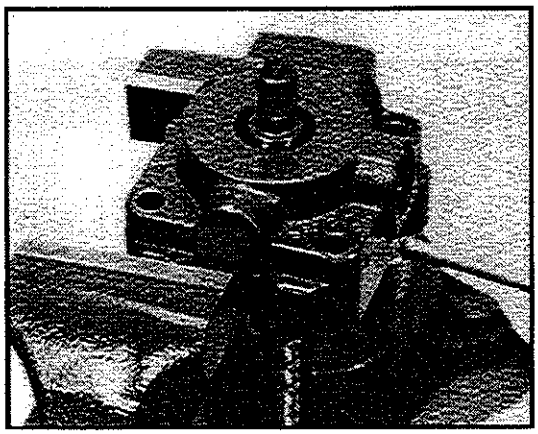
26. Recheck input shaft torque. It should match torque measured in step 24. Repeat steps 24 and 25 if necessary.



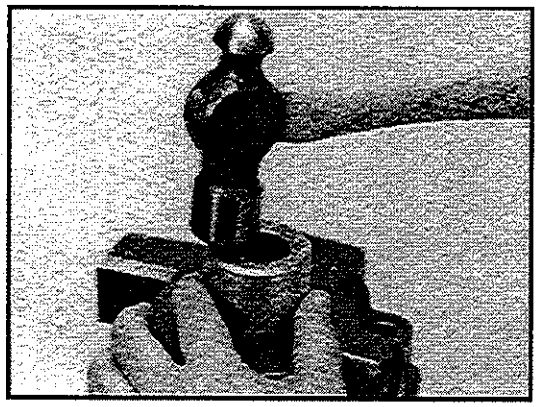
27. Stake valve housing into the clockwise most corner of two opposing slots in locknut. Stake the locknut into the adjuster in two places (180 degrees apart) at threaded area. Choose areas that have not been previously staked. After staking, torque required to rotate input shaft must be between t-10 lbf•in (.5-1.0 N•m) greater than the torque noted in step 24. Torque value must not exceed 22 lbf•in (2.5 N•m). Unstake and readjust if necessary.



28. Reposition worm screw/valve housing subassembly in soft-jawed vise, clamping tightly against valve housing, so the worm screw is pointing down.



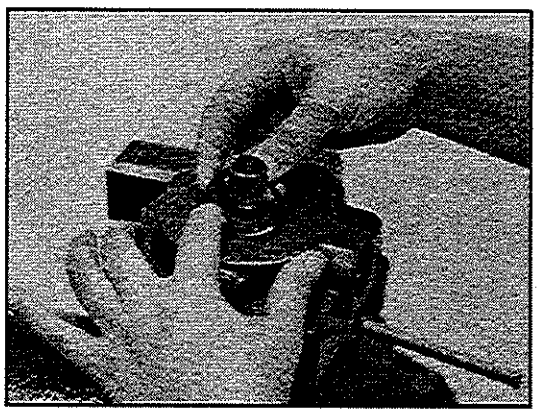
29. Apply clean grease to the outside and inside diameters (fill cavity between the lips) of the new input shaft seal and assemble it, garter spring side first over the input shaft. Align seal in the valve housing seal bore. Assemble seal installer tool #J37073, small diameter end first, over the input shaft and against the seal. Tap the seal installer tool until the tool shoulder is squarely against the valve housing. This will correctly position the seal in the housing bore just beyond the retaining ring groove. Remove any seal material that may have sheared off and is in seal bore and retaining ring groove.



Caution

The input shaft seal must be square in the seal bore and installed to the correct depth.

30. Insert new retaining ring into its groove in valve housing.

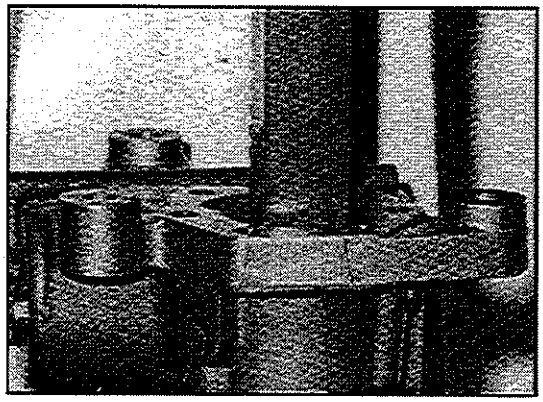


Return to Step 28 under Section entitled "Disassembly".

Roller Bearing or Retaining Ring Replacement

Tools Required	Materials Required
Press	Grease
J38779 (TAS85)	
Screwdriver	

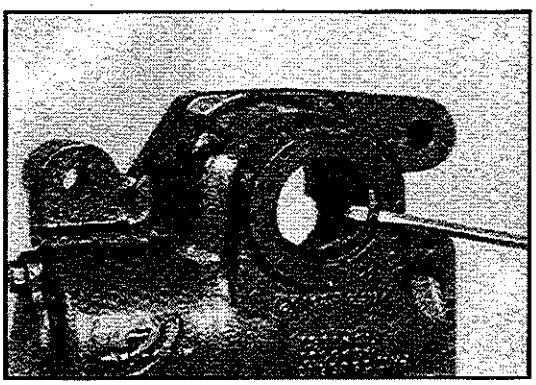
1. If roller bearing in housing needs to be replaced, place the bearing removal end of the bearing and seal tool against the side cover end of the bearing and press it out of trunnion end of the bear bore. Discard bearing.



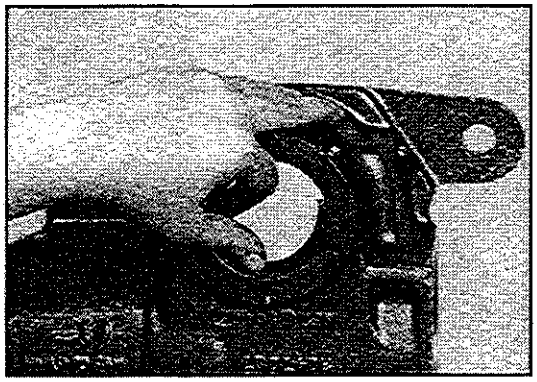
Caution

The bearing must be pressed out from the side cover side to protect the seal counterbore. Be sure to use a bearing removal tool that will clear the retaining ring.

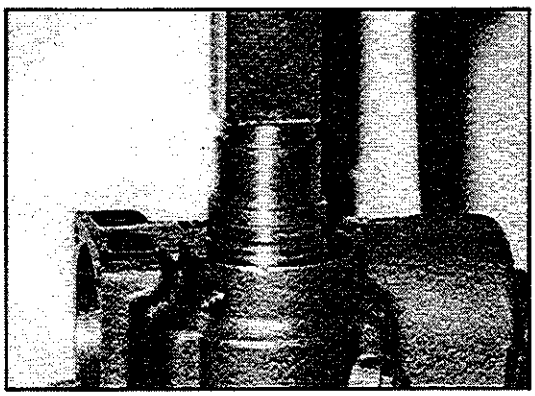
2. If the retaining ring that is still in the housing bearing bore needs to be replaced, remove it through the trunnion end of the bearing bore to protect the pressure seal bore area from being damaged.



3. Insert retaining ring, if it was removed, into the housing bore from the trunnion end (to protect sealing area). Make sure it is seated in the retaining ring groove closest to side cover end of the bearing bore. Lubricate the bearing bore.



4. Press the roller bearing into the housing from the trunnion end of bearing bore until it is seated against the retaining ring. Be sure the housing is square with the press base and the bearing is not cocked.



Caution

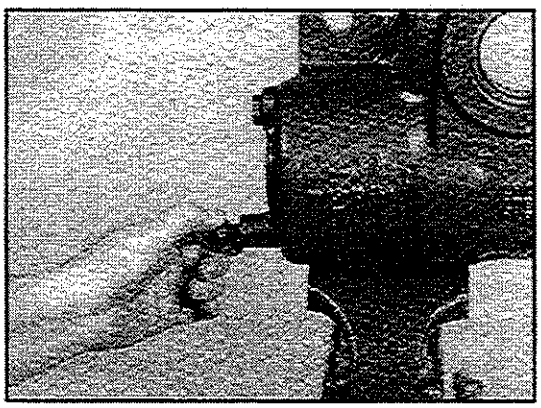
Use the bearing installation end of the tool. If the bearing removal end of the bearing and seal tool is used to press in bearing, the case on the new bearing may be damaged.

Return to Step 32 under "Disassembly".

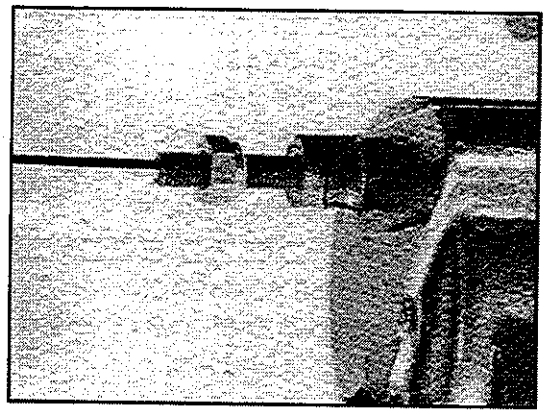
Replace Housing Ports, Plugs, Screws, Fittings

Tools Required	Materials Required
Allen wrench	
Torx sockets	
Sockets	
Lbf•in Torque wrench	
Lbf•ft Torque wrench	

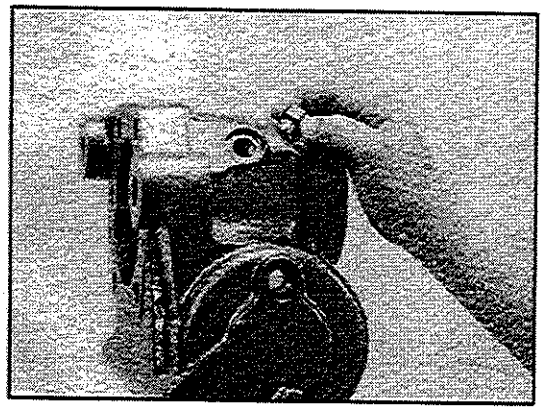
1. If damaged, remove and replace the poppet fixed stop screw and washer if equipped. Replace with poppet fixed stop screw, discard the washer. Torque to 48 lbf•ft (65 N•m).



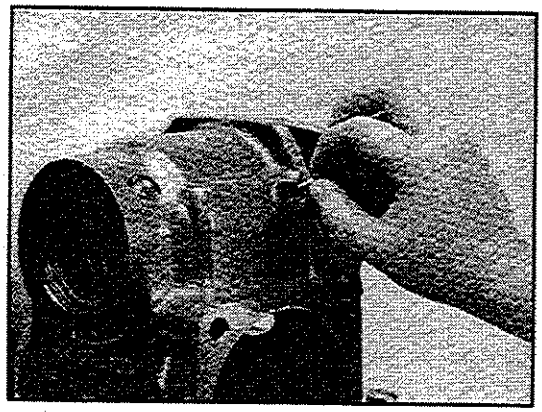
2. If damaged, remove poppet adjusting screw and sealing nut without allowing the nut to change its position on the screw. Assemble the new nut onto the new adjusting screw, matching its position to the nut and screw removed. Torque sealing nut to 35 lbf•ft (47 N•m).



3. If damaged, remove and replace automatic bleed plug. Torque to 48 lbf•ft (65 N•m). If damaged, remove and replace permanent auxiliary port plugs and o-rings. Assemble new o-rings on port plugs and torque to their respective ports in the house or valve housing to 30 lbf•ft (41 N•m).



4. If damaged, remove and replace manual bleed screw. Torque to 30 lbf•in (3.4 N•m).

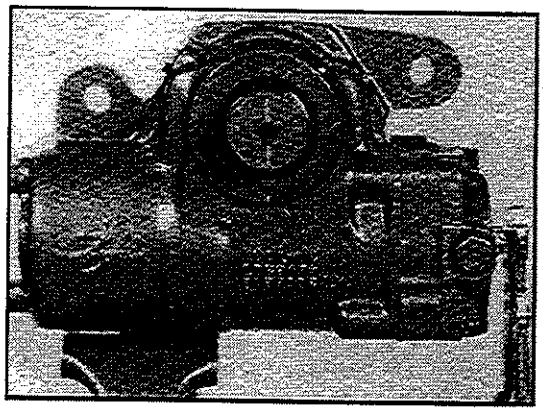


Return to Inspection section.

Final Adjustments

Tools Required	Materials Required
Box-end wrench	
Lbf•ft Torque wrench	
Lbf•ft Torque wrench	
Screwdriver	
Sockets	

1. To center the steering gear, rotate input shaft, valve worm assembly until the timing mark on the end of the sector shaft is in line with the timing mark on the end of housing trunnion.



Caution

Do not rotate the input shaft more than 1.5 revolutions from center position until the steering gear is installed, during poppet setting procedure. Doing so could make the automatic poppets inoperative, which would require disassembly of steering gear to reposition poppet seat and sleeve assemblies.

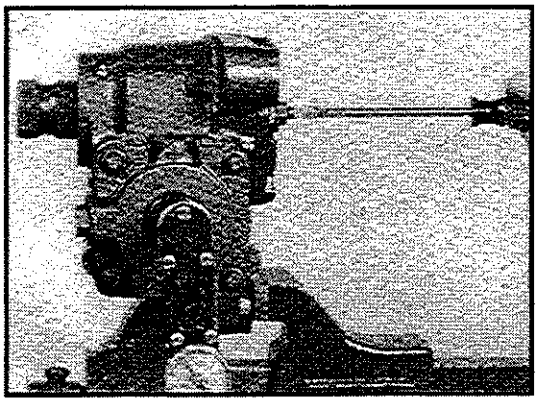
Note

Initial poppet contact will occur at less than one input shaft rotation in one direction from steering gear center position, if new or reset poppet adjuster seat and sleeve assemblies are assembled in the unit.

Note

Worm preload adjustment was set when input shaft, valve and worm were assembled into valve housing.

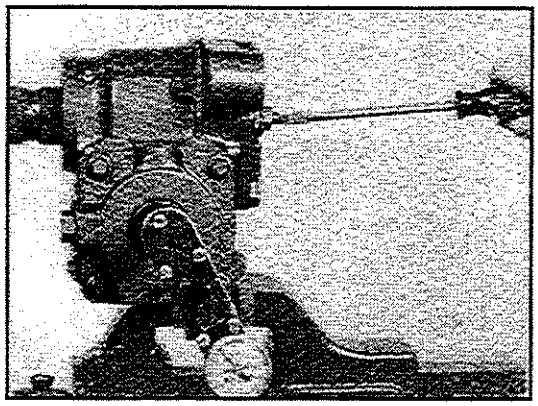
2. With adjusting screw jam nut loose, turn sector shaft adjusting screw clockwise to provide 45-50 lbf•in (5-5.5 N•m) of torque required to rotate the input shaft, valve/worm assembly through one half turn (180 degrees) each side of center.



Note

This procedure will proper mesh and seat the rack piston and sector shaft teeth for final adjustments.

3. Turn sector shaft adjusting screw counterclockwise one half turn and note maximum torque required to rotate the input shaft, valve/worm assembly through one half turn (180 degrees) each side of center.



4. Adjust sector shaft adjusting screw clockwise to increase maximum torque noted in step 3 by 7 lbf•in (.8 N•m). Tighten jam nut firmly against side cover while holding the adjusting screw in position. Final torque jam nut to 43 lbf•ft (58 N•m) and check input shaft, valve/worm assembly torque again. Readjust if input shaft torque exceeds 40 lbf•in (4.5 N•m).

Reinstallation

1. Verify that axle stops are set to manufacturer's wheelcut or clearance specifications.
2. Bolt gear to frame, torque to vehicle manufacturer's recommendation.
3. Connect return line to reservoir in TAS return port.
4. Connect hydraulic line from pump to pressure port in TAS unit.
5. Connect steering column to input shaft, torque pinch bolt to vehicle manufacturer's recommendation.
6. Install pitman arm on output shaft, with timing marks aligned. Torque bolt to vehicle manufacturer's recommendation.
7. Connect drag link to pitman arm.

Poppet Resetting

If poppets remain unchanged from when gear was removed from vehicle and gear is being installed on the same vehicle with no change in axle stops or linkage, check (after

installation) to make sure poppets relieve in both turns just before axle stop contact is made. If not, use resetting procedure.

If poppets were replaced with new components or reset during gear disassembly and are ready for automatic positioning, use poppet setting procedure.

If poppets may have been moved during disassembly or reassembly procedures, or gear is being installed on a different vehicle, use poppet resetting procedure.

Glossary

Aerated Fluid - Fluid with air bubbles.

Automatic Bleed Systems - Gears are mounted in such a way that trapped air can be forced out of the system "automatically" without loosening bleed screw.

Axial - In-Out movement along an axis (imaginary straight line on which an object moves)

Date Code - Date the steering gear was built

Discoloration - Change in color.

External Leakage - Fluid Leaking out of the system or steering gear.

Full Turn - Hub contacts axle stop

Integral Power Steering - Steering gear has manual steering mechanism, hydraulic control valve, and hydraulic power cylinder all within gear housing.

Impact - The application of torques and forces to steering gear components during accidents or other similar events which exceed the hydraulic capacity of the steering gear.

Internal Leakage - Fluid leaking inside gear.

Lash - Free play.

Manual Bleed Systems Gears are mounted in such a way that an air pocket could form in one end of the steering gear. The bleed screw is positioned so trapped air can be forced out when loosened.

OSHA - Occupational Safety and Health Administration

Poppets - Unloading valves, reduce pressure in full turns.

Relief Valve - Limits maximum supply pressure.

Return Line - Line that connects steering gear to reservoir to recirculate hydraulic fluid.

Rotary Control Valve - Controls flow in internal cavities.

Scoring - Scratch.

Shock Load - Shake or jar.

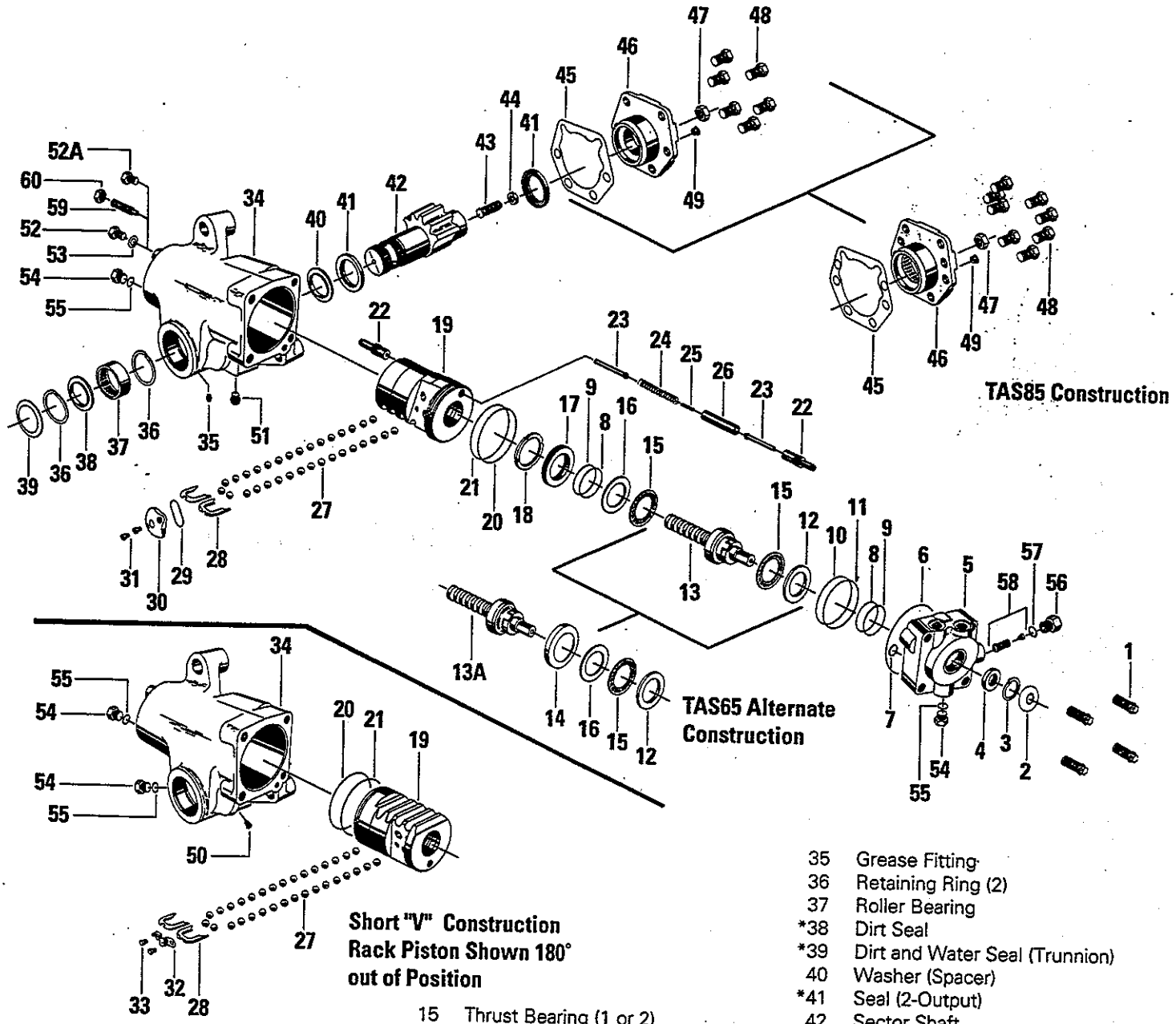
Spalling - Flaking of chipping.

Subassembly - An assembled unit that fits into a larger unit.

Supply Line - Connects pump to steering gear.

Twisted Serrations - Output shaft serrations damaged by impact overload. Serrations can be twisted at the area between the large diameter of the shaft and the end of the serrations.

TAS Series Exploded View -- Typical



Item	Description
1	Bolts (4-Valve Housing)
*2	Dirt and Water Seal
*3	Retaining Ring
*4	Seal (Input Shaft)
5	Valve Housing
*6	Seal Ring (Valve Housing)
*7	Seal Ring (Valve Housing)
*8	Seal Ring (2)
*9	O-ring (2)
*10	Seal Ring
*11	O-ring (Valve Housing)
12	Thrust Washer (Thick)
13	Input Shaft, Valve, Worm Assy.
13A	Input Sh., Valve, Worm Assy. (Alt)
14	Spacer Sleeve (Alt.)
15	Thrust Bearing (1 or 2)
16	Thrust Washer (Thin)
17	Bearing Adjuster
*18	Adjuster Locknut
19	Rack Piston
*20	Teflon Seal Ring
*21	O-ring (Back up; Rack Piston)
22	Poppet Seat and Sleeve Assy. (2)
23	Poppet (2)
24	Poppet Spring
25	Spacer Rod
26	Push Tube
27	Balls
*28	Ball Return Guide Halves (2)
*29	Seal (Cap)
30	Ball Return Guide Cap
*31	Torx Screws (2-Cap)
*32	Ball Return Guide Clip
33	Hex Screws (2-Clip)
34	Housing
35	Grease Fitting
36	Retaining Ring (2)
37	Roller Bearing
*38	Dirt Seal
*39	Dirt and Water Seal (Trunnion)
40	Washer (Spacer)
*41	Seal (2-Output)
42	Sector Shaft
43	Adjusting Screw (Sector Shaft)
44	Retainer (Adjusting Screw)
*45	Gasket (Side Cover)
46	Side Cover Assembly
47	Jam Nut
48	Special Bolts (6 or 8-Side Cover)
*49	Vent Plug (Side Cover)
50	Bleed Screw (Manual)
51	Plug (Auto Bleed)
52	Fixed Stop Screw (Poppet)
52A	Fixed Stop Screw (Poppet-Alt)
53	Washer (Stop Screw)
54	Auxiliary Port Plug (2)
*55	O-ring (2-Aux. Port Plug)
56	Relief Valve Cap
*57	O-ring (Relief Valve)
58	Relief Valve (2 piece)
59	Service Poppet Adjusting Screw
60	Service Sealing Jam Nut

*These items are included in seal kits. Kits also include 406015 lubricant and a service bulletin.

Service Parts List

Common Parts

Item	Description	Part Number
1	Bolts (4-Valve Housing)	020251
2	Dirt and Water Seal	478044
3	Retaining Ring	401637
4	Seal (Input Shaft) (High Temp)	478076
7	Seal Ring (Valve Housing)	032823
8	Seal Ring (2)	029123
9	O-ring (2) (High Temp)	032200-158
10	Seal Ring	029116
11	O-ring (Valve Housing) (High Temp)	032200-152
12	Thrust Washer (Thick)	400143
15	Thrust Bearing (2)	070027
16	Thrust Washer (Thin)	400144
17	Bearing Adjuster	400149
18	Adjuster Locknut	027007
27	Balls	216191-X1
29	Seal (Cap)	478042
30	Ball Return Guide Cap	400161
31	Torx Screws (2-Cap)	020228
32	Ball Return Guide Clip	402448
33	Hex Screws (2-Clip)	G179810
35	Grease Fitting	037027
43	Adjusting Screw (Sector Shaft)	021200
44	Retainer (Adjusting Screw)	062005
47	Jam Nut	G9419666
49	Vent Plug (Side Cover)	036201
50	Bleed Screw (Manual)	213705
51	Plug (Auto Bleed)	021397
52A	Fixed stop screw	021426
54	Auxiliary Port Plug (2)	G9410358
55	O-ring (2-Aux. Port Plug)	032229
57	O-ring (Relief Valve)	032200-153
59	Service Poppet Adjusting Screw	021407
60	Service Sealing Jam Nut	025119

Parts Vary by Specification*

Item	Description
5	Valve Housing
13	Input Shaft, Valve, Worm Assy.
13A	Input Shaft, Valve, Worm Assy. (Aft)**
14	Spacer Sleeve (Aft)**
19	Rack Piston
34	Housing
42	Sector Shaft
46	Side Cover Assembly
56	Relief Valve Cap
58	Relief Valve (2 piece)

*Contact Service/Sales for part numbers
**Applicable to TAS65 gears only

BB# 1469261

Kits

Items	Description	Part Number
54 & 55	Port Plug & O-ring	415437-A1
56 & 57	Relief Valve Cap & O-ring	411061-A1
59 & 60	Poppet Adj. Scr. & Jam Nut	021407-X1
	TAS40 Seal Kit	TAS400002
	TAS55 Seal Kit	TAS550002
	TAS65 Seal Kit	TAS650006
	TAS85 Seal Kit	TAS850002

Parts Vary by Gear Size

Item	Description	TAS40	TAS55	TAS65	TAS85
6	Seal Ring (Valve Housing)	032829	032829	032616	032834
20	Teflon Seal Ring	032828	032830	032590	032547
21	O-ring (Back up, Rack Piston)	032827	032831	032615	032556
22	Poppet Seat and Sleeve Assy. (2)	409118-A2	409118-A2	409118-A2	409118-A6
23	Poppet (2)	040210	040210	040210	040217
24	Poppet Spring	401662	401662	401662	401684
25	Spacer Rod	040209	040209	040209	040218
26	Push Tube	080154	080154	080154	080158
28	Ball Return Guide Halves (2) R.H.	400158	400160	400156	400162
	L.H.	400159	400165	400157	400163
36	Retaining Ring (2)	401674	401650	401650	401685
37	Roller Bearing	070028	071025	071020	072003
38	Dirt Seal	478052	478041	478041	478057
39	Dirt and Water Seal (Trunnion)	478053	478045	478045	478059
40	Washer (Spacer)	028527	028519	028519	028534
41	Seal (2-Output)	478051	478040	478040	478058
45	Gasket (Side Cover)	HFB529000	HFB649000	HFB649000	TAS859000
48	Special Bolts (6 or 8-Side Cover)	021277	G223734	G223734	G223734

LTC Suspension

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

List of Tables

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Safety

The purpose of this safety summary is to ensure the safety and health of individuals performing service and/or operation on this Blue Bird product, and the protection of equipment. Before using this manual to perform any service or operating procedure, individuals should read and adhere to the applicable warnings and cautions located throughout this manual.

Warnings

Warnings apply to a procedure or practice that, if not correctly adhered to, could result in injury or death. Particular attention should be paid to sections of this manual where warnings appear.

Cautions

Cautions apply to a procedure or practice that, if not correctly adhered to, could result in damage to or destruction of equipment.

Notes

Notes are used to explain, clarify or otherwise give additional insight for a given subject, product or procedure.

Introduction

These procedures were documented using a Blue Bird LTC bus with a Cummins M11 engine, an Allison B500 World Transmission and Ridewell Air Suspension.

Description of Operation

The Ridewell Air suspension uses pressurized air, drawn from the conventional vehicle air system, to form the load carrying, shock absorbing springs. Automatic height control valves regulate the air pressure required for varying loads, and maintains a constant vehicle ride at all times. Its basic characteristic is its ability to provide a cushioned ride through the light to loaded range.

Preparatory Work

Caution

Do not use the leveling jacks for this procedure. The leveling jacks are for tire changing and leveling of the bus.

1. Park the vehicle on a level surface.

Warning

Do not place any part of your body under the bus until the jackstands are in place.

Caution

A requirement to loosen all bolts and nuts is a step in the procedure. Do not remove any hardware at Step 4.

2. Install six 15,000-pound (total capacity 90,000-pounds) jacks on the front and rear tires.
3. Raise the bus using four jacks. (See Figure 1—ARI-hetra Mobile Lifting Systems.)

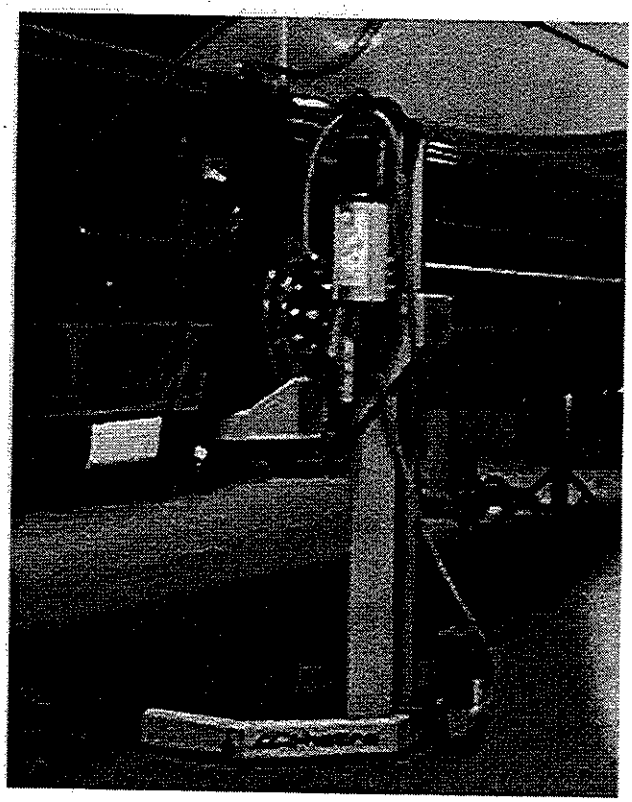

Figure 1—ARI-hetra Mobile Lifting System

Caution

Make sure that the jack stands are in the correct location. Body and/or frame damage can occur if the stands are misplaced.

Place the jackstands under frame rails. Do not use any other parts of the bus for the jackstands.

Be careful when placing the stands so no damage is done to the steering rod and ball joint.

4. Install four tall 15,000-pound jackstands, two in the front and two in the rear. (See Figure 2—Jackstand Locations.)
5. Loosen all required nuts and bolts.
6. Lower the bus enough to put bus weight on the jackstands.
7. Inspect for safe operation in all areas.

Warning

Never place hands or finger between parts of the suspension.

8. Remove all required hardware.

Caution

Do not over heat the frame or suspension hanger. Protect all wiring and fuel lines.

9. Cut the Huckspins. (Refer to Table 1—Huckspin to Capscrew Conversion.)

Caution

When a huckspin is removed, replace with the proper capscrew and a lock nut. (Refer to Table 1—Huckspin to Capscrew Conversion.)

10. Lower the suspension system using the ARI-hetra Mobile Lifting Systems.

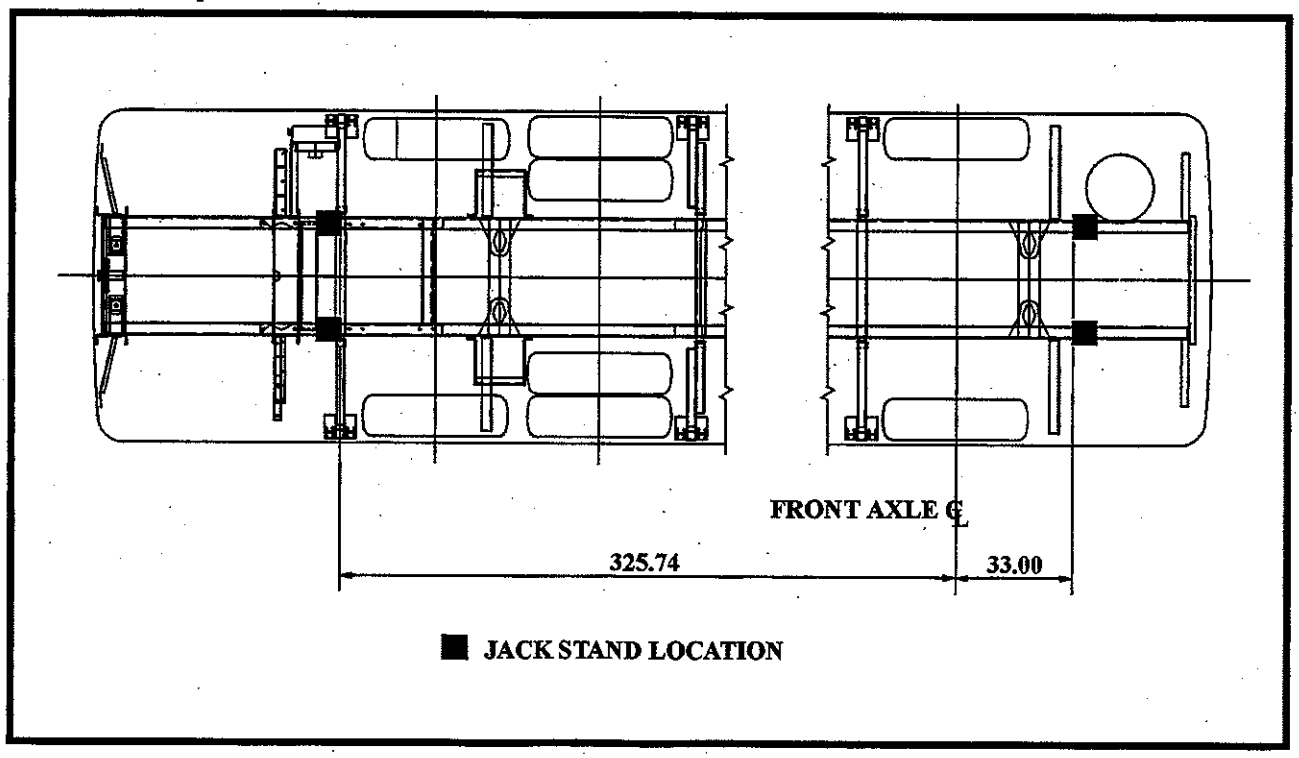

Figure 2—Jackstand Location

Caution

Make sure the top of the bus has height room.
Make sure that antennas are removed or folded.
Make sure that mirrors are clear from obstruction.

Technical Assembly Information

1. End link bushing orientation tapered bushing fit into stabilizer bar. Flat bushings fit to endlink bracket (6).
2. Coat bar assembly (1) and bushing (4) at contact areas in two places. Use bushing lube supplied with kit.
3. Install bushing over bar with flat face of bushing facing up to match mid-section bracket (3).

- **Stabilizer Bar Torque Values**

1. 1/2 inch bolts 75 to 85 foot-pounds (102 to 115 N•m).
2. 5/8 inch bolts 106 to 112 foot-pounds (144 to 152 N•m).

- **Air Bag Torque Values**

1. 1/2 inch bolts 25 foot-pounds (34 N•m).
2. 3/4 inch bolts 50 foot-pounds (68 N•m).

- **Front Suspension Torque Values**

1. 1 inch bolts 460 foot-pounds (624 N•m).
2. 1-1/4 inch bolts 750 foot-pounds (1017 N•m).
3. 1-1/2 inch bolts 1100 foot-pounds (1491 N•m).

Technical Installation Information

1. Replacement bushing for (21 and 22) is Ridewell Part Number 1110512B000.
2. Replacement bushing for (9) is Ridewell Part Number 1111795B000.

Axle Alignment Procedure

Caution

Mount Suspension with arrow marking on the eccentric bolt (20) at exactly 12 o'clock position.

1. Loosen nut on eccentric bolt (7).
2. Move axle using eccentric bolt head (20). Maximum movement is from 9-o'clock to 3-o'clock.
3. Tighten eccentric bolt (5) at final setting.
4. Weld anti-turn washer (11) over head of eccentric bolt (20).

Air Suspension Ride Height Specification

See Figure 3—Air Suspension Ride

Note

Maintain system air pressure in excess of 100 PSI (689 kPa). Park the coach on a level surface. Air spring height is measured bottom of frame to top of air spring seat.

The correct measurement for the steer axle is eight inches and the correct measurement for the drive axle is eight inches. The tag axle measurement is determined by the drive axle measurement.

Height Control Valve Adjustment

1. Position vehicle on a level surface and maintain air pressure of 100 PSI (689 kPa).
2. Disconnect both height control valve linkage assemblies from the external actuating levers.
3. Move each actuating lever to a vertical down position to exhaust all air from the air springs.
4. Connect one actuating valve to the correct link assembly. Let air spring that is controlled by the matching valve fill until valve shuts off.
5. Measure air spring height. (See Figure 3—Air Suspension Ride Height Specification.)
6. Adjust valve by loosening adjustment lock nut.
7. Move the nylon block until the proper height dimension is correct.
8. Tighten adjustment lock nut.

Note

After moving the actuating lever, 2 to 6 seconds will elapse before air starts to flow through the valve due to a time delay.

9. Disconnect link assembly and deflate air spring about half way.

Note

If necessary, repeat steps 10, 11 and 12 until proper air spring height is accomplished.

10. Re-connect link assembly to inflate spring.
11. Re-check spring height dimension when valve shuts off.
12. Re-measure spring height dimension.
13. Disconnect the properly set height control value.
14. Move the actuating lever to a vertical down position to deflate springs.
15. Move to the other link assembly and repeat all settings for height adjustment.
16. Connect both valve actuating levers to the correct valves.
17. Re-connect link assembly to inflate spring.
18. Re-check spring height dimension when valve shuts off.

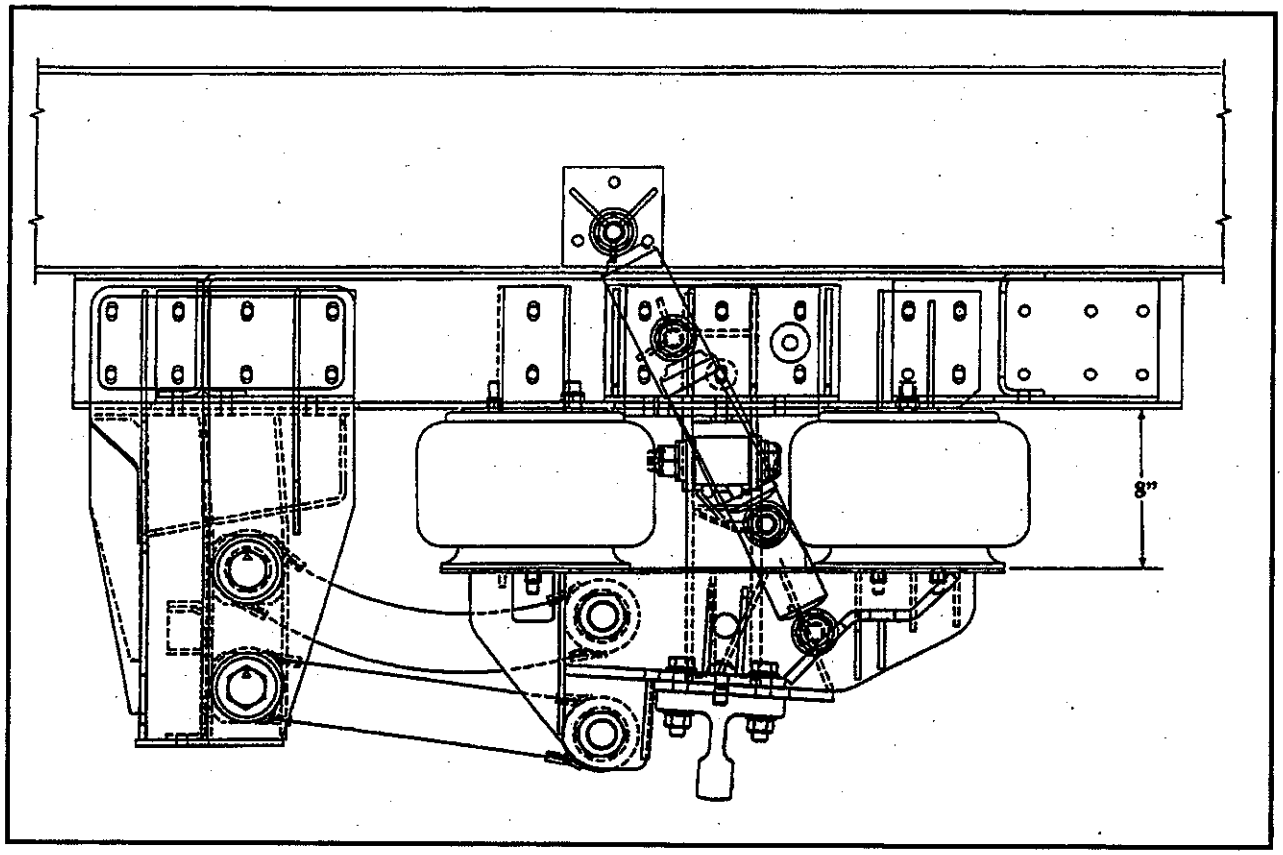

Figure 3—Air Suspension Ride

Front Suspension Disassembly

1. Remove nuts (3) and (4) and washers from air bag bolts. (See Figure 4—Disassembly of Suspension.)
2. Disconnect drag rod from steering arm on steering axle before lowering the bus.

- **Shock Absorber Removal**

Remove nut (5) and washer (7) from shock bracket (15).

- **Transverse Torque Rod Removal**

Remove nut (6) and bolt (2) from sway bar (9). (See Figure 5—Transverse Torque Rob and Bushing Removal..)

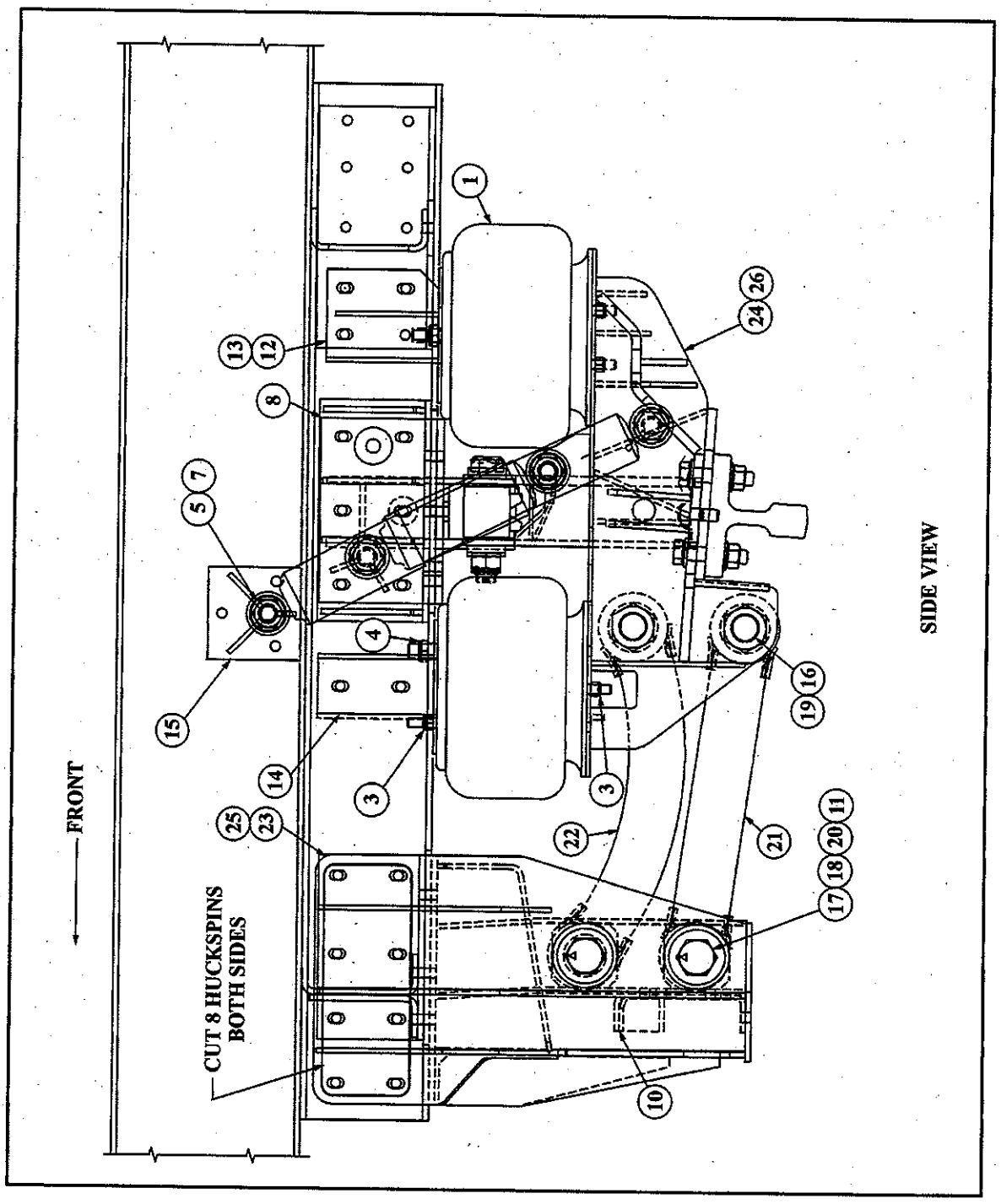

Figure 4—Disassembly of Suspension

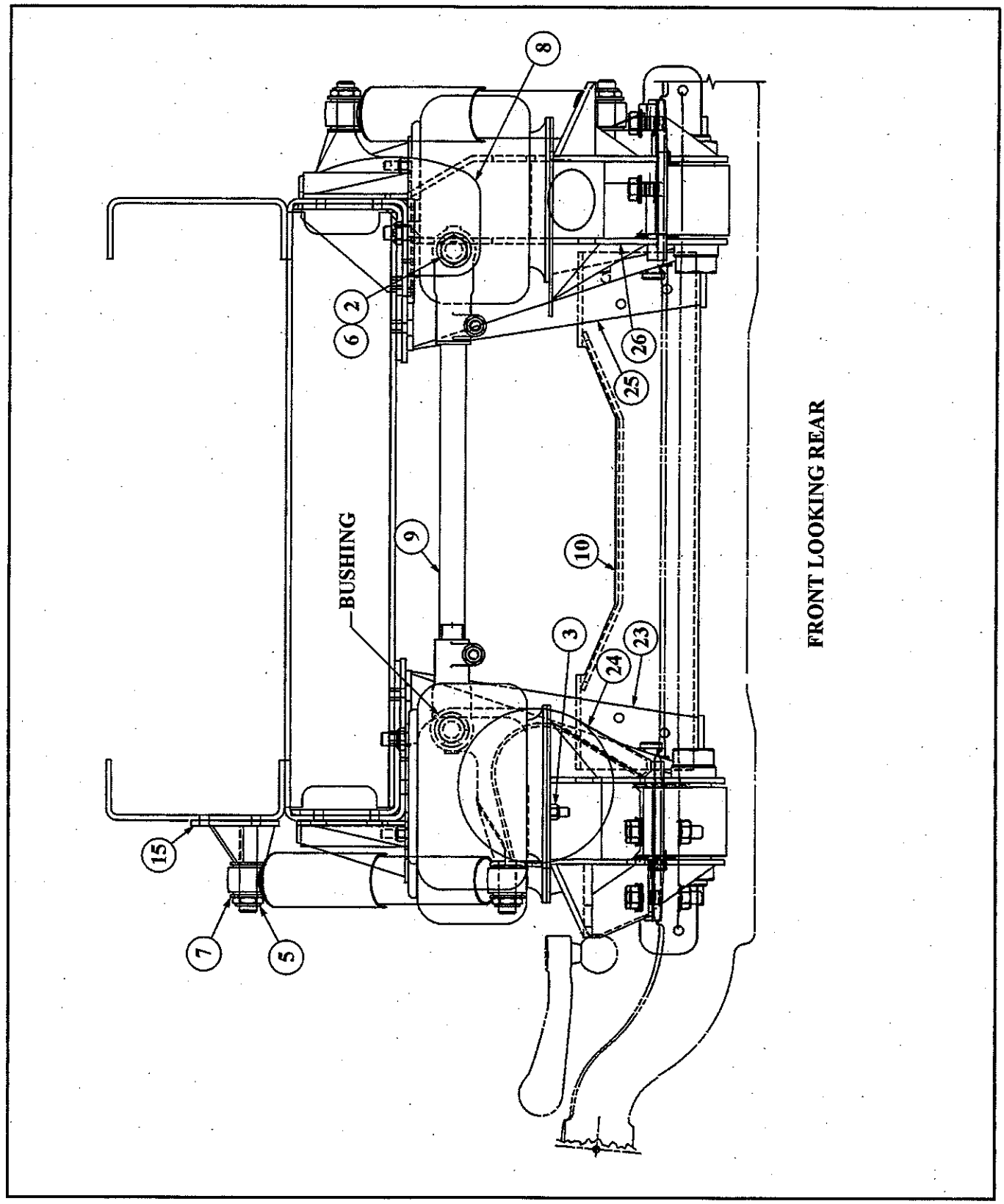

Figure 5—Transverse Torque Rod and Bushing Removal

Caution

Make sure that two flat washers are used, one under the nut and one under the capscrew head. Use lock nut with the capscrew replacing the huckspin.

HUCKSPIN					
BB P/N	Huck Number	Nominal Length	Min Grip Range	Max Grip Range	Nominal Length
1636943	-10	2.25	0.43	0.90	1.50
1636943	-10	2.25	0.43	0.90	1.75
1636950	-16	2.60	0.85	1.25	1.75
1636943	-10	2.25	0.43	0.90	1.75
1636950	-16	2.60	0.85	1.25	1.75
1746817	-20	2.85	1.09	1.50	2.00

CAPSCREW BOLTS THIS MATERIAL THICKNESS		BB P/N	USE FLAT WASHER	USE LOCKING NUT
Minimum	Maximum	---	---	---
0.25	0.75	0803239	1003045	0850800
0.50	1.00	0803148	---	---
0.50	1.00	0959452	---	---
0.75	1.25	0803205	---	---

Table 1—Capscrew to Huckspin Conversion

Front Suspension Stabilizer Bar Removal

- **End Link Assembly**

1. Remove the nuts (9) and washer (5) from the bolt (2). (See Figure 6—Front Suspension Stabilizer Bar.)
2. Remove the flat bushing (8).
3. Pull the bolt (2) to remove stabilizer bar from the end link.
4. Remove the flat bushing (8).
5. Remove the flat washer (5).
6. Remove the flat bushing (8).
7. Remove the flat washer (5).
8. Remove the sleeve (7).
9. Remove all of the flat washers and bushings.
10. Pull the bolt (2) to remove the stabilizer bar from end link.

- **Stabilizer Bar**

1. Remove the nuts and bolts securing bracket (3).
2. Disassemble the mid-bushing (4).

Caution

After suspension has been in operation for 6,000 miles (9656 km), all fasteners are to have a re-torque to recommended torque. Repeat procedure every 25,000 miles (40234 km).

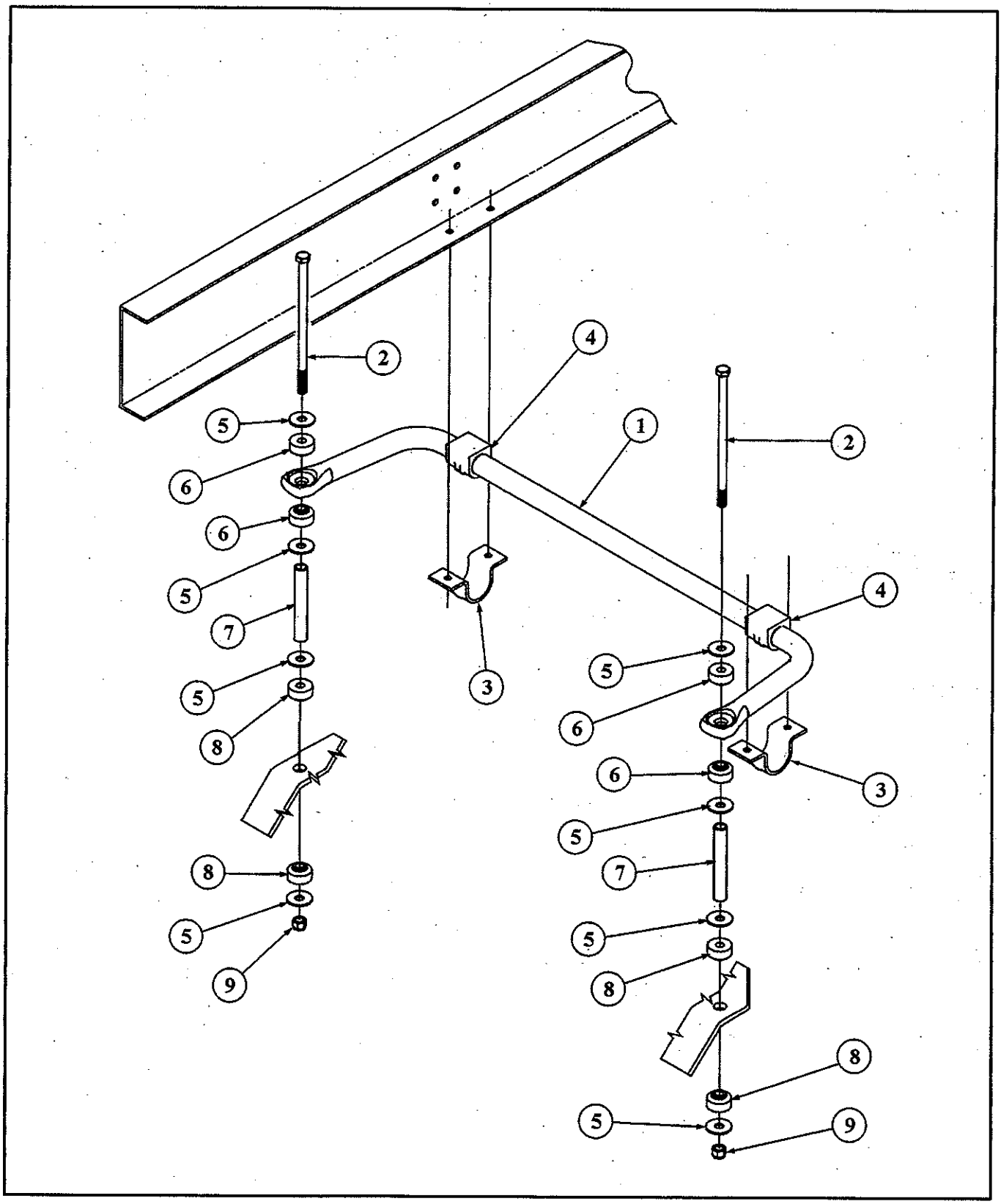

Figure 6—Front Suspension Stabilizer Bar

Rear Suspension Removal

Warning

Do not use the leveling jacks for this procedure. The leveling jacks are for tire changing and leveling of the bus.

Caution

Make sure the top of the bus has height room.
Make sure the antennas are removed or folded.
Make sure the mirrors are clear from obstruction.

1. Park the vehicle on a level surface.

Caution

A requirement to loosen all bolts and nuts is a step in the procedure. Do not remove any hardware at step 4.

2. Install six 15,000-pound (total capacity 90,000-pounds) jacks on the front and rear tires. The ARI-hetra Mobile Lifting Systems are used by Blue Bird (Model HDML 8-6); two lifts per axle.
3. Raise the bus using four jacks. (See Figure 1—ARI-hetra Mobile Lifting Systems.)

Caution

Make sure that the jack stands are in the correct location. Body and/or frame damage can occur if the stands are misplaced.

Place the jackstands under the frame rails. Do not use any other parts of the bus for jackstands.
Be careful when placing stands to avoid damage to the steering rod and ball joint.

4. Install four tall 15,000-pound jackstands two front and two rear, see Figure 2—Jackstand Locations.
5. Loosen all required nuts and bolts.
6. Lower bus enough to put bus weight on the jackstands.

Warning

Do not place any part of a body under bus until safety stands are in place. Never place hands or fingers between parts of the suspension.

7. Inspect for safe operation in all areas.
8. Disconnect all air lines to air bags and air brake cambers.
9. Disconnect ABS wiring to axle.
10. Disconnect rear axle from the drive shaft.
11. Disconnect the transverse torque rod from the rear axle housing.
12. Remove the bottom shock absorber nut and bolt.
13. Remove top nuts from air bag.
14. Lower the suspension system using the ARI-hetra Mobile Lifting Systems.

Rear Suspension Disassembly

1. Disconnect transverse torque rod from the rear housing. (See Figure 7—Transverse Torque Rod and Axle Housing.)
2. Remove the top bolt from the shock absorber.
3. Remove the air bags from the beam assembly. (See Figure 8—Shock Absorber and Air Bags.)

Fixed/Tag Suspension Removal

1. Disconnect all air lines to air bags and air brake cambers. (See Figure 9—Fixed/Tag Axle.)
2. Disconnect ABS wiring to axle.
3. Remove the bottom bolt (1) from the both shock absorbers.
4. Remove both air bags (2) from the beam assembly.

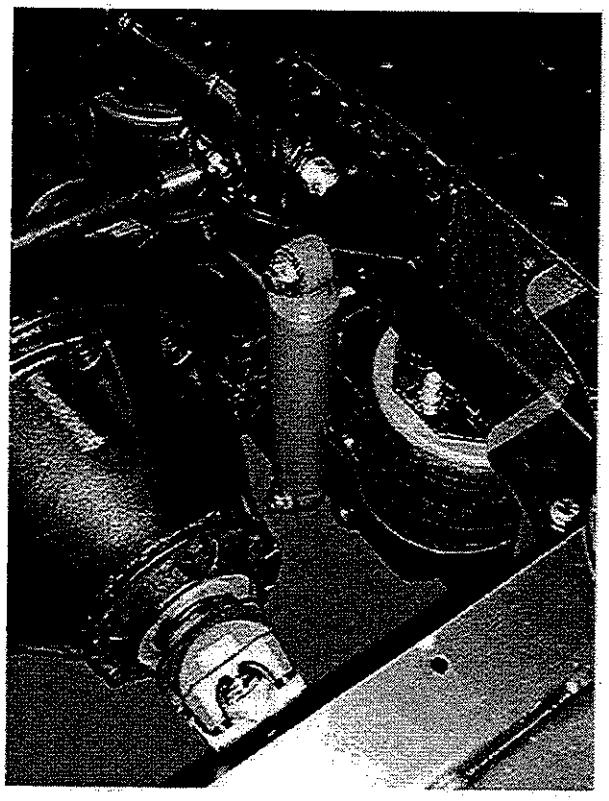

Figure 7—Transverse Torque Rod and Axle Housing

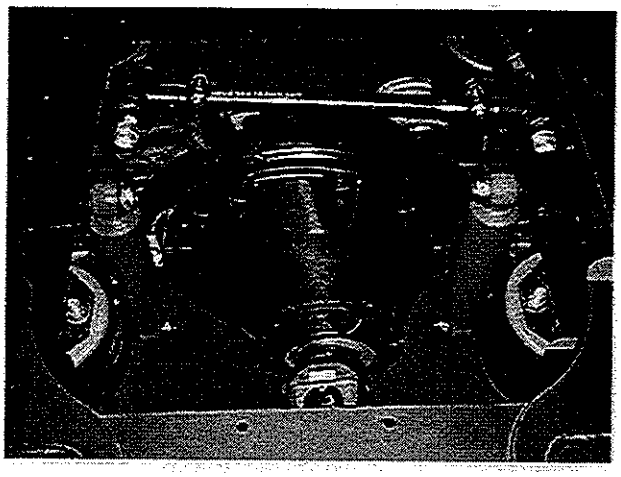

Figure 8—Shock Absorber and Air Bags

5. Remove nut and bolt from beam both bushing (3).

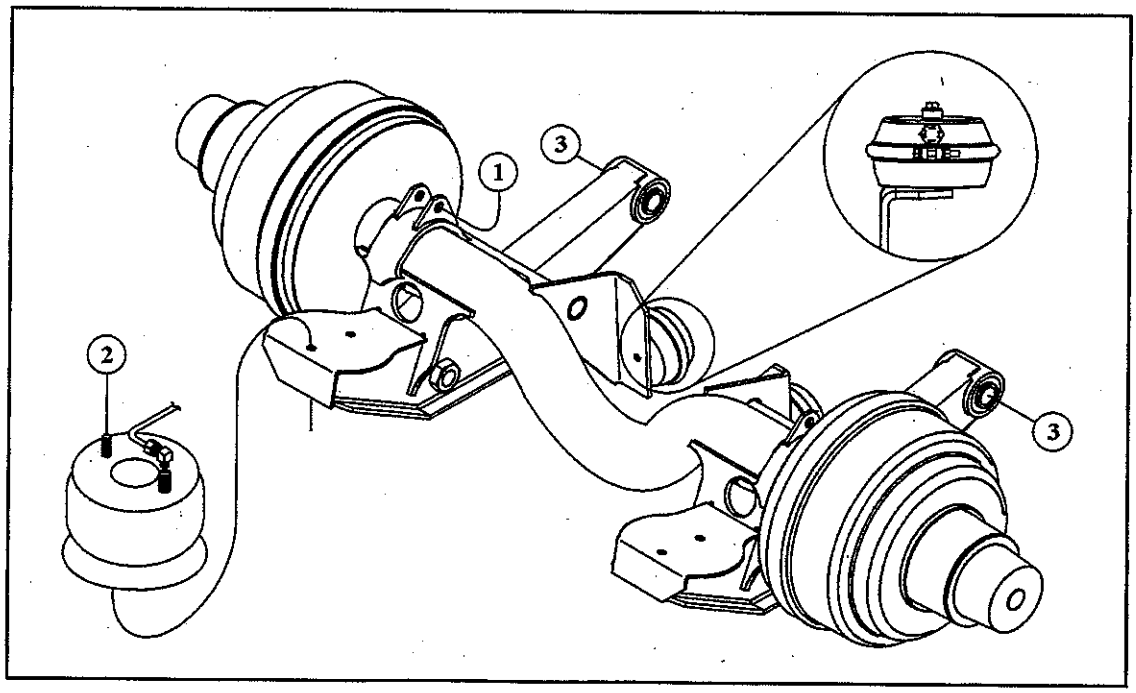

Figure 9—Fixed/Tag Axle

LTC Kneeling Feature

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

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Warnings apply to a procedure or practice that, if not correctly adhered to, could result in injury or death. Particular attention should be paid to sections of this manual where warnings appear.

Cautions

Cautions apply to a procedure or practice that, if not adhered to, could result in damage to or destruction of equipment.

Notes

Notes are used to explain, clarify or otherwise give additional insight for a given subject, product or procedure.

Introduction

The kneeling feature design is to lower the front of the entrance doorstep for easier access of boarding the bus.

Description of Operation

Warning

A bus equipped with the kneeling feature can drop suddenly and without warning. Use extreme measures to remain outside of the bus body and not up under the bus. Use jack stands to support the bus.

There is a control valve mounted near the horn on the mounting angle bracket. (See Figure 1—Height Control Valve Kneeling Feature.)

Adjustment is 6 to 12 PSI (41.4 to 82.8 kPa) made at the regulator valve on the Schrader valve. (See Figure 3—Front Air Suspension System with Kneeling Feature.)

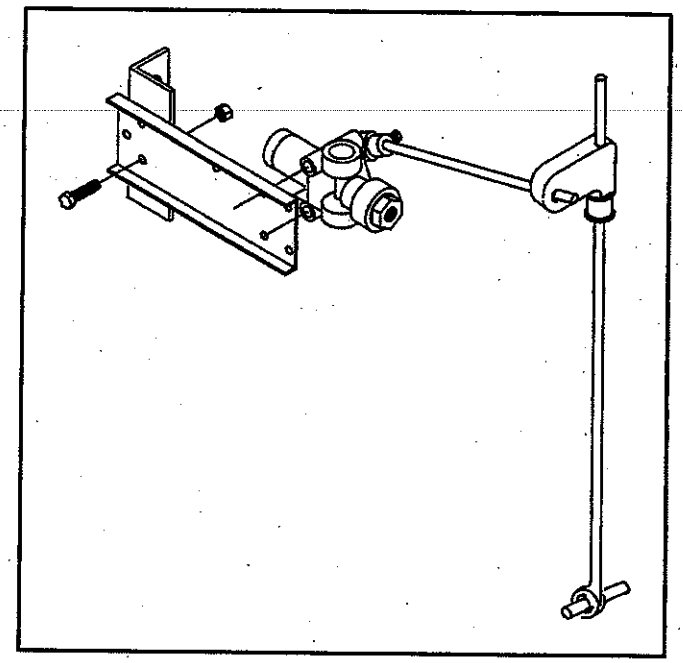

Figure 1—Height Control Valve Kneeling Feature

The kneeling feature is controlled by a kneel switch located on the front face of the shifter pedestal.

Note

The transmission must be in neutral and the parking brake applied for the kneeling feature to operate.

The adjusting positions at the switch are down, off, and up.

See Figure 2—Rear Air Suspension System with Kneeling Feature.

See Figure 3—Front Air Suspension System with Kneeling Feature.

To Lower the Bus

Note

Air is released from the front air suspension bags very rapidly. The entrance doorstep will drop three inches (76 mm) in three seconds. The horn sounds to give warning, and a light on the dash is illuminated.

1. Place the position switch in the down position.

2. Place the position switch in the off position.

Warning

Attention must be given to passengers' feet before using the kneeling feature.

To Raise the Bus

Place the switch in the up position.

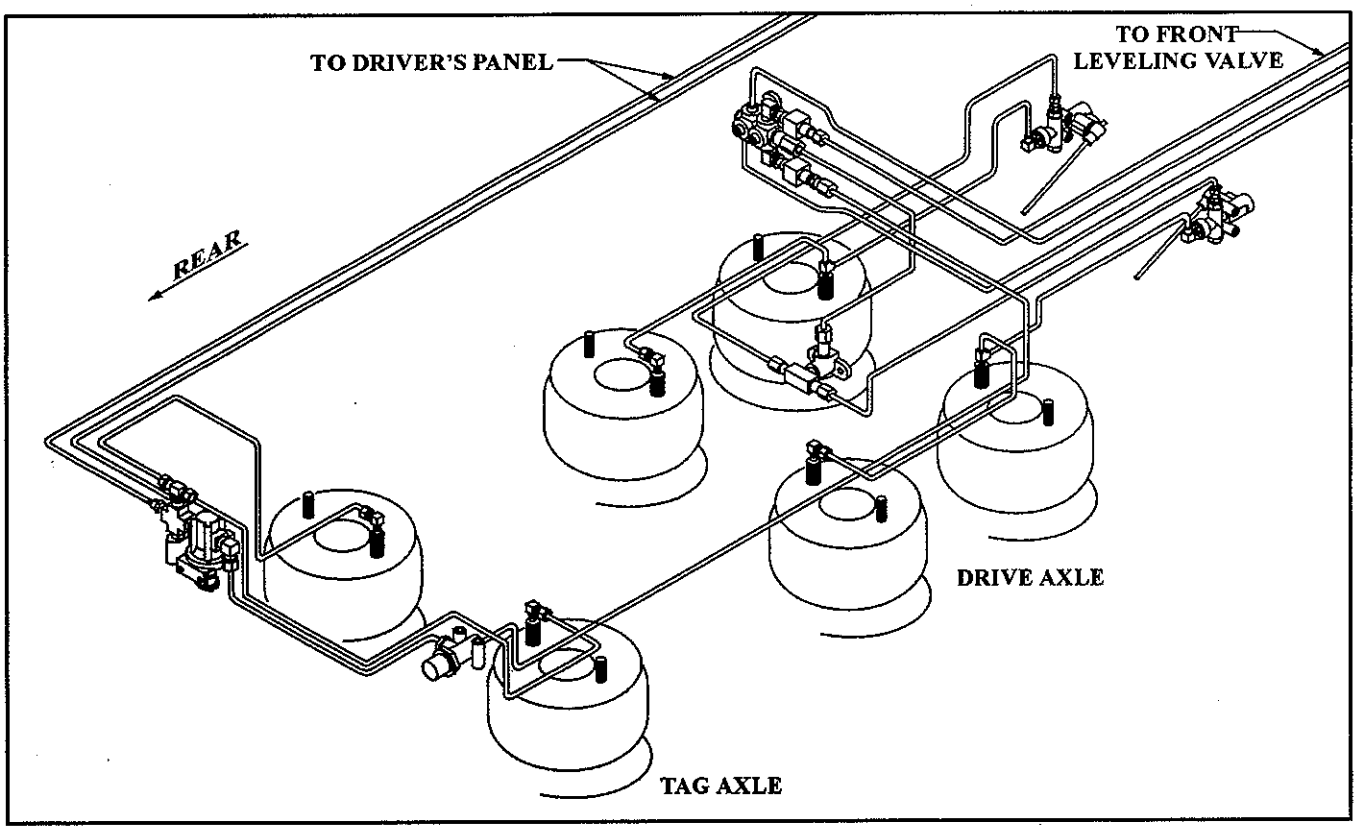

Figure 2—Rear Air Suspension System with Kneeling Feature

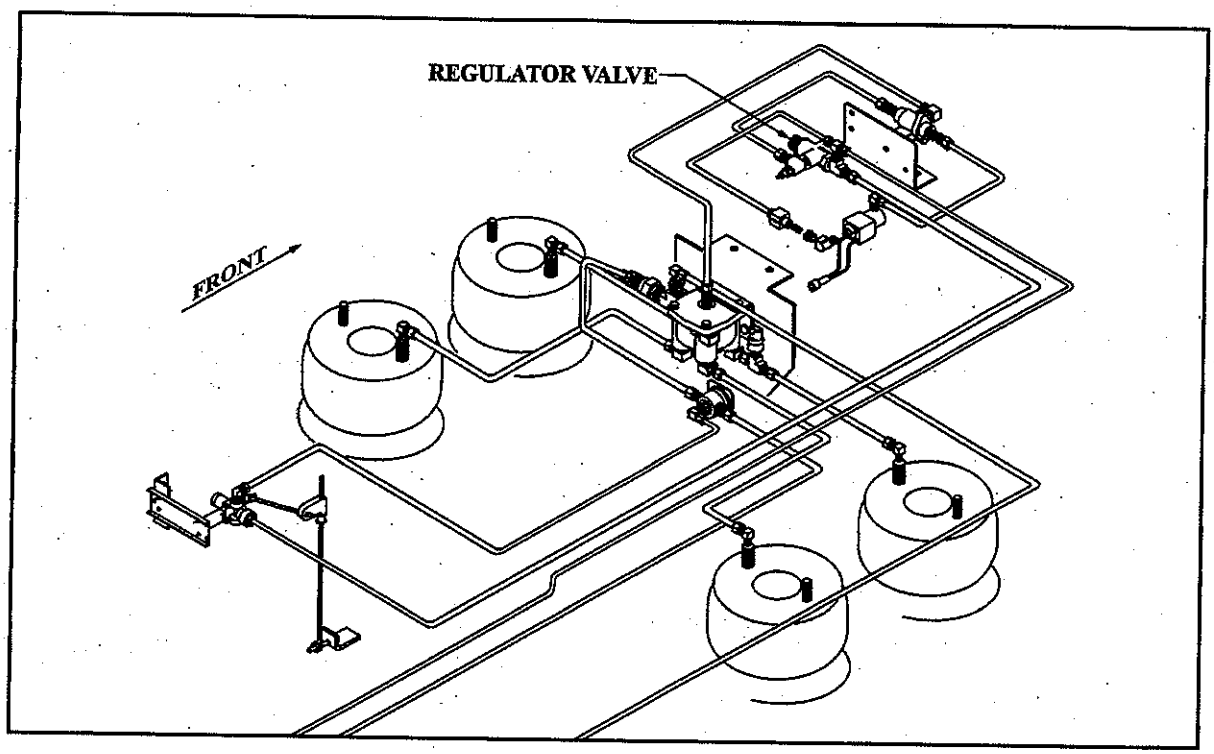

Figure 3—Front Air Suspension System with Kneeling Feature

LTC Transmission

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

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Cautions

Cautions apply to a procedure or practice that, if not correctly adhered to, could result in damage or destruction of equipment.

Notes

Notes are used to explain, clarify or otherwise give additional insight for a given subject, product or procedure.

Introduction

These procedures were documented using a Blue Bird LTC bus with a Allison transmission. Vehicles with other engines or transmissions will use similar, and in most cases identical, procedures.

These procedures are generic for connections, fittings, lines and other parts. All need to be removed. However, it may not be appropriate or possible to remove connections, fittings, lines and other parts on the vehicle. Parts can be removed at any time when necessary.

Tools

- Common mechanic hand tools.

Note

The jack or dolly must be strong enough to take the weight of the transmission.

Warning

Use the parking brake. Use wheel chocks at the rear wheel. Make sure the vehicle is stable before moving under the vehicle.

Preparatory Work

1. Park the vehicle on a level surface. Once parked, set the parking brake and chock the rear wheels. Though a lift is not required, much of the under vehicle work would be made easier via using a lift.
2. Disconnect the battery.

Note

If using a hydraulic lift, ensure that there is enough room for the transmission to clear axles.

3. Support the vehicle with jack stands.
4. Place the jack stands under the chassis frame rails.
5. Position the jack stands to balance the transmission.

Warning

Transmission oil is flammable and toxic to the skin, eyes and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Drain fluid in a well-ventilated area.

6. Drain transmission fluid into appropriate recovery containers.

Transmission Removal Configuration

All transmissions with Ridewell Suspension.

1. Remove brake air or hydraulic lines and ABS wires.
2. Remove the nuts and bolts directly below transmission and on the left and right side.

3. Secure the steering linkage to prevent damage.

Transmission Electronic Troubleshooting

See Figures 2, 3, 4, and 5 for electronic diagrams.

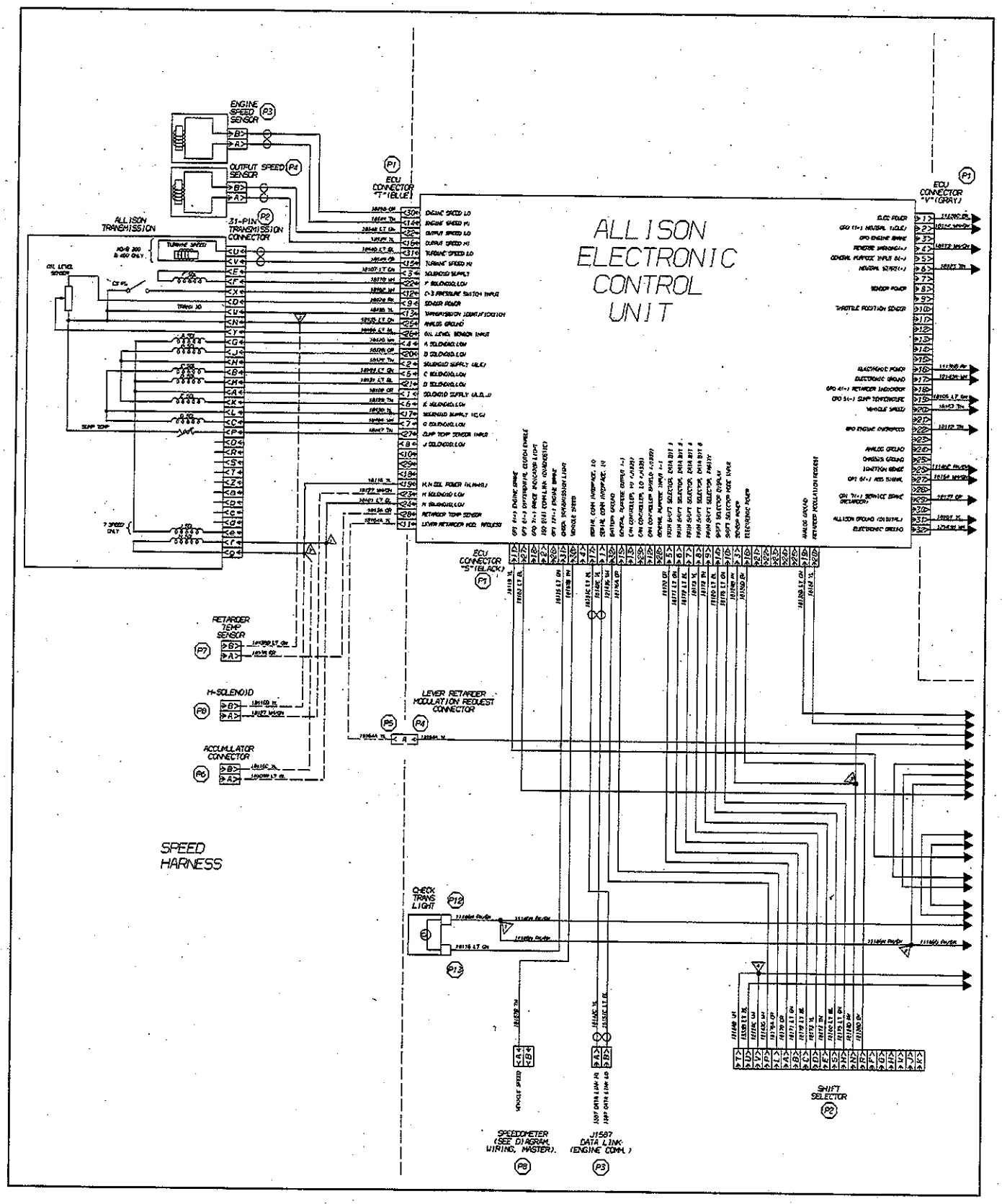


Figure 1—Electronic Control Diagram (1 of 2)

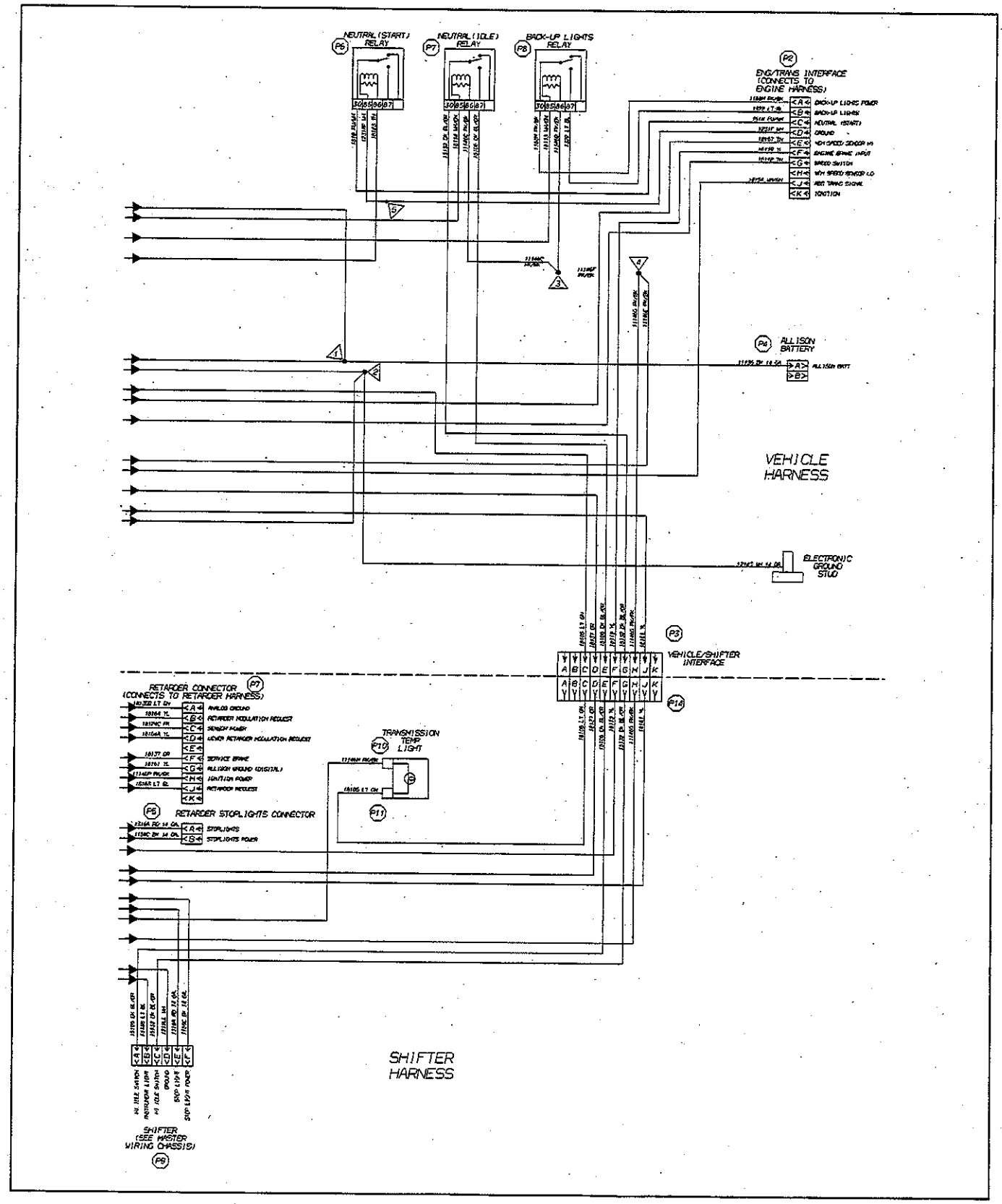


Figure 2—Electronic Control Diagram (2 of 2)

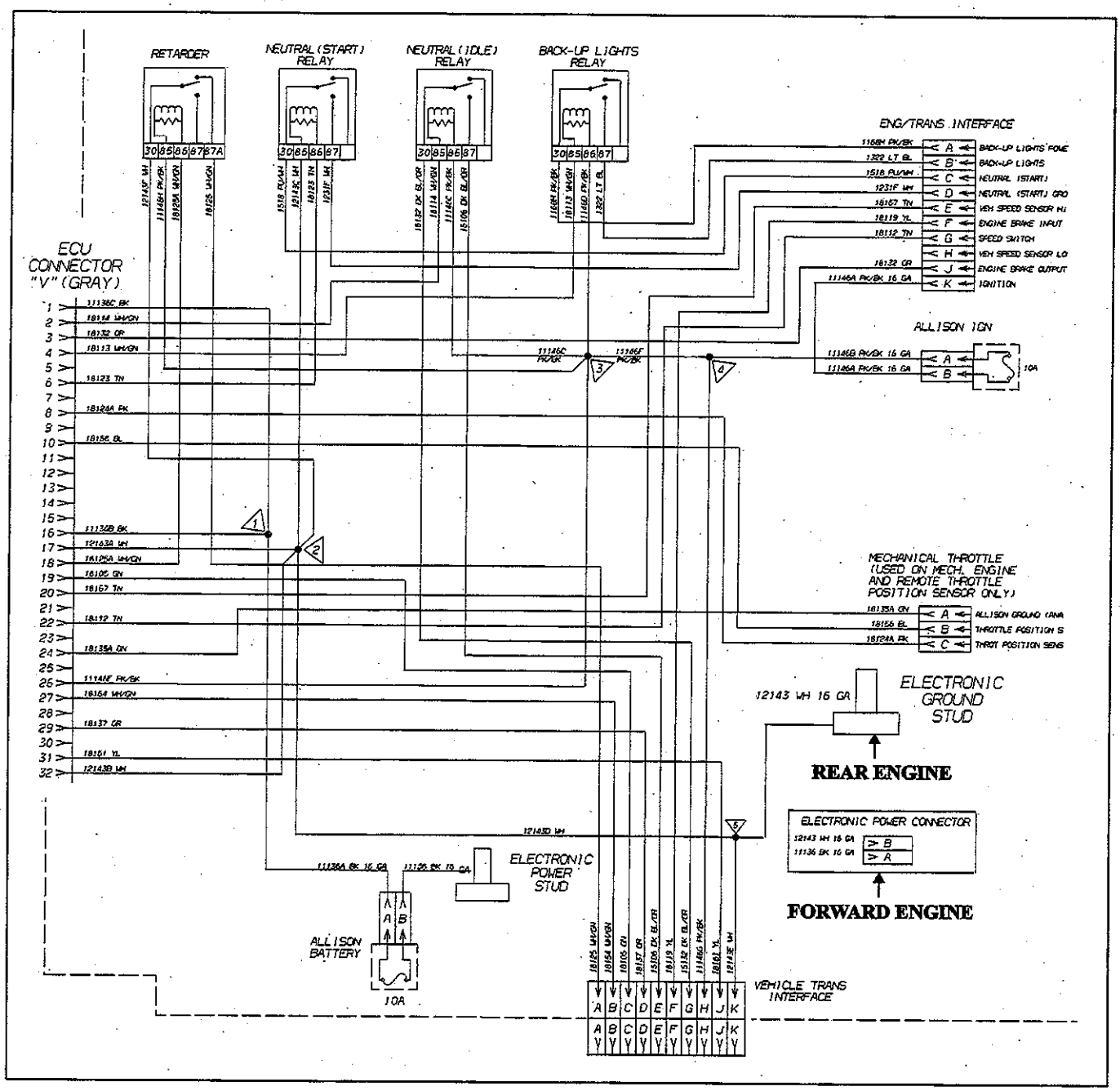


Figure 3—Electronic Control Diagram

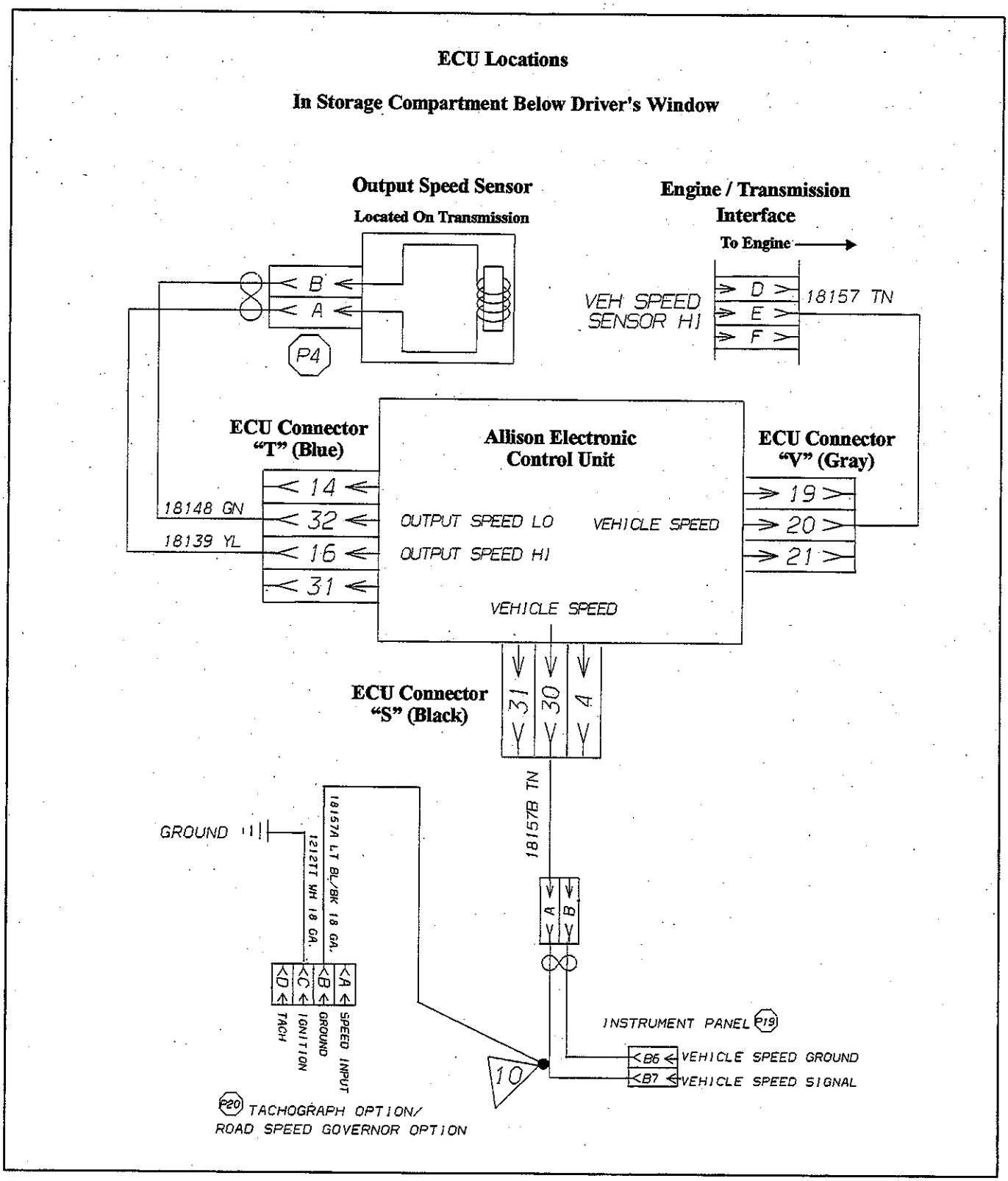
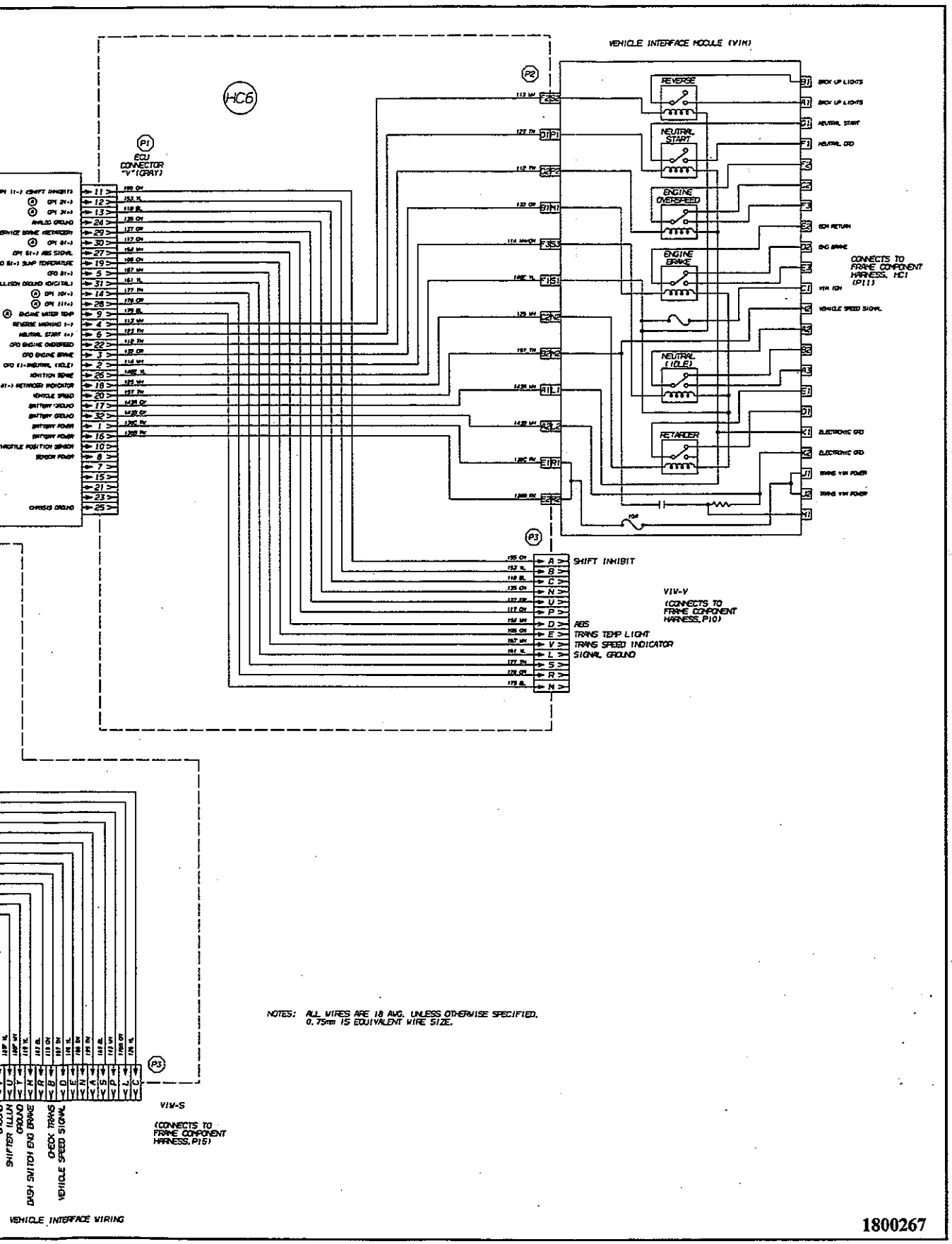


Figure 4—Electronic Control Unit Location



orld Transmission Wiring

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Transmission Removal

Note

If the transmission is removed because of a failure, the fluid system should be flushed. Check with an approved Allison dealer to determine the appropriate flush procedure.

1. Disconnect battery cable.

2. Disconnect backup switch (6), neutral start (5) and speedometer switch (4) for the Allison transmission. (See Figure 6—Backup, Neutral Start Switch and Speedometer.)

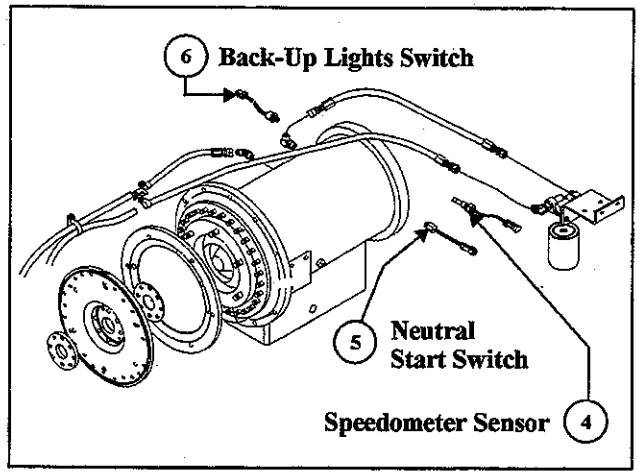

Figure 6—Backup Neutral Start Switch and Speedometer.

3. Disconnect coolant hose (15) from elbow (54) and discard O-ring. (See Figure 7—Transmission Hoses.)

4. Disconnect coolant hose (14) from elbow at filter.

5. Disconnect transmission fluid (13) from elbow (12) at filter.

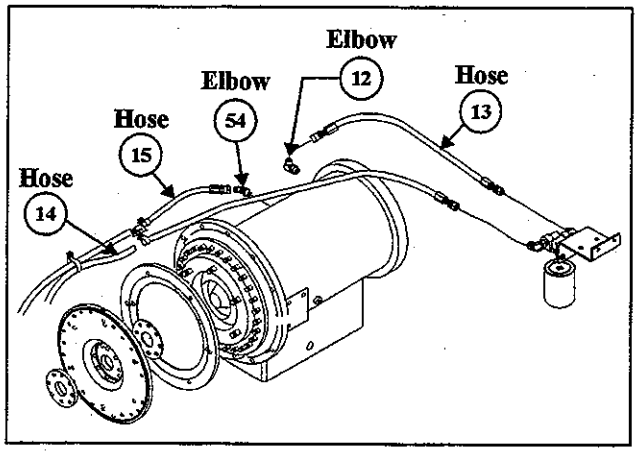

Figure 7—Transmission Hoses

6. Disconnect electronic shift (8A). (See Figure 8—Electrical Connections.)

7. Disconnect transmission air throttle control (8B).

8. Disconnect neutral start switch (5).

9. Disconnect the Allison transmission speedometer (4).

10. Disconnect backup light switch (6).

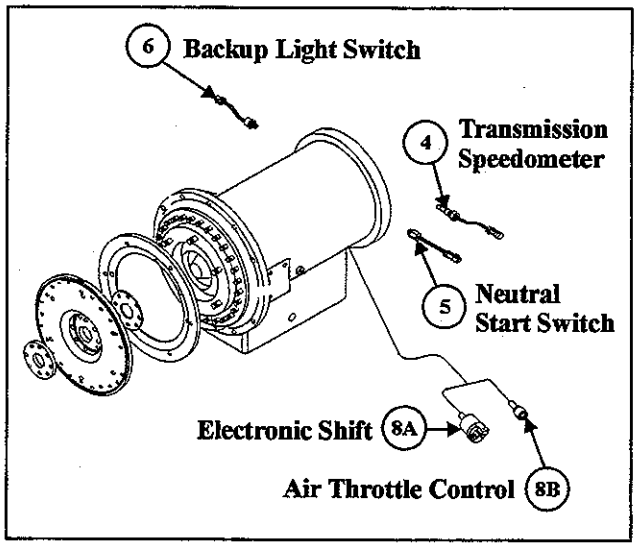

Figure 8—Electrical Connections

11. Remove nut (31), bolt (29) and washer (30) from bracket (20). (See Figure 9—Dipstick Removal.)

12. Remove dipstick tube (16).

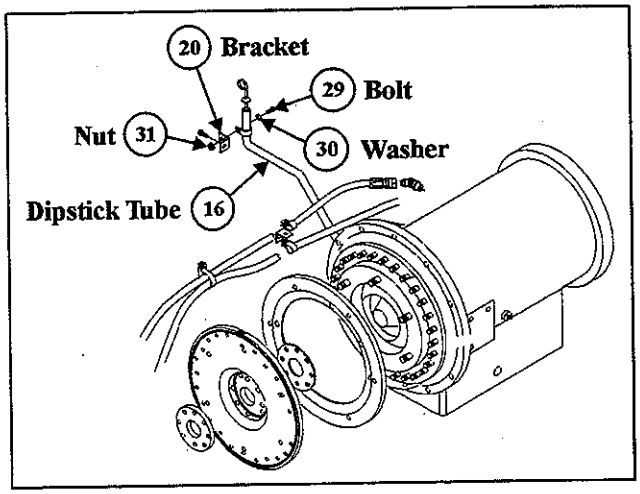

Figure 9—Dipstick Removal.

Caution

Make sure that the transmission is supported before removing bolts.

13. Remove 4-bolts (18) from bracket (17) on drive shaft. (See Figure 10—Drive Shaft Yoke.)

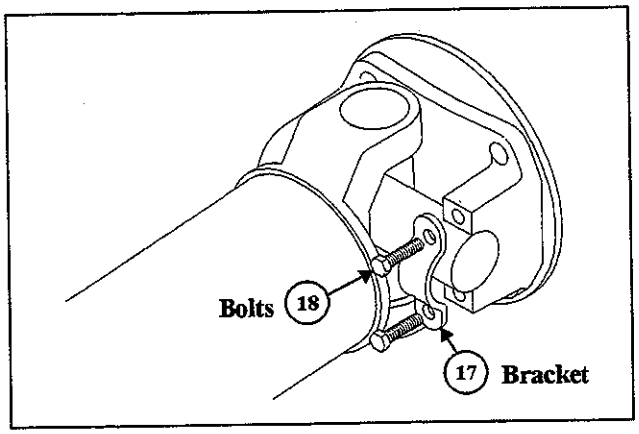

Figure 11—Drive Shaft Yoke

Caution

Make sure that all connections around the transmission are in fact disconnected.

14. Remove six bolts (A) from flange adapter.

15. Remove bell housing capscrews (28) and lock washers (27). (See Figure 11—Bell Housing.)

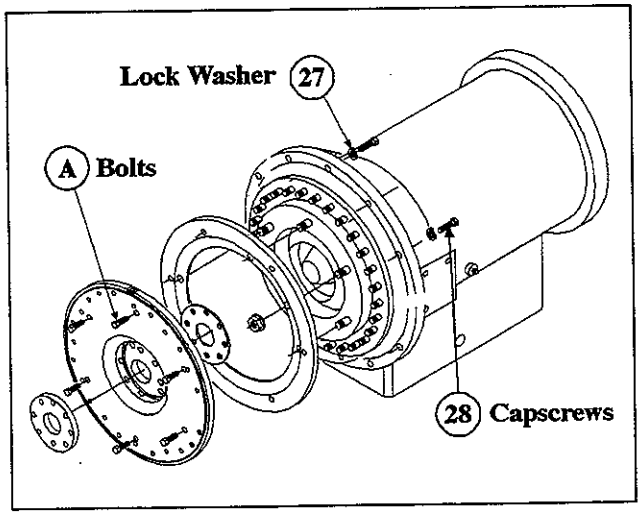

Figure 11—Bell Housing

16. Slide transmission aft to disengage engine.

Transmission Installation

1. Position the transmission directly behind the engine flywheel.

2. Turn the engine by hand to align the hole on the flex plate with the access hole on the engine bell housing. Use a dowel or drift pin to help align the holes.

Caution

Do not install bolts until all holes are in alignment.

3. Turn the torque converter until the attach hole aligns with the dowel or drift on the flex plate.

4. Place the engine and transmission bell housing together.

5. Install washer (27) and bolts (28) AT-545 and torque to 50 foot-pounds (67.8 N•m).

6. Install washer and bolts MD transmission torque to 38 to 43 foot-pounds (51.5 to 58.3 N•m).

7. Remove dowel or drift.

8. Install the first flex plate/torque converter bolt, do not torque.

9. Turn the engine crankshaft by hand until boltholes line up.

10. Install bolts torque to 38 to 45 foot-pounds (51.5 to 61.0 N•m).

11. Install bolts MD transmission torque to 18 to 21 foot-pounds (24.4 to 28.5 N•m).

12. Install dipstick tube.

Caution

Make sure that all lines and wires are 2 or more inches away from the exhaust system.

13. Connect the fluid lines and coolant lines.

14. Attach the drive shaft and the universal joint to transmission output shaft yoke.

15. Service the transmission check for leaks.

Notice for Extended Transmission Coverage (ETC)

Most Allison automatic transmissions purchased at retail for use in on-highway vehicle applications are eligible for coverage. ETC may be purchased only within 12 months after delivery of the vehicle to the first retail purchaser.

Use of TranSynd™ or Test Engineering Specification 295 (TES 295) equivalent transmission fluid is a requirement for the full term of the Extended Transmission Coverage. The use of TranSynd or TES 295 equivalent transmission fluid is required for all transmission models, excluding off-highway transmission models. TranSynd or TES 295 equivalent transmission fluid must be installed during the first initial transmission fluid change or one month following the ETC registration, whichever occurs later. Proof of transmission fluid maintenance may be required. Failure to comply with the use of TranSynd of TES 295 equivalent transmission fluid will result in termination of the ETC contract. Any repairs that occurred outside the standard warranty period will not be honored.

ETC Coverage

ETC is available for one, two or three years with unlimited mileage/hours for the transmission as purchased from Allison Transmission. Allison will pay 100% parts and labor for covered repairs during the ETC coverage period.

Agreement Period

ETC coverage time is measured from the end of the standard warranty period.

Terms and Conditions

The terms and conditions under which Allison Transmission offers Extended Transmission Coverage are set forth on the back of the ETC Agreement Registration available from any authorized Allison Transmission Distributor or Dealer.

LTC Hydraulic Fan Drive System

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

List of Tables

Safety

The purpose of this safety summary is to ensure the safety and health of individuals performing service and/or operation on this Blue Bird product, and the protection of equipment. Before performing any service or operating procedure, individuals should read and adhere to the applicable warnings and cautions located throughout this manual.

Warnings

Warnings apply to a procedure or practice that, if not correctly adhered to, could result in injury or death. Particular attention should be paid to sections of this manual where warnings appear.

Cautions

Cautions apply to a procedure or practice that, if not adhered to, could result in damage to or destruction of equipment.

Notes

Notes are used to explain, clarify or otherwise give additional insight for a given subject, product or procedure.

Introduction

These procedures are documented using a Blue Bird LTC bus with a Cummins M11 or Detroit Diesel Series 60 engine and an Allison B500 World Transmission. The LTC bus uses a Hayden™ dual hydraulic fan cooler. The hydraulic fan cooler stabilizes hydraulic oil temperature to ensure maximum fan performance.

Hydraulic Fan Drive Components

For the Hydraulic System S-60, see Figure 1.

For the Hydraulic System Series M11/ISM, see Figure 2.

Description of Operation

The fan drive system responds to cooling requirements by monitoring engine coolant temperature and charge air temperature.

The system then provides a modulated fan speed to meet cooling requirements for each system. (See Figure 1—Hydraulic System M11 ISM and Figure 2—Hydraulic System Series 60.)

A hydraulic fan motor directly drives the engine-cooling fan. Modulated fan speed will depend on the amount of oil flowing through the fan motor.

The oil flow is measured in Gallons Per Minute (GPM). Low oil flow results in low fan speeds. As oil flow increases, fan speed increases. Oil flow through the fan motor will depend on three main areas of the hydraulic fan drive system:

Pump speed is the amount of oil allowed to bypass the Fan motor Pilot control valve assembly. A pump creates oil flow necessary to operate the hydraulic fan drive system. The pump is a positive displacement gear type pump.

As engine Revolutions Per Minute (RPM) increase, oil flow increases proportionately. As engine RPM decreases, oil flow decreases proportionately.

The fan motor bypass valve controls the amount of oil allowed to bypass the fan motor. The valve is located in the fan motor control valve, which is integrated into the fan motor housing.

The hydraulic pilot operated circuit controls the fan motor bypass valve. The hydraulic pilot circuit is in turn controlled by a charge air override valve and a thermovalve.

Tools Required

High pressure hydraulic test cut off valve
0 to 4000 PSI pressure gauge
Phototach
Power steering analyzer
0 to 30 gallon per minute flow meter.

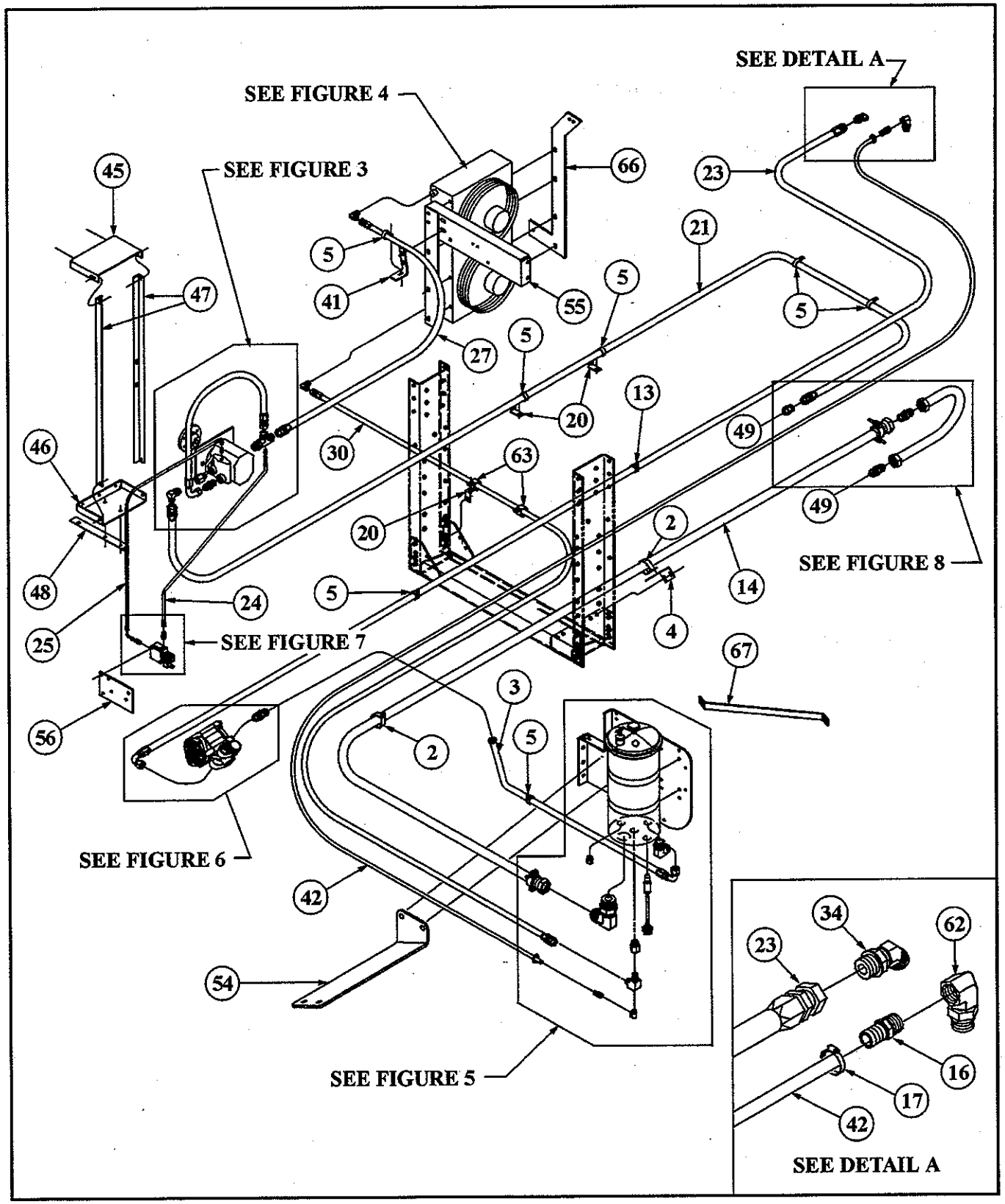

Figure 1—Hydraulic System S-60

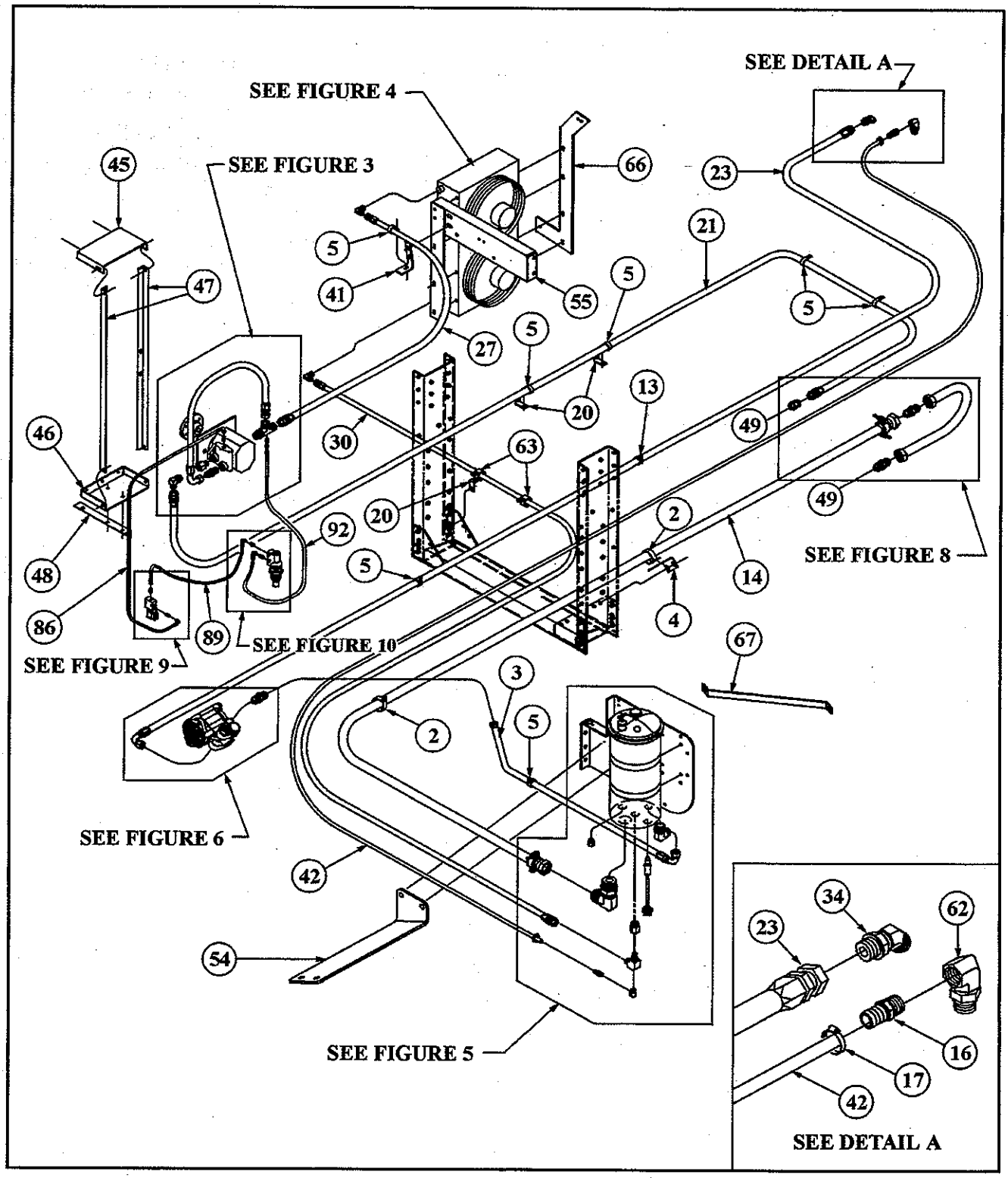

Figure 2—Hydraulic System M11 ISM

Hydraulic Fan Drive Troubleshooting

Problem	Troubleshoot	Repair
Hydraulic oil is not overheating. Hydraulic oil overheat indicator light is on.	Warning circuit or temperature sensor has failed	Disconnect hydraulic oil temperature sensor connector. If light goes off, temperature sensor has failed Replace sensor. If light stays on, the warning circuit is grounded Check and repair circuit.
Hydraulic oil overheat light on.	Hydraulic oil overheating (Hydraulic System Failure) **Caution** *Do not probe temperature sensor. Electronic circuitry can be damaged.* Hayden hydraulic oil cooler contaminated externally.	Refer to Hydraulic Fan Drive Troubleshooting Clean the cooler thoroughly
Hayden oil cooler electric fan will not run.	Check Hayden fan fuse for continuity. Check for 12-volt on number 30 pin of the Hayden fan cooler.	Replace fuse if no continuity. If 12-volt is not present, check the circuit between fuse and relay.
	Jumper between terminal 30 and 87 of the fan relay. If the fan does not run, jumper 12-volt to terminal A and a ground to terminal B of the Hayden fan connector. If the fan motor does run. The fan motor and fan circuits are okay. The relay or the hydraulic oil sensor has failed. With ignition on, check for 12 volt on terminal, 86 on the Hayden fan relay. Disconnect the hydraulic oil temperature sensor at connector P2 Jumper a ground to terminal 85 of the Hayden fan relay.	If the motor does not run, the motor has failed. Replace motor If the motor does not run, the motor has failed. Replace motor Check relay and/or temperature sensor. If the fan runs, the hydraulic oil sensor or the circuit is at fault. If the fan runs, the hydraulic oil sensor or the circuit is at fault.

Table 1—Troubleshooting (1 of 2)

Problem	Troubleshoot	Repair
Hayden oil cooler electric fan will not run.	Jumper a ground to terminal C on the temperature sensor connector P2. With ignition on, check for 12-volt on pin B of the temperature sensor connector P2. Check for ground on pin A of the temperature sensor connector P2. If test on pins A, B, and C check okay, the temperature sensor is faulty.	If fan runs, circuit is okay. If the fan does not run, check circuits between sensor and relay. If 12-volt is not present, check circuit. If a ground is not present, check circuit. Replace sensor.
Noisy Fan Drive	Low oil supply	Check oil level and refill.
	Restricted oil supply	Check for restriction to oil supply hose inside of reservoir. Check for restriction in supply line. Check for kinked supply line. Look for obstruction inside of supply hose. Check for a collapsed supply hose.
Air in the oil supply	**Note** *Remove the dipstick, shine a light into the reservoir, and look for bubbles. Oil should be air free.*	Check oil level in reservoir. Check for loose fitting on supply lines. Check for restriction in supply hose. Check the hydraulic pump shaft seal.
Mechanical Failure	**Note** *Rotation of fan is done in the normal rotation direction.*	Check for excessive metal in filter; this will indicate a mechanical failure. With the engine off, spin the fan by hand and check for free rotation.
Fan not rotating	Hearing excessive noise	Remove and replace motor.
Normal oil color Air in the supply line	**Note** *Oil overflowing will have air mixed with it or will be foamy.*	Reservoir may be over filled. Check for loose connection on the supply hose. Check for restriction in supply hose. Check hydraulic pump shaft seal.
Discolored oil is black like engine oil		Check pump shaft seal. Seal has failed allowing engine oil to transfer into the hydraulic system.

Table 1—Troubleshooting (2 of 2)

Caution

Do not operate bus with a coolant leak, engine oil leak, or hydraulic oil leak. Major engine damage will occur.

Make sure that all clamps on hoses or tubes are tight to prevent leaks of air or fluid. Make sure that all screws and bolts are tight to prevent damage to vehicle.

Engine Over Heating.

- **A-Check Engine Coolant Level**

Inspect all hoses for leaks.

Inspect all valves for leaks.

Inspect for radiator blockage.

- **B-Check Hydraulic Oil Level.**

Check reservoir level.

Inspect all hoses for leaks.

Inspect all valves for leaks.

- **C-Check for Air in the Hydraulic Oil**

Remove the dipstick

Shine a light in the reservoir and look for air bubbles. If air bubbles are in the oil:

Check oil level in reservoir

Inspect connections on the pump supply line.

Inspect restriction in supply hose, internal and external.

Inspect hydraulic pump shaft seal.

- **D-Check De-Energize the Charge Air Override Solenoid (CAOS)**

Caution

Do not test if engine temperature is above 212 °F, as major engine damage will occur.

Note

De-energizing the CAOS will cause the fan to operate in a charge air override mode all the time, rather than cycling on and off to meet charge air-cooling needs. In this mode of operation, the hydraulic fan drive system will operate at approximately 50% to 60 % of maximum efficiency.

Override Solenoid (CAOS)

If the fan speed does not increase as engine speed increases, disconnect the electrical circuit at the CAOS or the electrical circuit at the charge air override sensor.

Accelerate the engine to full RPM and observe fan speed.

If there is a large increase in fan speed with the CAOS de-energized, the thermovalve is at fault. If so, replace the thermovalve.

If there is no large increase in fan speed, go to step I-Check Hydraulic Fan Circuit Pressure.

If the engine temperature is below 200 degrees Fahrenheit, disconnect the electrical circuit at the CAOS. Disconnect the electrical circuit at the charge air override sensor. Test-drive the bus to determine if this resolves the over heating.

If this resolves the problem, the thermovalve is at fault. Replace the valve.

If this does not fix the problem, refer to step I-Check Hydraulic Fan Circuit Pressure.

Caution

Do not operate a bus with the CAOS de-energized for long periods. This is a test procedure only. Operating the bus with the CAOS de-energized can result in the following conditions:

Shortening the life of the hydraulic fan drive system

Increasing service requirements for the HFD

Decreasing fuel mileage

Over cooling the engine

Shortening the life of the engine thermostat

Decreasing efficiency of the engine

Adversely affecting the engine's emissions system

Caution

Operating the hydraulic fan system in a charge air override mode may provide adequate cooling under light operating loads and cooler weather. Bus may over heat under heavier loads and hotter climate.

- **E-Check the Condition of the Fan Blade**

Warning

Rotating fan blades can cause serious bodily injury.

1. Inspect for cracked, chipped, or broken fan blades.

2. Replace the fan if needed

- **F-Check the Fan Motor for Free Rotation**

Note

The hydraulic fan drive system should be thoroughly flushed when the system has been opened for mechanical repair.

Note

The fan should rotate smoothly with some resistance from oil in the fan motor.

With the engine off manually rotate the fan. A rough rotation indicates a mechanical failure in the fan motor. In this case, repair or replace the fan motor.

- **G-Check Radiator for External Contamination**

Inspect the entire area of the radiator and the charge air cooler for obstructed airflow using a light source.

Note

The charge air cooler may have to be removed to properly clean the radiator.

Clean the radiator and charge air cooler as necessary.

- **H-Check Radiator and Charge Air Baffles**

Note

Missing or damaged baffles can cause heated engine compartment air to re-circulate through the radiator causing an overheating condition.

Check the condition of the baffles between the radiator and the charge air cooler.

Check the condition of the baffles between the charge air cooler and the bus body.

Replace or repair baffles as necessary.

- **I-Check Hydraulic Fan Circuit Pressure**

1. Check hydraulic fan circuit pressure with engine temperature between 205 and 210 degrees Fahrenheit.

There are two methods for checking the pressure.

Method 1

Do not exceed maximum pressure ratings for the system. Bodily injury can occur.

Install a test fitting in hydraulic line and pressure gauge that will function from 0 to 4000 PSI.

Start the engine and accelerate to full RPM while observing the pressure gauge.

Compare the pressure with the specifications. (See Table 2—Hydraulic Cooling System Performance.)

If the pressure reading is low, the Hydraulic Fan Drive System (HFDS) is at fault. Go to step I.

If the pressure reading is correct and the fan speed appears to be correct, this is an indication that the over heating is in the cooling system. Refer to step J.

Method 2

Note
This procedure bypasses the thermovalve and should cause fan to run at full speed and full system pressure.

Disconnect hydraulic line **G** from fan motor control valve.

Install a pressure gauge that will function from 0 to 4000 PSI in port **P** on the fan motor control valve.

Start the engine and accelerate to full RPM while observing the pressure gauge.

Compare the pressure with the specifications. (See Table 2—Hydraulic Cooling System Performance.)

If the pressure is low, the HFDS is at fault. Go to step J-Check Fan Speed.

If the pressure reading is correct and fan speed appears to be correct is an indication the over heating is in the cooling system, refer to section Cooling System and specific engine manufacture's troubleshooting.

- **J-Check Fan Speed**

Note
Fan should run at full RPM with engine temperature above 205 providing the engine is at full RPM.

Check fan speed with engine temperature between 205 to 210 degrees Fahrenheit.

Start the engine and accelerate to full RPM.

Check the fan RPM with a Phototach. Compare with specification. (See Table 2—Hydraulic Cooling System Performance.)

If the fan speed is within specification, the HFDS is not at fault.

Check the engine cooling system to determine over heating. (Refer to section Cooling System and specific engine manufacture's troubleshooting.)

If the fan does not run at full RPM one of the following is at fault.

Thermovalve
Hydraulic Pump
Priority Flow Divider Valve
Fan Motor Control Valve
Fan Circuit Relief Valve
Fan Motor

Check fan speed with engine temperature below 200°F.

Warning
The test valve must be capable of withstanding 5000 PSI and designed for hydraulic test purposes. The use of improper test equipment can cause serious injury.

Disconnect hydraulic lines E and F, see figure BB Hydraulic Fan Drive Circuit from the thermovalve.

Note
Make sure the valve is in the full open position.

Connect hydraulic lines E and F to A hydraulic cut off test valve.

Start the engine and accelerate to full RPM.

Observe the fan speed using a Phototach while slowly closing the cut off valve.

If fan speed reaches full RPM. (See Table 1—Troubleshooting, the thermovalve is defective.)

If the fan does not run at full RPM with the test valve closed completely off the fault is in one of the following areas.

Hydraulic Pump
Priority Flow Divider Valve
Fan Motor Control Valve
Fan Circuit Relief Valve
Fan Motor

- **K-Test the Hydraulic System**

Caution
Clean and lubricate all parts before re-assembly.

Note

Careful disassembly, cleaning, and re-assembly of the flow divider valve may resolve the problems. Fine emery cloth dipped in a cleaning solvent may be used to polish spool valves. All spool valves should move freely through the bore inside the valve body.

1. Install 0 to 30 GPM flow meter in H line.
2. Start engine and accelerate slowly to full RPM observe GPM. (See Table 2—Hydraulic Cooling System Performance.)

If GPM is within specifications go to step F.

3. Stop engine and install a power steering
4. analyzer in H line I, (the steering circuit supply line). (Refer to section 120 Steering.)
5. 4.Start engine and accelerate to full RPM; observe the GPM in the power steering circuit.
6. 5.If GPM is within specification the pump is at fault, see Table 2—Hydraulic Cooling System Performance.
7. Replace or repair pump.
8. If GPM is higher than specified the priority flow divider valve is at fault.
9. Re-inspect steering system and hydraulic fan drive system flow rates and fan speed after replacing or repairing the flow divider. Compare data with specifications. (See Table 2—Hydraulic Cooling System Performance.)

If systems are not within specification, proceed with troubleshooting.

If the GPM is within specification, one of the following is at fault:

Fan Motor Control Valve
Fan Circuit Relief Valve
Fan Motor

Repair or replace the Fan Motor Control Valve (FMCV).

Repair or replace the fan circuit relief valve (FCRV).

Disassemble and inspect the fan motor for internal damage. (Replace or repair.)

Product Line: RCDA Engine Model: ISM					
Horse Power	**Idle**	**Governor**	**No-Load Governor**	**Pump Drive**	**Ratio**
450	**700**	**2100**	**2300**	**PTO**	**1.23**

Pump Number	**Motor Number**	**Fan Trim Speed**	**Displacement 100%**	**Displacement 86%**	**Displacement 100%**	**Displacement 90%**
1743947	**1758937**	**2200**	**2.92**	**2.51**	**2.68**	**2.98**
Relief PSI 2755	**P/S 0**					

Engine RPM	**Pump Flow GMP at 100%**	**Pump Flow GMP at 86%**	**Fan Speed Motor 100% Pump Speed 100%**	**Hydraulic HP**	**Fan Speed Motor 90% Pump Speed 86%**	**Hydraulic HP**
700	10.88	9.36	938	17.5	726	15.0
800	12.44	10.70	1072	20.0	830	17.2
900	13.99	12.03	1206	22.5	934	19.3
1000	15.55	13.37	1340	25.0	1037	21.5
1100	17.10	14.71	1474	27.5	1141	23.6
1200	18.66	16.05	1608	30.0	1245	25.8
1300	20.21	17.38	1742	32.5	1348	27.9
1400	21.77	18.72	1876	35.0	1452	30.1
1500	23.32	20.06	2010	37.5	1556	32.2
1600	24.88	21.39	2144	40.0	1660	34.4
1700	26.43	22.73	2278	42.5	1763	36.5
1800	27.99	24.07	---	---	1867	38.7
1900	29.54	25.41	---	---	1971	40.8
2000	31.10	26.74	---	---	2075	43.0
2100	32.65	28.08	---	---	2178	45.1
2200	34.21	29.42	---	---	---	---
2300	35.76	30.75	---	---	---	---

Table 2—Hydraulic Cooling System Performance Data

Hydraulic Flushing Procedures

The hydraulic flushing procedures should be used whenever component failures have accrued in the system.

Caution

Failure to thoroughly flush and clean all areas of the hydraulic system after a failure may cause repeat failure of the same component.

1. Remove the hydraulic pump, fan motor, and all hoses.
2. Disassemble, inspect, and clean any component that is to be used again.
3. Flush all hydraulic hoses.
4. Flush the thermovalve.
5. Remove the filter inside the reservoir.
6. Flush the reservoir and install a new filter.

7. Remove the stop bolt in the bottom of the steering gear, and the steering circuit pressure relief valve. (Refer to section 120 Steering.)

8. Place chocks at the rear wheels.

9. Lift the front axle off the ground.

10. Turn the steering wheel to full turn left and right four times.

11. Clean the stop bolt and pressure relief valve.

12. Install the stop bolt and relief valve.

13. Install all removed components and hoses.

14. Fill the hydraulic reservoir with HD32 Hydraulic Oil.

Note

Oil level must be maintained in the sight glass while the engine is running.

15. Start and run the engine for 30 seconds.

16. Stop the engine and refill the reservoir.

17. Repeat steps 15 and 16 until oil level is maintained in sightglass.

18. Disconnect the electrical circuit at the charge air override solenoid valve. This will cause the fan to run at a moderate speed.

19. Run the engine at approximately 1500 RPM.

20. Reconnect and disconnect the electrical charge air override circuit 3 times.

21. Place chocks at the rear wheels.

22. Jack the front axle off the ground.

23. Turn the steering wheel to full turn left and right four times.

24. Run the engine for 10 minutes.

25. Stop the engine.

26. Drain the oil from the reservoir.

27. Remove the filter from the reservoir.

28. Install a new filter.

29. Fill the reservoir with HD32 Hydraulic Oil.

30. Inspect the total hydraulic system for leaks.

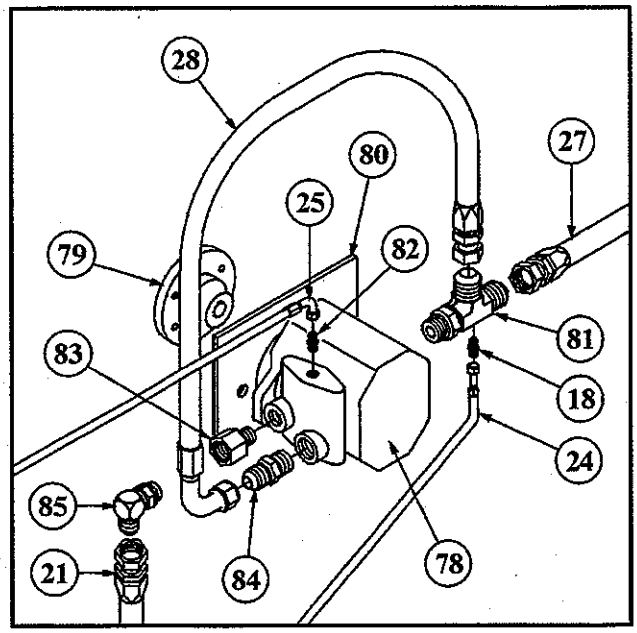

Figure 3—Motor and Switch Valve Assembly

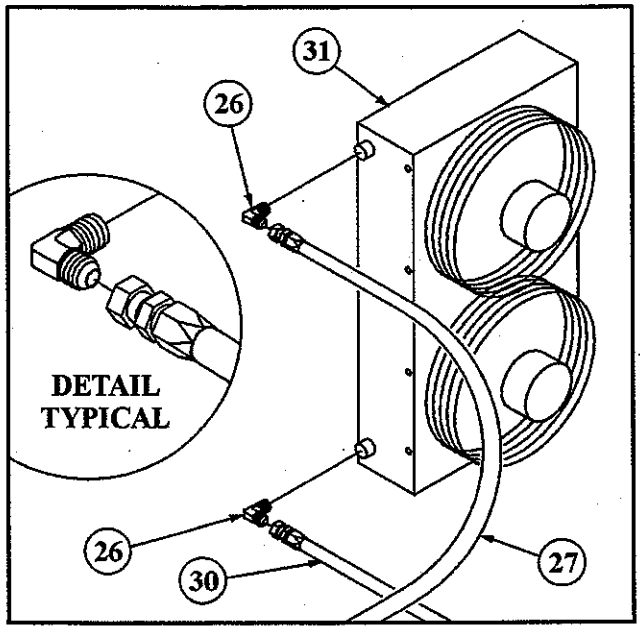

Figure 4—Hayden Air to Oil Cooler

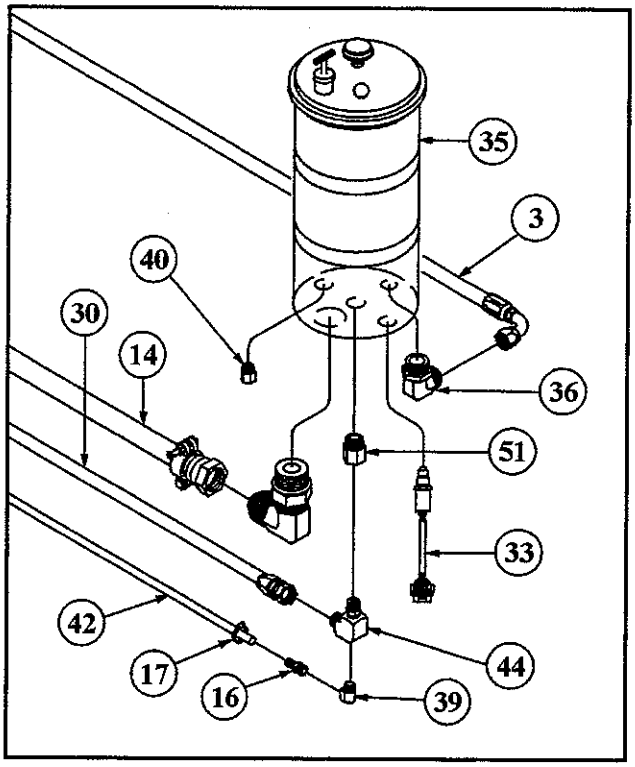

Figure 5—Reservoir 16-Quart with O-Rings

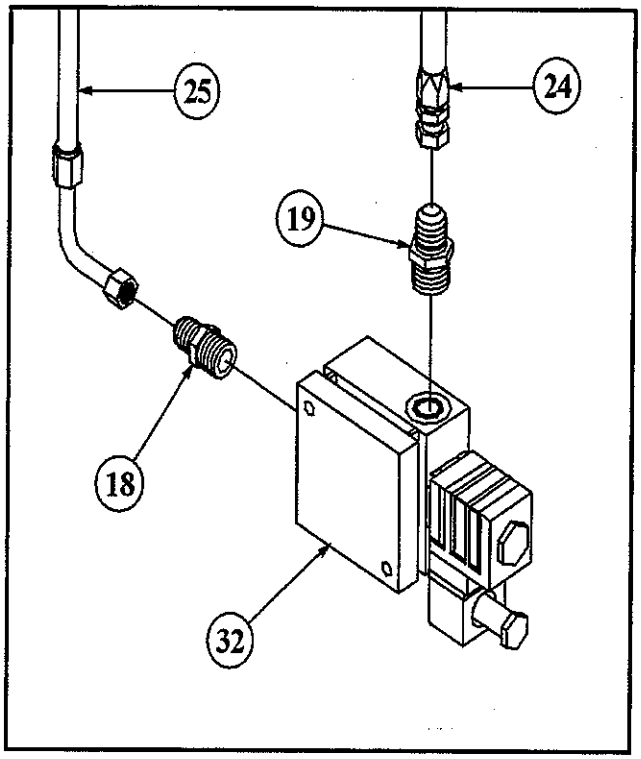

Figure 7—12-Volt Fan Control Valve

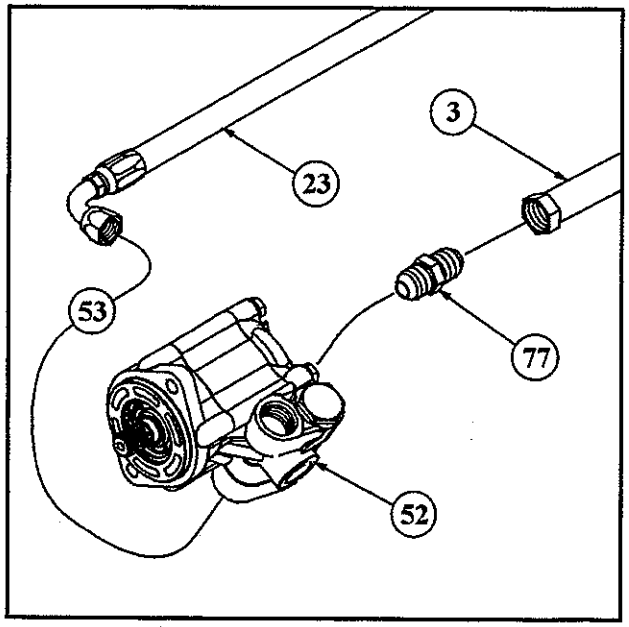

Figure 6—TRW Power Steering Pump

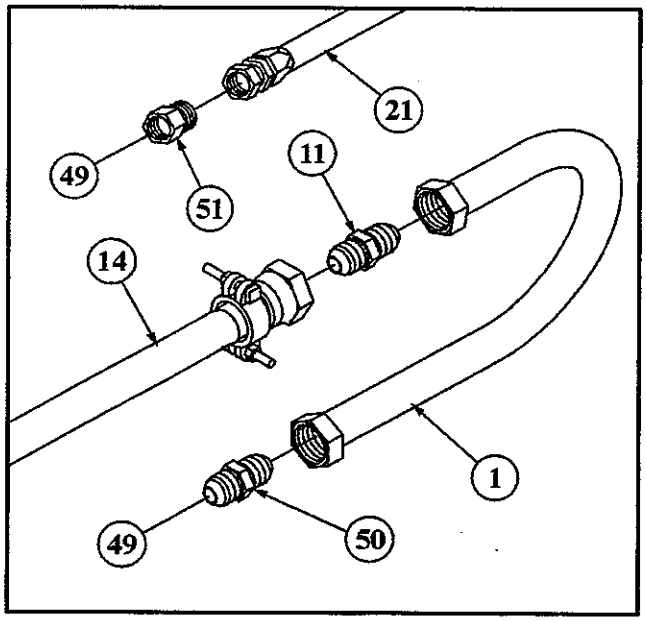

Figure 8—Hydraulic Hose and Tube Pump

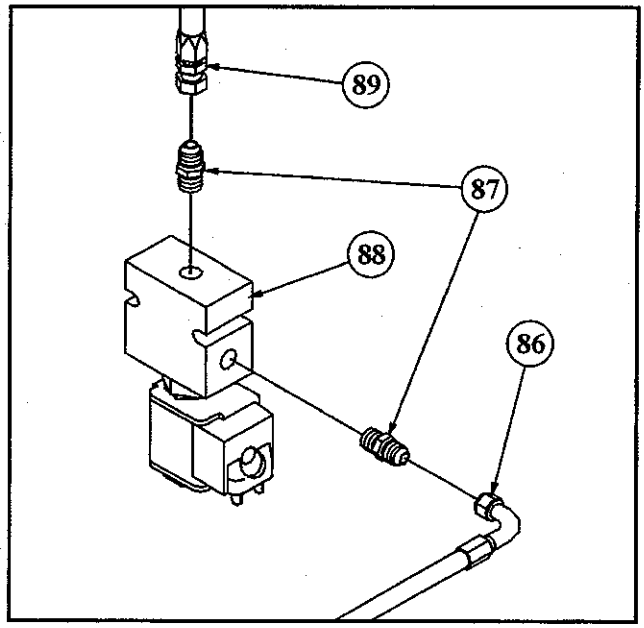

Figure 9—Solenoid Pilot Control Valve

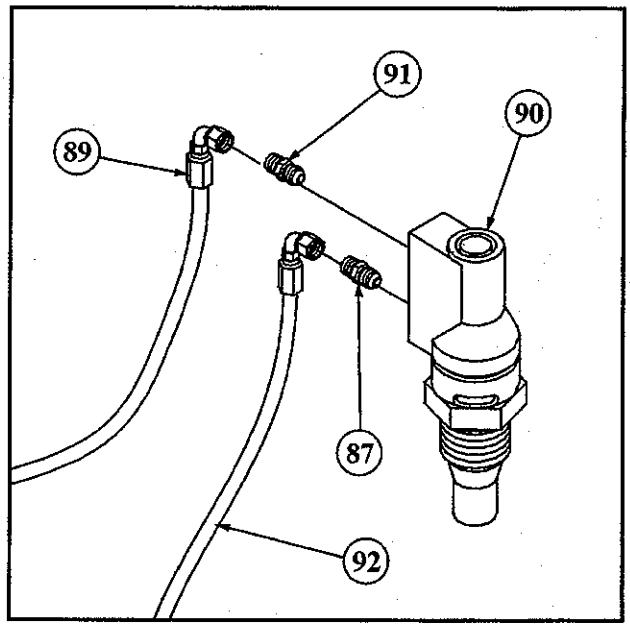

Figure 10—Thermostat Valve

LTC Body General

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

Safety
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Notes
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Introduction
These procedures are documented using a Blue Bird LTC with a Cummins M11 engine and an Allison B500 World Transmission.

Description of Operation
The method for repairing and replacing damaged bus body panels is intended for authorized dealer, repair, and service organizations.

There are special techniques required for the rivet-bonded joint using a combination of fasteners and adhesive.

The special techniques are required to meet joint strength. Special application and curing are necessary.

The adhesive used in rivet-bonded joints is strong and difficult to remove.

The Blue Bird Body Company requires that any damage be reported so that a trained service organization can assist in the repair.

Warning
Skin, eye and respiratory protection is required. Avoid repeated or prolonged contact. Use in a well-ventilated area.

Caution
Make sure that the area to be repaired is on a solid surface. Do not flex or move the joint during the entire curing cycle.

Stepwell Removal

Warning
Use the parking brake. Use wheel chocks at the rear wheel. Make sure the vehicle is stable before moving under the vehicle.

1. Jack the front of the bus up so that the removed stepwell will clear.
2. Support the stepwell for removal.
3. Cut all sealant at edge of steptread to wall of stepwell.
4. Remove steptread. (See Figure 1—Stepwell and Steptread.)
5. Remove three screws from lower flange of door frame assembly.
6. Remove lower screws from handrail assembly at stepwell and barrier.
7. Remove three screws to light lens retainer.

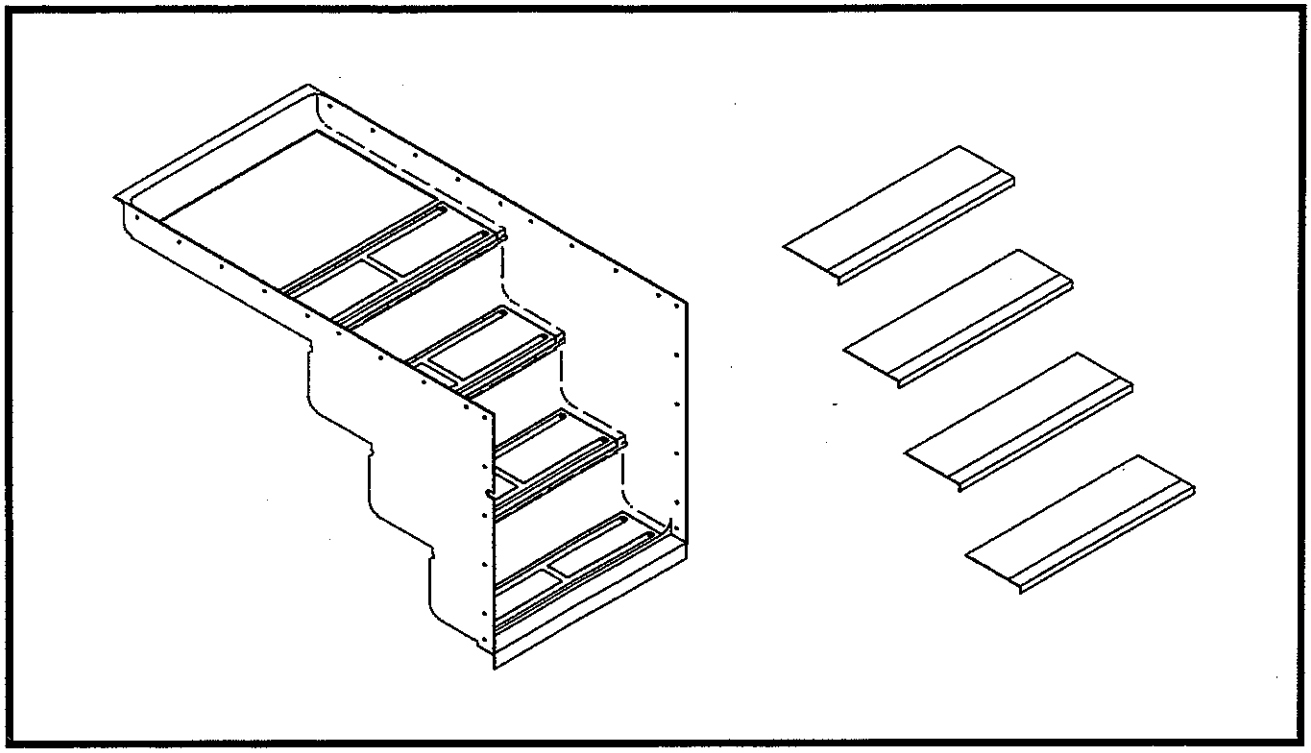

Figure 1—Stepwell and Steptread

8. Remove light lens retainer, gasket, and lens.
9. Remove three mounting screws.
10. Disconnect gray wire in light assembly.
11. Remove all screws from the stepwell.
12. Raise stepwell and remove.

Caution

Do not deform steptread. Floor level steptread should not be removed.

Stepwell Installation

1. Position stepwell in proper position.
2. Install all screws.
3. Lower bus and remove jack.
4. Install three screws to lower flange of door frame assembly.
5. Install steptread.
6. Reseal edges to prevent moisture seepage underneath steptread.
7. Install screws to trim around top edge of stepwell.
8. Install screws to handrail assembly at stepwell.
9. Connect gray wire in light assembly.
10. Mount light housing and gasket with three mounting screws.
11. Install light lens retainer, gasket, and lens.
12. Install three screws to light lens retainer.

Other Body Components

For service maintenance procedures on **Doors**, see Section 350.

For service maintenance procedures on **Fuel Fill Door**, see Section 350.1

For service maintenance procedures on **Windows**, see Section 360.

For service maintenance procedures on **Seats**, see Section 380.

For service maintenance procedures on **Mirrors**, see Section 390.

For service maintenance procedures on **Windshield Wiper System**, see Section 400.

For service maintenance procedures on **LTC Lights**, see Section 420.

For service maintenance procedures on **Luggage Compartment**, see Section 450.

LTC Doors

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

Safety

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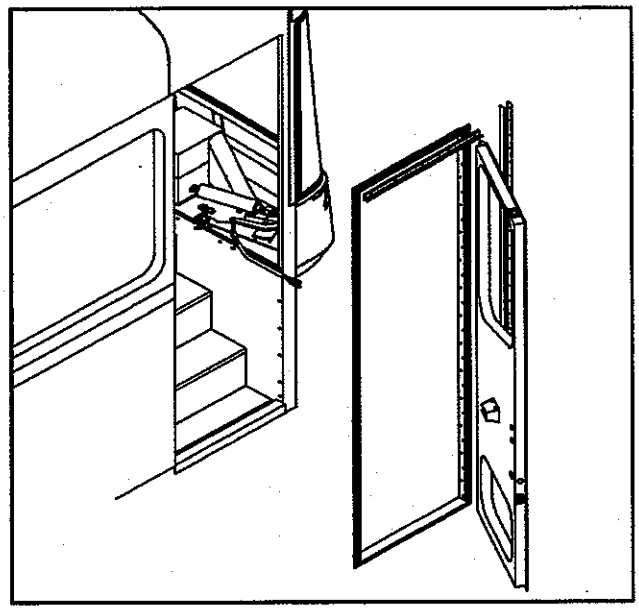

Figure 1—Entrance Door

Introduction

This section provides maintenance procedures for door equipment on a Blue Bird LTC bus. These procedures are documented using a Blue Bird LTC with a Cummins M11 engine and an Allison B500 World Transmission.

Description of Operation

Doors are in a prefabricated framework that eliminates the effect of body construction variations on door and seal operation. (See Figure 1—Entrance Door.)

The doors are on a full door length hinge located inside a frame. The door has three panels in the door assembly. The inner, filler, and outer panels are illustrated in Figure 2—Door Panels.

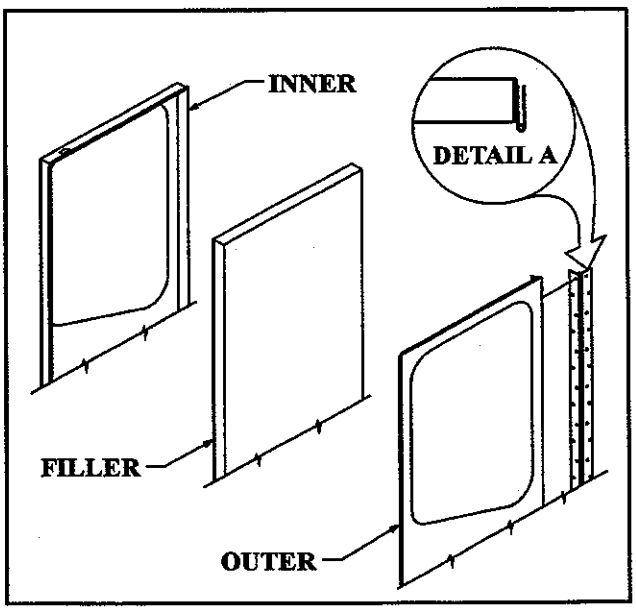

Figure 2—Door Panels

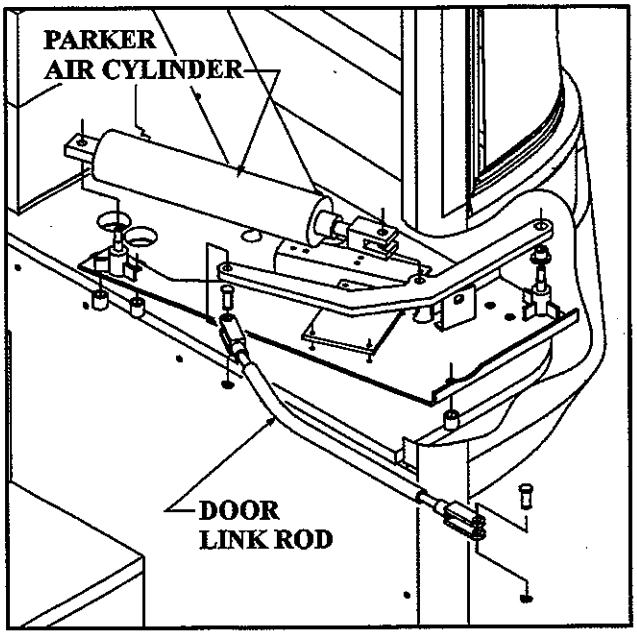

Figure 3—Parker Air Cylinder

The interlink connection is an assembly with a Park Air Cylinder. (See Figure 3—Parker Air Cylinder.)

There are two air locks, one is at the top of the doorframe, and the other is at the side. (See Figure 4—Upper and Lower Door Air locks.)

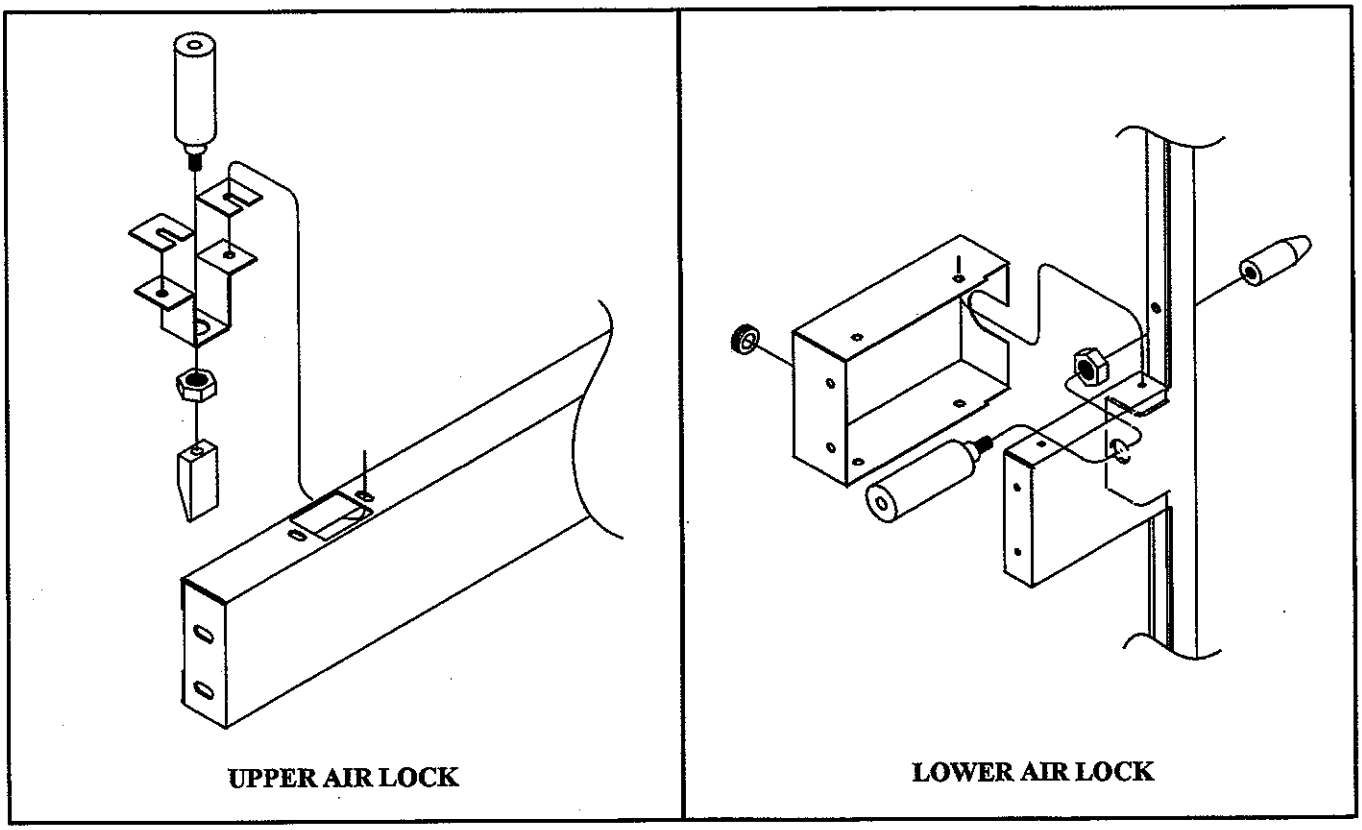

Figure 4—Upper and Lower Door Air Locks

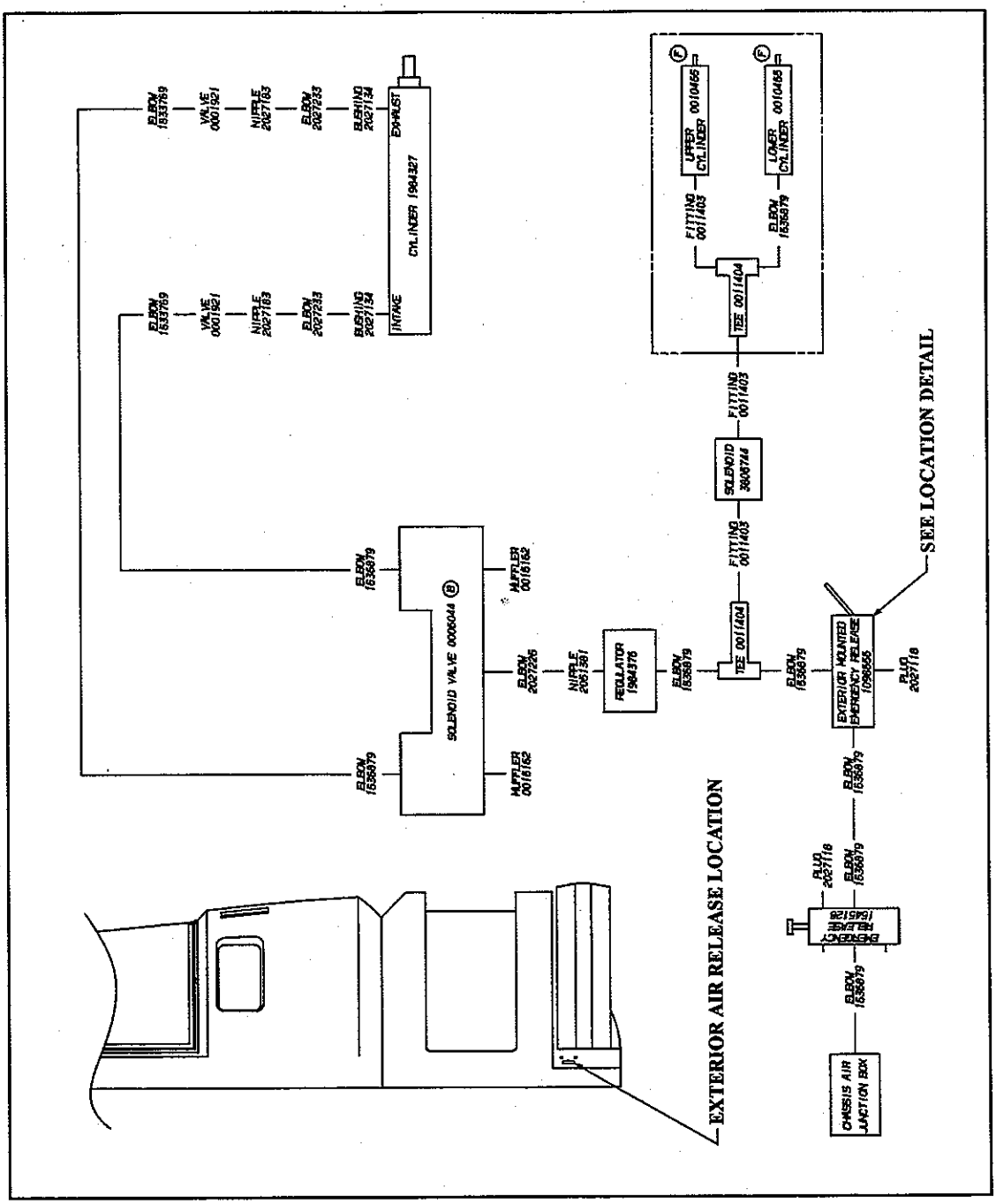

Figure 5—Exterior Air Release

There is an exterior air release and an interior emergency door release. (See Figure 5—Exterior Air Release and Figure 6—Interior Emergency Door Release.)

Interior Emergency Door Release

The Interior Emergency Door Release is located inside the door mounted on the dash.

Push knob down to activate the emergency door release. (See Figure 6—Interior Emergency Door Release.)

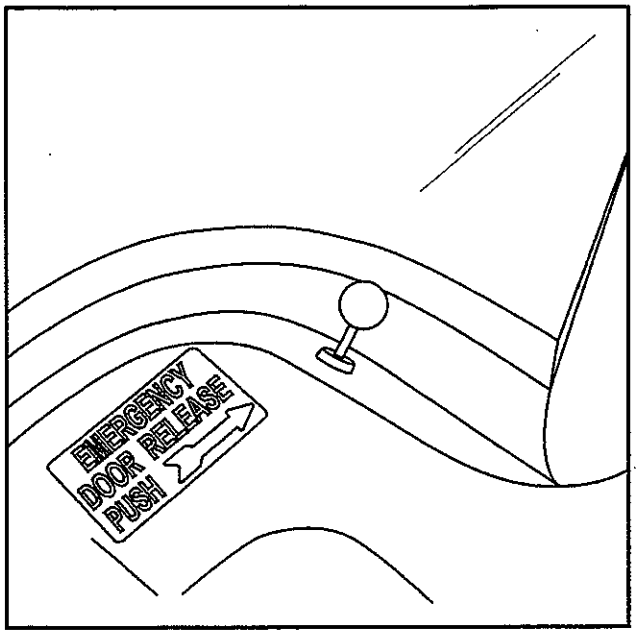

Figure 6—Interior Emergency Door Release

Door Control Assembly Removal

Note

Disassembly and installation of door components are made easier by closing the door.

1. Remove four screws (24) from entrance door link rod door cover (5). (See Figure 7—Door Control Assembly.)
2. Remove retaining ring (47) and clevis rod pin (19) from right door yoke end (11). (See Figure 7—Door Control Assembly.)
3. Open door for easy access to other door assemblies.
4. Remove retaining ring (47) and clevis rod pin (19) from entrance door pivot arm (14). (See Figure 7—Door Control Assembly.)
5. Remove retaining ring (47) and clevis pin (35) from Parker Air Cylinder (15).
6. Remove hex nut (20) from front door pivot arm mounting stud (12).
7. Remove Parker Air Cylinder.
8. Remove hex nut (20) from the inside door pivot arm mounting stud (12).
9. Remove hex nut (20), entrance door pivot arm (14).
10. Remove entrance door pivot arm nylon bushing from the outside door pivot arm mounting stud (12). (See Figure 7—Door Control Assembly.)

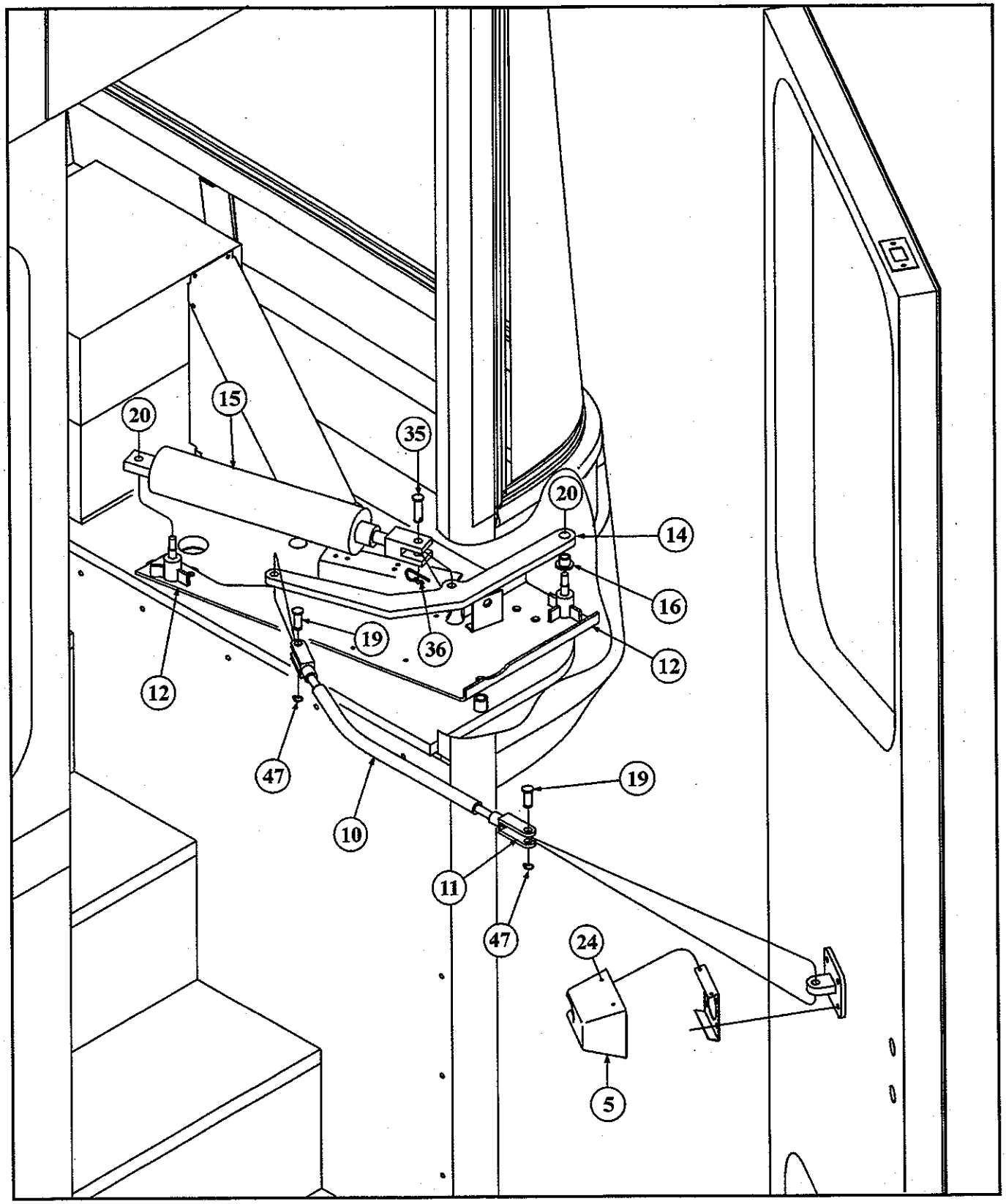

Figure 7—Door Control Assembly

Door Removal

Remove 27 screws (23) from door hinge. (See Figure 8—Door Hinge.)

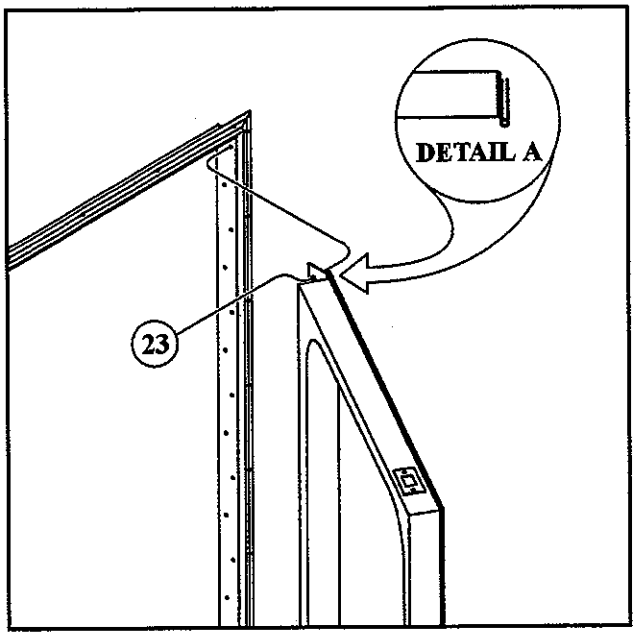

Figure 8—Door Hinge

Door Striker Removal

- **Upper Striker.** (See Figure 9—Upper and Lower Door Striker.)

1. Remove screw (21), door striker (4).
2. Remove rubber seal G-7056 (51).
3. Remove upper retainer seal (52).

- **Lower Striker.** (See Figure 9—Upper and Lower Door Striker.)

Remove screw (57), door striker (56).

Upper and Lower Air Lock Removal

- **Upper Air Lock**

1. Remove air line from upper Parker Air Cylinder (41). (See Figure 4—Upper and Lower Air Locks.)
2. Remove capscrew (44), flat washer (44) spacer bracket (55).
3. Remove bracket (42).
4. Remove jam nut from upper Parker Air Cylinder (41) and top lock pin (43).

- **Lower Air Lock**

1. Remove air line from lower Parker Air Cylinder (41). (See Figure 4—Upper and Lower Air Locks.)
2. Remove screw (21) from lower air cylinder cover (50).
3. Remove lower air cylinder cover (50).
4. Remove jam nut from upper Parker Air Cylinder (41) and lower lock pin (54).

Dead Bolt Lock Removal

1. Remove two screws from the inside lock plate. (See Figure 9—Upper and Lower Striker.)
2. Remove inside lock plate.
3. Remove bolt and lock sleeve.

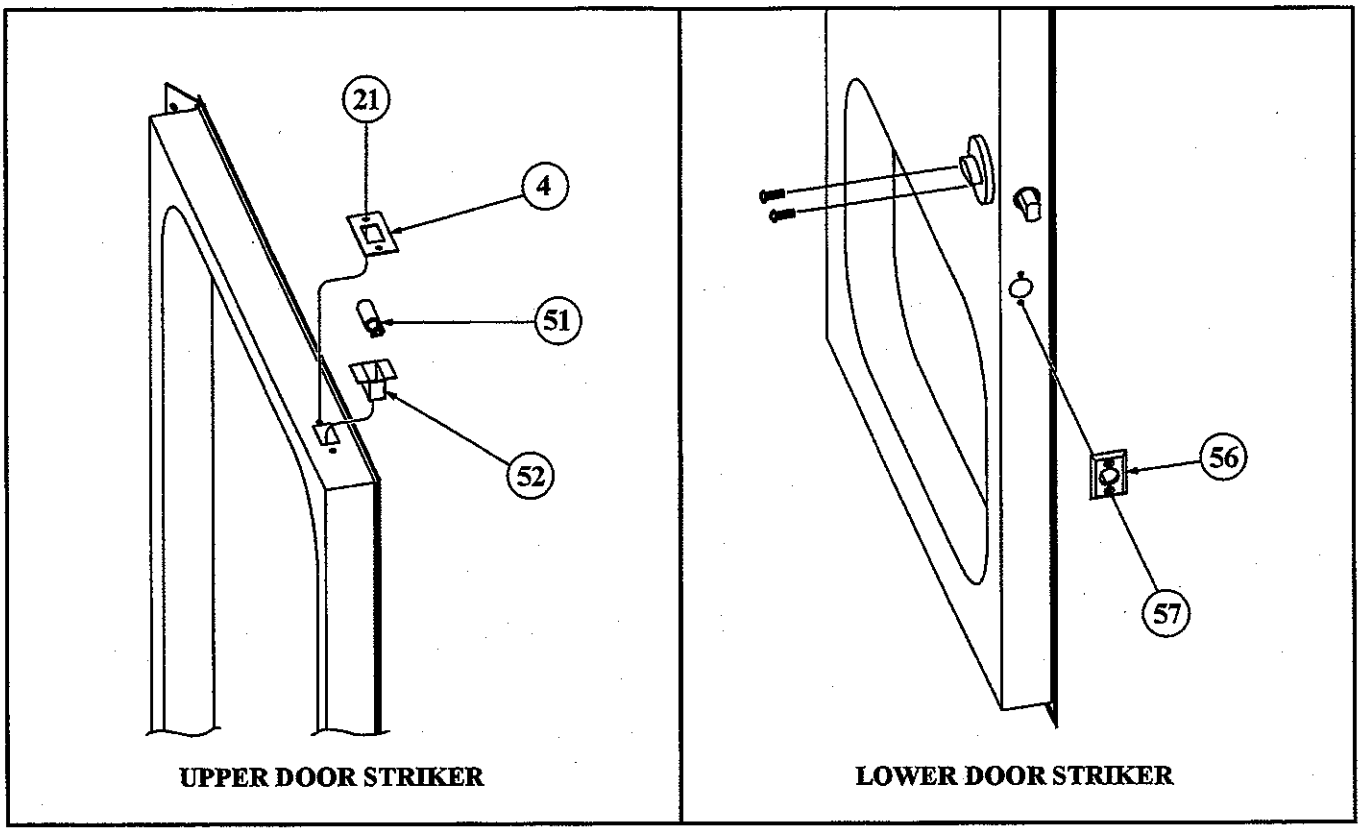

Figure 9—Upper and Lower Door Striker

Rear Door Removal

1. Disconnect the battery.
2. Raise the Rear Engine Door.
3. Support the door at each side so the door can be removed.
4. Cut light wire on rear door.
5. Cut plastic ties from lift cylinder.
6. Remove nuts from lower lift cylinders.
7. Remove nuts from upper cylinders.
8. Remove nuts and bolts from door frame.
9. Lower door.

Installation

Reverse procedures for removal.

Caution

In the repair operations performed by fiberglass manufacturer, only the materials listed are to be used. Do not use lacquer primer or glazing putty on these parts because of incompatibility problems.

Pre-bake assembly for one hour at 180 °F (82.2 °C).

- 285-22 MS primer
- 929-28/1 hardener
- 352-91 or 544-101 reducer
- 839-11 fine body plastic
- DE-15 epoxy primer
- PA-16 Activator

LTC Fuel Fill Door

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

Safety
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Introduction
General information is a section for the maintenance of the LTC. Information in this section applies to fuel doors.

Description of Operation
The fuel fill door is fiberglass. (See Figure 1—Fuel Fill Door.)

Fuel Fill Door
- **Removal**

1. Pry off upper push-nut and discard.
2. Slide rod down through the door.
3. Retain the spacers.

Installation

1. Install the Stainless Steel rod though door bracket and spacers.

Note
The 0.188 inch (4.78 mm) diameter Stainless Steel rod and the round push-on nut is commercially available.

2. Install the upper push-on nut on the rod.
3. Adjust door for fit and finish.

Fuel Fill Door Repair

Caution

In the repair operations performed, only the materials listed are to be used.

Do not use lacquer primer or glazing putty on these parts because of incompatibility problems.

- **Mix the Repair Materials.**

285-22 MS primer

929-28/1 hardener

352-91 or 544-101 reducer

839-11 fine body plastic

DE-15 epoxy primer

PA-16 Activator

Pre-bake assembly for one hour at 180° F (82° C).

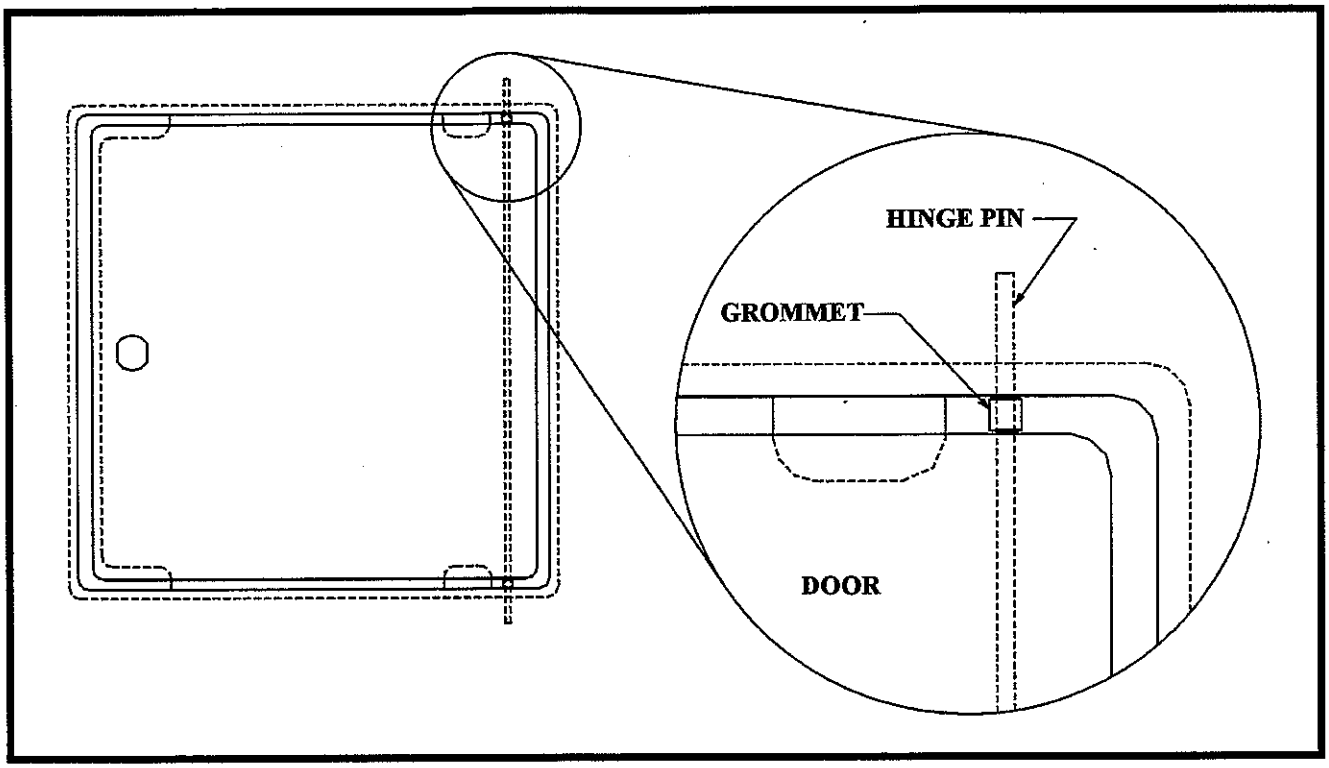

Figure 1—Fuel Fill Door

LTC Windows

Table of Contents

Table of Contents

List of Figures

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Introduction

There are two configurations of LTC transit windows, the push-out (egress) and the stationary. This section applies to both sliding configurations.

Transit Window Removal

1. Remove screws inside the aluminum extrusion.
2. Loosen the sealer between the window frame with a putty knife.
3. Pry out the window using screwdriver.

To Remove Push-Out (Egress) Transit Sliding Window

1. Release window lever located inside the bus at the side of each push-out window. (See Figure 1—Transit Egress Window.)
2. Remove the hinge screws on outside of the body.
3. Lift and pull the window out of the section.

To Remove Stationary Transit Sliding Window

1. Remove all screws between the inner frame and outer frame. (See Figure 2—Stationary Transit Sliding Window.)
2. Loosen the sealer between the window frame with a putty knife.
3. Pry out the window using a screwdriver.
4. Reassemble by reversing removing procedure.

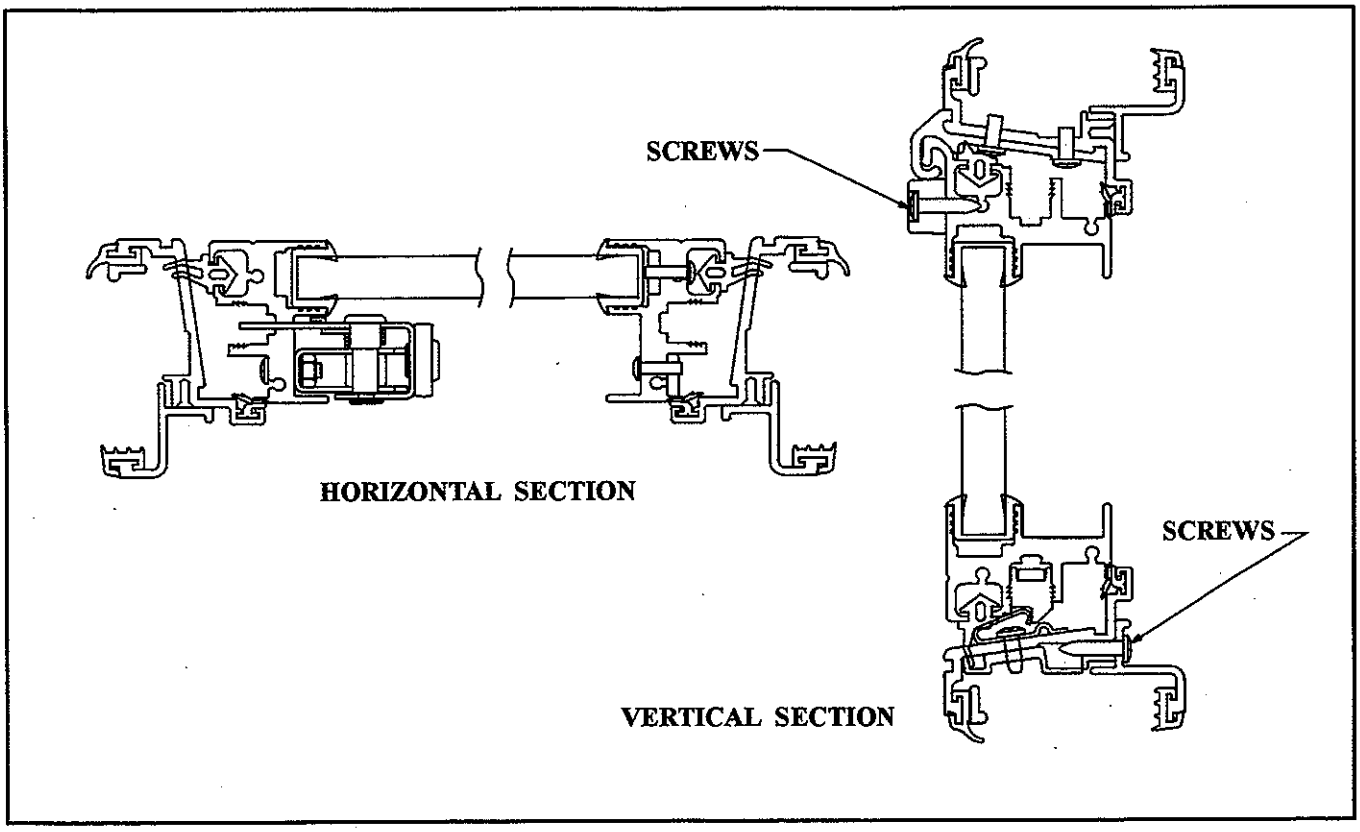

Figure 1—Transit Egress Window

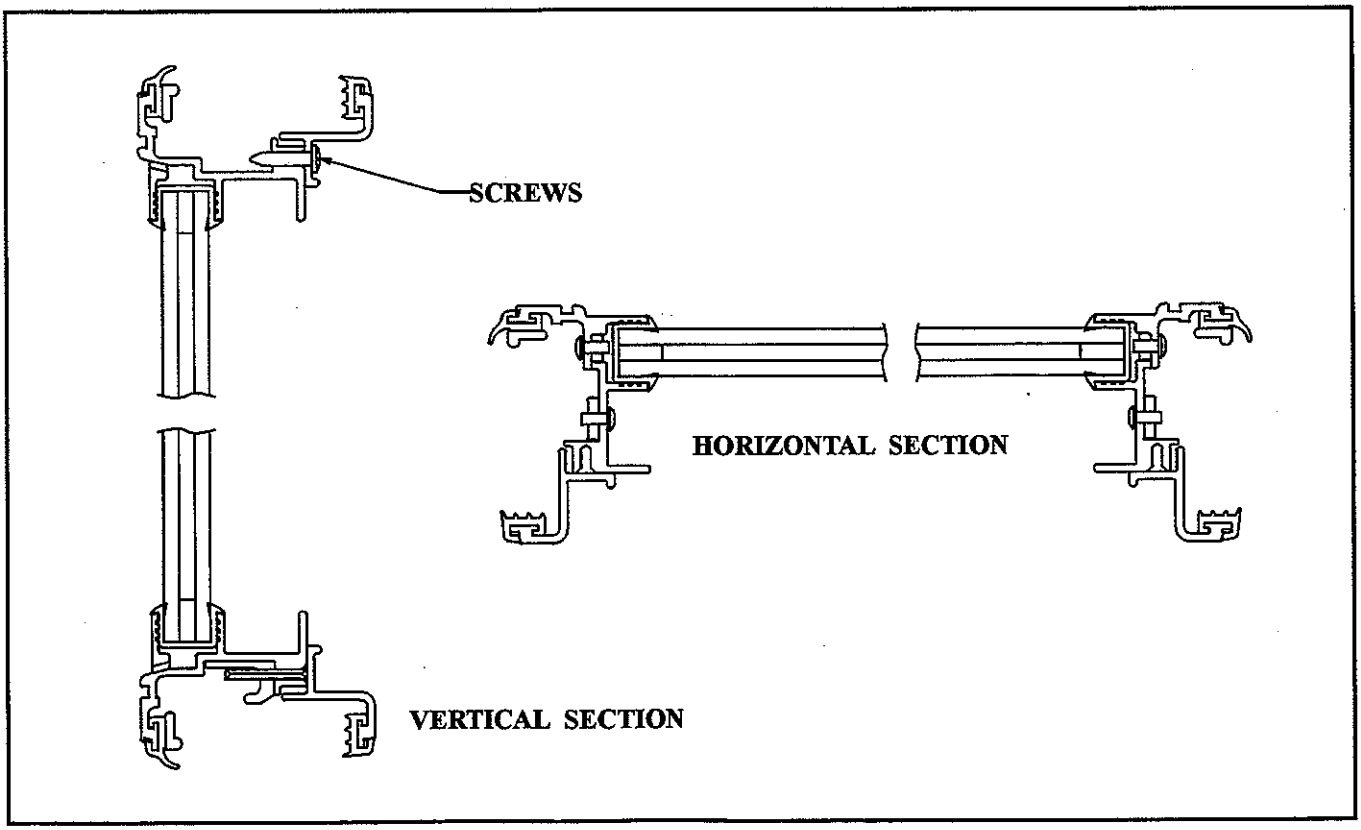

Figure 2—Stationary Transit Sliding Window

LTC Heaters and Defrosters

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

List of Tables

List of Schematics

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Introduction

These procedures are documented using a Blue Bird LTC with a Cummins M11 engine and an Allison B500 World Transmission.

The major components are listed as follows

- Controls
- Cutoff Valve
- Sidewall Heaters

Description of Operation

This bus uses a hot water type heater. Heat is used from the engine coolant.

Control Panel

The operation/control switch for the heating system is located on the bus console. (See Figure 1—Control Panel.)

Caution

Make sure the engine radiator is full and all coolant flow valves are open.

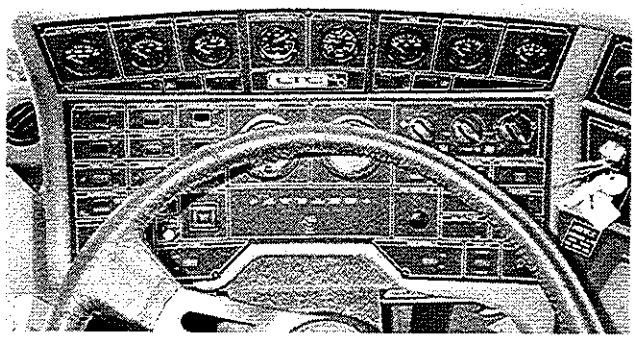


Figure 1—Control Panel

Heater

Performance of body heaters depends on adequate engine coolant temperature. Thermostat rating regulates the heat. The thermostat rating should not be higher than the recommended rating of the engine manufacturer.

The heating system depends on heat generated by the engine to heat the coolant to operating temperature. The coolant is pumped through the heaters inside the bus body, and back to the engine.

Warning

With a hot engine, rapid venting or rapid removal of radiator cap will allow coolant to spray out. To prevent serious burns, slowly vent pressure and then remove radiator cap.

Heater Core

Warning

When using compressed air for cleaning, cooling or drying, do not exceed 30 psi. Wear eye protection and do not direct compressed air at self or others.

Make sure that all clamps on hoses or tubes are tight to prevent leaks of air or fluid. Make sure that all screws and bolts are tight to prevent damage to vehicle.

The heater will be efficient when the core and fins are clean. The core can be cleaned with compressed air or by vacuum. Damaged fins should be straightened with a fin comb to prevent air flow restrictions. Access to core is through removal of the aluminum housing.

Engine Compartment Heater Piping

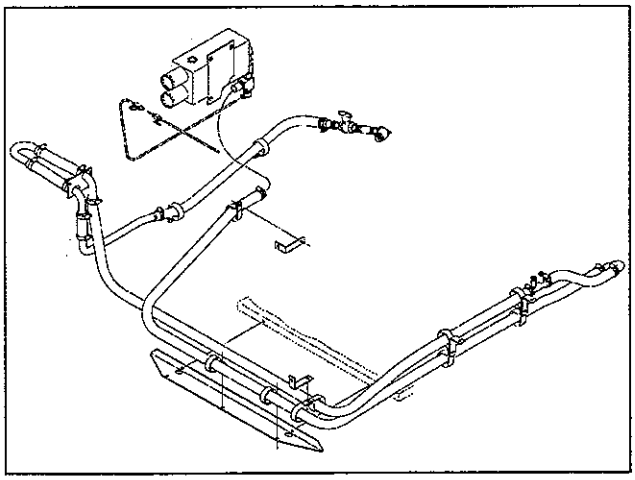


Figure 2—Engine Compartment Heater Piping

Heater Air Bleed Procedure

Use of antifreeze (ethylene glycol type) is recommended for summer or winter operation. (See Tables 1, 2 and 3.)

Use a 50/50 solution of antifreeze and water for freeze protection to approximately 30 °F below zero (-34 °C). Ultimate protection is attained at 68% antifreeze to 32% water. A 68 to 32% ratio will protect to approximately 92 °F (69 °C) below zero.

Warning

With a hot engine, rapid venting or rapid removal of radiator cap will allow coolant to spray out. To prevent serious burns, slowly vent pressure and then remove radiator cap.

During the bleeding process, it is necessary to remove the radiator cap and refill the cooling system. The refill is to ensure adequate coolant is available to replace purged air and coolant lost when bleeding.

1. Turn engine off to cool.

2. Shut all engine heater gate valves or clamp close all heater hoses as close to the engine as possible. (See Figure 2—Engine Compartment Heater Piping.)

Warning

Exhaust gases are harmful and potentialy lethal. Do not run engine in an enclosed area. Perform work in a well-ventilated area.

3. Fill cooling system completely, including surge tank with coolant.

4. Run engine until coolant hoses are warm to touch.

5. Open the heater hose supply line gate valve by turning on heater at the control panel or unclamp supply line hose.

6. Check water pump to make sure it is running.

7. Run engine between 2,000 and 3,000 rpm.

Note

Be sure to use a large container for draining coolant.

8. Loosen bleeder valve located in heater hose line. (See Figure 2—Engine Compartment Heater Piping.)

Note

Coolant refill is necessary during bleeding.

9. Bleed air and coolant through bleeder valve until air is eliminated from heater system.

10. Stop bleeding when continuous stream of coolant is discharged.

11. Open gate valve in heater hose return line after all air is purged.

12. Run engine between 2,000 and 3,000 rpm until thermostats open.

13. Refill cooling system including radiator surge tank.

Cutoff Valves

Caution

Do not operate with valve closed and other valves open due to high-pressure build up.

Valves are used to isolate the heater system from the engine to control leaks. (See Figure 3—Heater Cutoff Valve.)

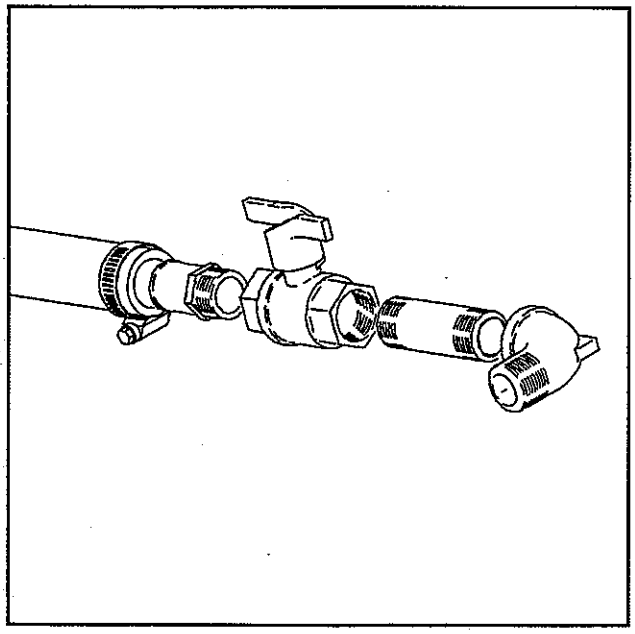


Figure 3—Heater Cutoff Valve

Preventative Maintenance

- **Hoses**

1. Check all water hoses for kinks that prevent water flow.
2. Inspect hoses for hardening of rubber or cracks.

- **Motors**
- Inspect wheels and fans for obstructions or damage by running each fan separately.

- **Switches**

1. Inspect for loose wiring.
2. Inspect for bad or loose connections.

- **Panels and Housings**
- Inspect fasteners that connect and retain structural and access panels.

- **Hose**

1. Repair damaged hose by cutting out the damaged section and installing a four-inch (101.6 mm) brass tube and hose clamps.
2. Replace full length of hose due to aging or heavy damage, if necessary.

Troubleshooting

See Schematic 1—Connection of Pot-5 Low Temperature. See Schematic 2—EasyTerm 92.

Caution

When operating DC voltage, output 2 of the solenoid valve must be grounded. The valve-grounding pin is left disconnected. The valve-grounding pin is used for grounding only when operating AC voltage.

The relay box is fastened with screws. No enclosure is needed because the electronics are well protected. The relay box should be mounted in a dry place for additional protection against humidity and oxidation of the terminals.

The EasyTerm 92 is capable of working in either of two temperature ranges, 44 to 86 °F (7 to 30 °C) or 43 to 176 °F (6 to 80 °C).

The EasyTerm 92 functions as an ordinary thermostat by adjusting the temperature according to the desired value set on the potentiometer. A sensor registers the actual temperature continuously. The EasyTerm 92 sensor is located at the back of shifter cab.

The potentiometer Pot-5 is located at the right lower dash. (See Figure 4—Connection of Pot-5 Low Temperature 45 °F to 86 °F (7 to 30 °C).)

If the temperature is lower than the preset level, EasyTerm 92 will switch on the heating function by de-energizing output 51.

If the temperature is higher than the preset level, EasyTerm 92 will switch off the heating function by energizing output 51.

The solenoid valve is located left rear wheel, well behind angled panel.

To operate EasyTerm 92 in the open/close mode the vehicle's hot water circuit, start/stop heating, a connection must be made. Output 51 is connected to

a solenoid valve to control a pneumatic 2-way valve, type NO, inserted in the heating circuit. (See Figure 5—EasyTerm 92.)

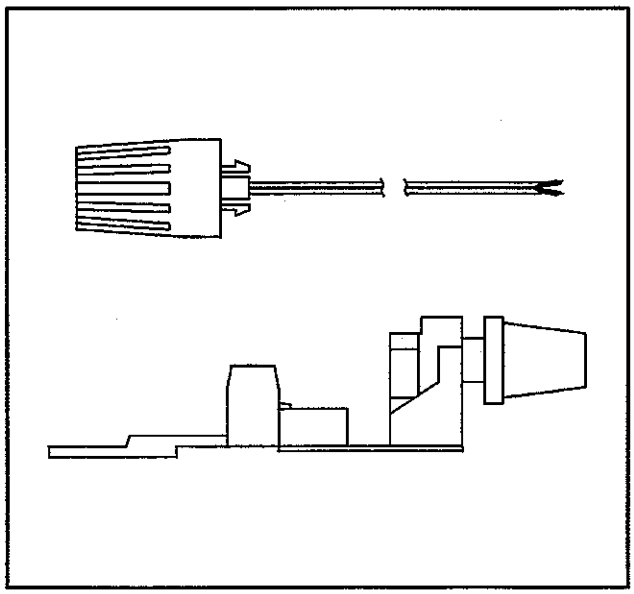


Figure 4—Connection of Pot-5 Low Temperature 45°F to 86°F (7° to 30°C)

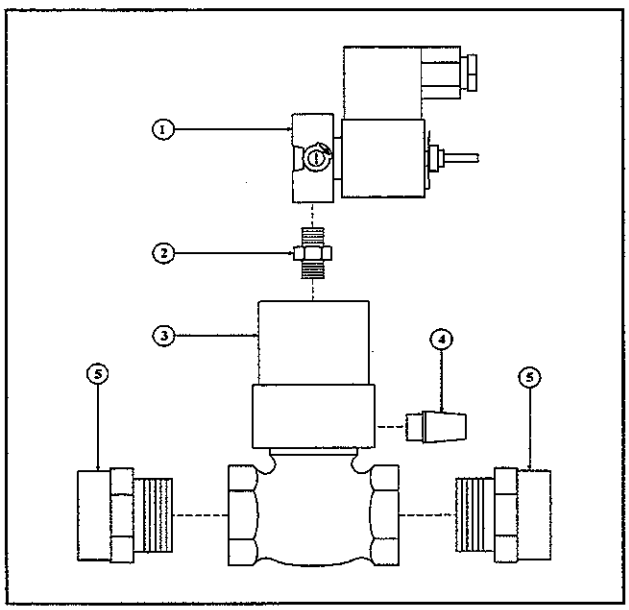
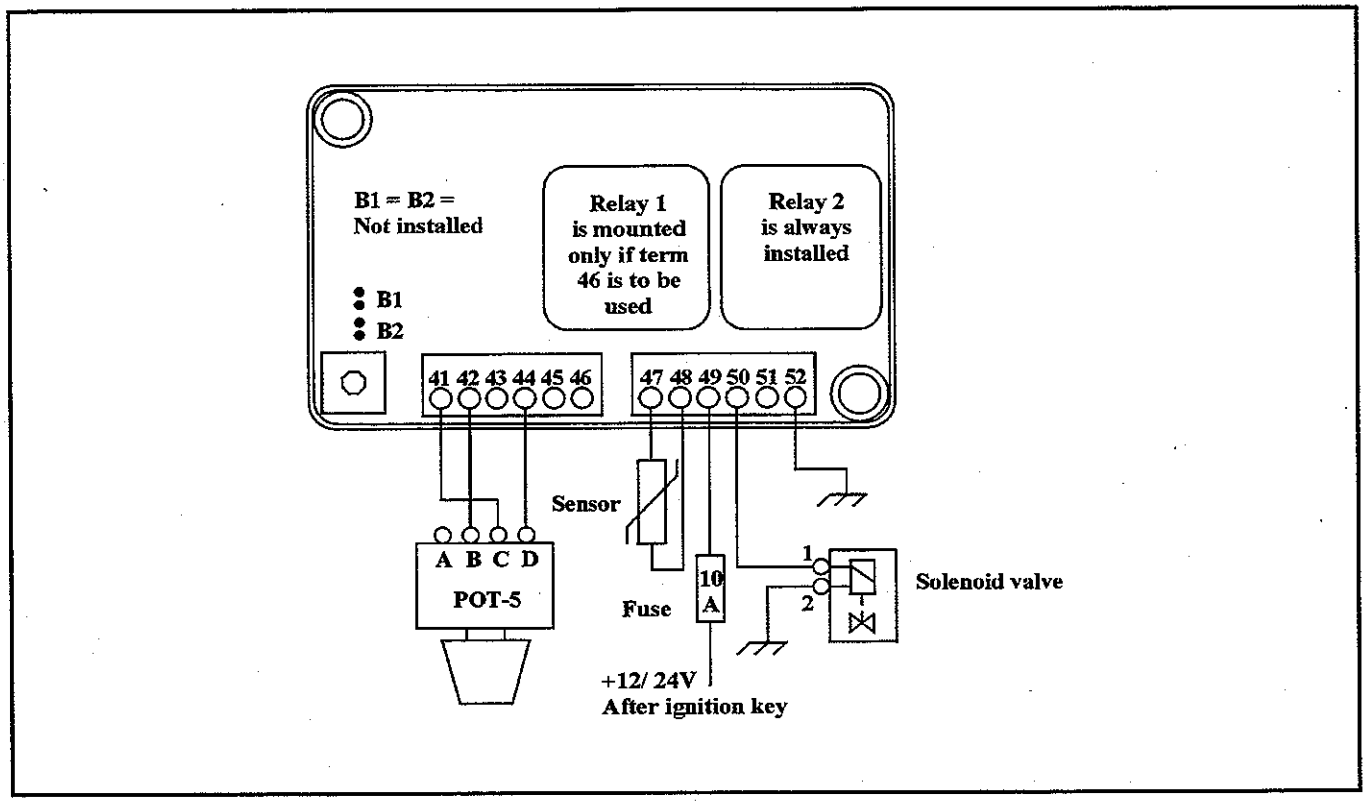


Figure 5—EasyTerm 92

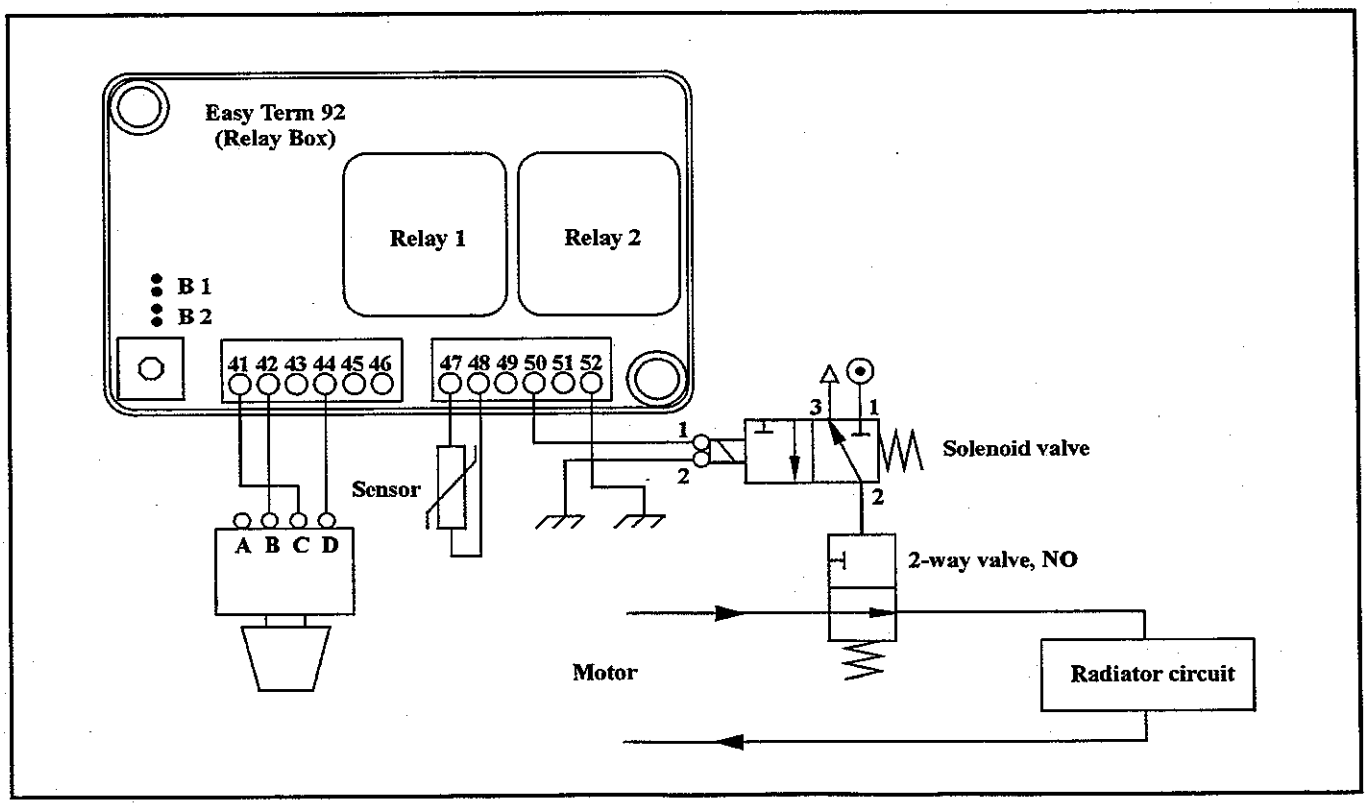
The sequences are activated as the temperature levels are adjusted. (See Table 4—Terminals 47—52 Compulsory Connections.)

Terminal 46	**Power On** Used to energize boost pump. Add relay to position number 1.
Terminal 47	**Sensor + Source** Input or temperature sensor NTC-4k7 (6968 1343 050). When the sensor is correctly connected, the potential is between + 2.5 volt at about 41 °F (5 °C) and is = 0.5 volt at about 176 °F (80 °C), while it is + 5 volt when the sensor is not connected.
Terminal 48	**Sensor** Ground for temperature sensor. The terminal is connected internally to the unit's power ground (terminal 52).
Terminal 49	**Voltage** Power supply, +12/24 volt, for the unit as well as external units by relay 1 and relay 2.
Terminal 50	**Energized** when temperature is **below** the preset level.
Terminal 51	**Energized** when temperature is **above** the preset level.
Terminal 52	**Ground** Units ground connection
Terminal 45	**Not used**

Table 1—Terminals 47—52 Compulsory Connections



Schematic 1—Base Board Heater Connection Pot-5 Low Temperature 45 °F to 86 °F (7° to 30 °C)



Schematic 2—Base Board Heater EasyTerm 9

LTC Seats

Table of Contents

Table of Contents

List of Figures

Safety

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Notes

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Introduction

The seating design in your Blue Bird LTC is for safety and comfort. Maintained and kept clean, the seats will have many years of service.

Driver's Seat

Warning

Do not attempt to adjust the driver's seat while the vehicle is in motion. A sudden, unexpected adjustment to the driver's seat while the vehicle is in motion, could result in serious injury or death.

Weight and Height Adjustment

To adjust, push the valve knob in to raise the seat and pull it out to lower the seat. When properly adjusted, the seat should not top nor bottom against the end limits of the vertical travel, under normal driving conditions. Adjustment position should also provide for driving visibility and vehicle control. (See Figure 1—Driver's Seat Adjustment Points.)

Fore and Aft Adjustment

Hold lever to the left to adjust seat position forward or backward.

Back Angle Adjustment

Lean forward slightly to remove pressure from seat back. Hold handle rearward to adjust to any position within the seats range.

Cushion Tilt Adjustment

Rotate seat tilt knob to decrease or to increase seat tilt.

Lumbar Adjustment

Rotate knob forward to increase or rearward to decrease the support in the lumbar area.

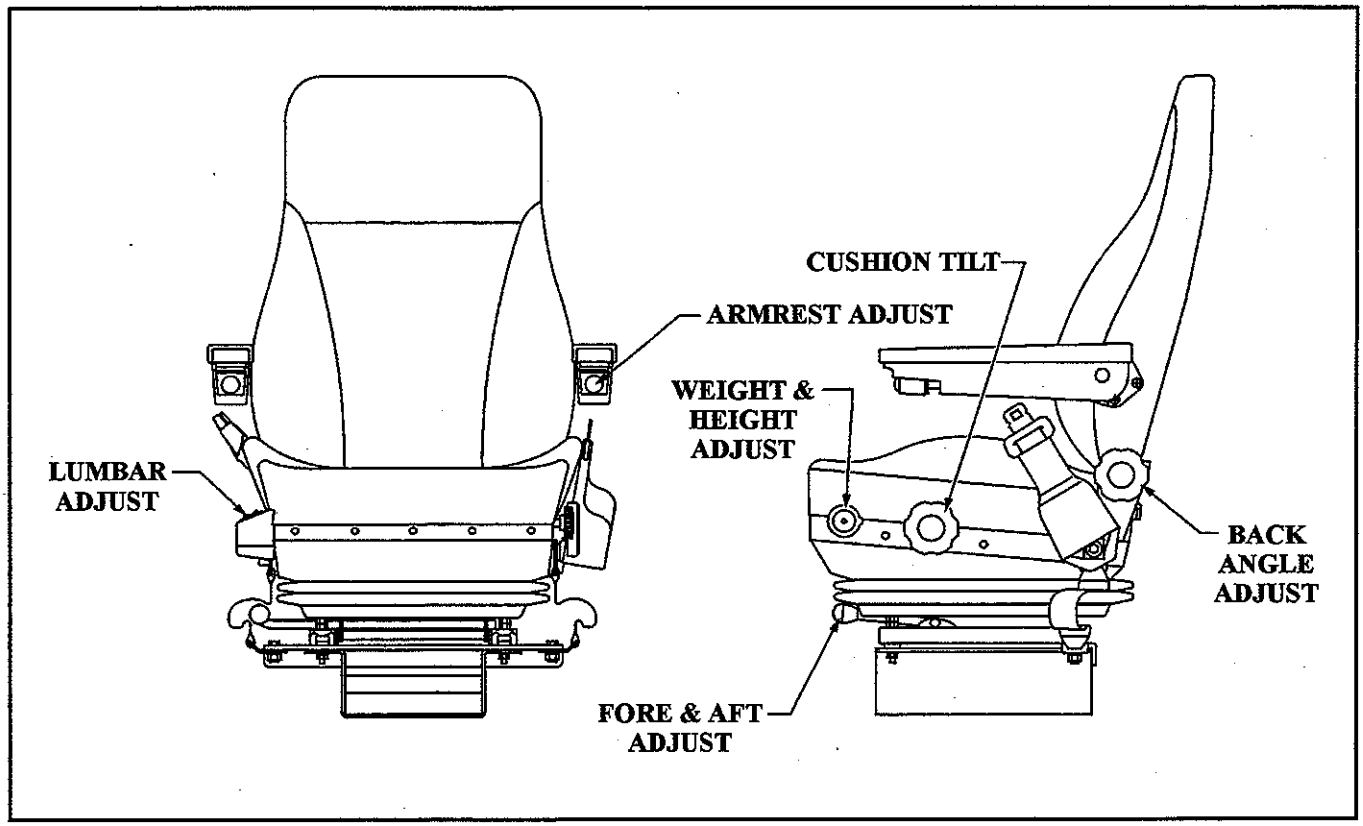

Figure 1—Driver's Seat Adjustment Points

Driver's Seat Lubrication

Caution

Lubricants can damage vinyl. Use caution around upholstery.

- The moving parts of the driver's seat require occasional lubrication for ease of operation, as well as longevity of the seat. Lubrication also prevents excessive wear.
- White lithium-based grease in an aerosol can is currently available, and is used by Blue Bird.
- Motor oil 10W30 or 10W40 will also provide adequate lubrication, although not as convenient to apply.
- All moving part joints, tilt pivots, slide forward, back adjustment and vertical motion pivots (4 total) require lubrication.

Seat Inspection and Maintenance

Seats used in the Blue Bird LTC are built to meet Federal Motor Vehicle Safety Standards.

- To provide safer passenger transportation, the following inspections should be done

1. Inspect mounting bolts every 90 days.
2. Inspect cushion attachments each week.
3. Inspect upholstery for cuts and tears every 90 days.

- If torn, remove upholstery by removing the staples at the bottom front of seat back or bottom of cushion.

Seat Care and Cleaning

- Every-day dirt and soil

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

Caution

Paint, tar and asphalt stains may become permanent if not cleaned immediately.

- Paint, tar, and asphalt

Remove stain immediately using a damp cloth and kerosene. Rub the stain gently, using small strokes.

- Nail polish and lacquer-based stains

Immediately soak up as much as possible with a dry cloth. Any remaining stain may be removed with a nonflammable cleaning fluid, such **Tuff Stuff™** or **Armorall™** cleanser. Rinse thoroughly with clean water.

- Ink

Immediately remove stain using a damp cloth and alcohol.

Driver's Seat Removal and Installation

1. Remove two bolts and washers.
2. Remove bolts from seat base mount and floor.

- **Driver's Seat Installation**

1. Clean six bolts removing dirt and grease.
2. Apply Loctite™ 242 Blue to five or six threads.
3. Install six bolts, washers, and nuts into the driver's seat mount.
4. Torque six bolts 15 to 20 foot-pounds (1.70 to 2.26 N•m).

Pedestal Mounted Passenger Seats

- **Removal**

For an illustration on the Pedestal Mounted Passenger Seat Removal, see Figure 2 (Pedestal Mounted Passenger Seat).

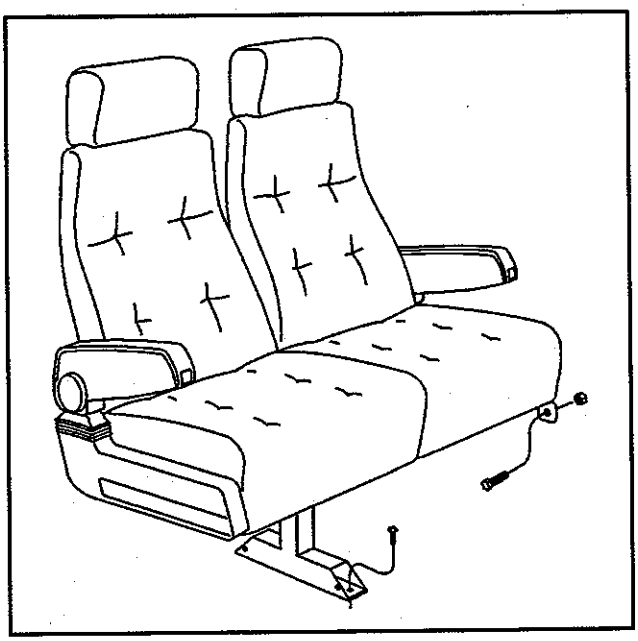

Figure 2—Pedestal Mounted Passenger Seat

1. Remove floor frame cap to expose the anchor bolt.
2. Remove two nuts and washers from floor anchor bolt.
3. Remove nuts, washers and two capscrews from bracket and sidewall. (See Figure 2—Pedestal Mounted Passenger Seat.)

- **Installation**

1. Install nuts and washers on the floor anchor bolt.
2. Torque nuts 34 to 37 foot-pound (3.8 to 4.2 N•m).
3. Install capscrews, washers, and nuts to bracket and sidewall.
4. Torque nuts 34 to 37 foot-pounds (3.8 to 4.2 N•m).

Other Type Passenger Seating

For other types passenger seating installation and removal, including installation and removal of track seating, contact the Blue Bird Service Department.

LTC Interior and Exterior Mirrors

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

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Interior Mirrors
For the interior rearview mirror adjustment illustration, see Figure 1—Interior Rearview Mirror.

Figure 1—Interior Rearview Mirror

1. Loosen knob on the ball joint.
2. Adjust mirror for the best all round view.
3. Tighten knob hand tight.

Notes
Notes are used to explain, clarify or otherwise give additional insight for a given subject, product or procedure.

Introduction
These procedures are documented using a Blue Bird LTC with a Cummins M11 engine and an Allison B500 World Transmission.

Description of Operation
Drivers are to adjust mirrors properly for safe driving. The driver must be aware of the limitations on viewing areas. Standard equipment on all Blue Bird LTC buses is two 12-volt heated outside rearview driving mirrors and one adjustable interior mirror. The remote is located on the driver's console.

Exterior Mirrors
Blue Bird LTC buses are equipped with two 8-inch elliptical mirrors, one on the left side of the vehicle and one on the right side. (See Figure 2—Exterior Mirror.)

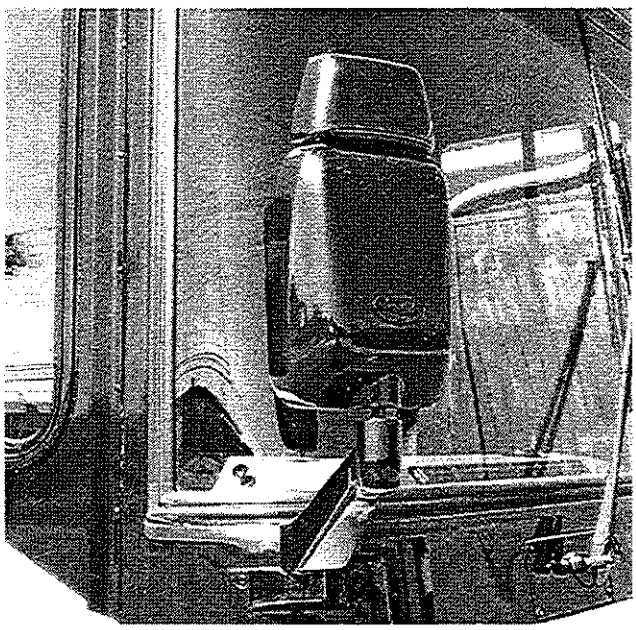

Figure 2—Exterior Mirror

Warning
People or objects seen in a convex mirror look smaller and appear farther away than with a flat

mirror. Do not put the vehicle into motion until persons or objects can directly be seen in a flat mirror.

Mirror Maintenance

Note

Make sure mounting fasteners are kept tight so that mirrors will not vibrate excessively.

1. Clean all mirrors at least weekly.

2. Clean with an ammonia solution to ensure that the mirrors are clean and safe.

3. Check clamps weekly and retighten as needed.

4. Check the entire mirror viewing areas daily, make necessary adjustments as required.

LTC Windshield Wiper System

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

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Introduction

Information in this section applies to the LTC Windshield Wiper System.

Description of Operation

The windshield wipers are wet arms with washing nozzle.

See Figure 1—Front Access Panel

See Figure 2—Screw Behind Parlgm

See Figure 3—Windshield Wiper Blade Assembly Bracket Location

See Figure 4—Blade Arm Alignment

Windshield Wiper System

- **Wiper Motor Removal**

1. Remove the two screws from the first. (See Figure 1—Front Access Panel.)
2. Remove the four screws from the front access panel.
3. Open the front access panel.
4. Remove and discard the sealant tape.

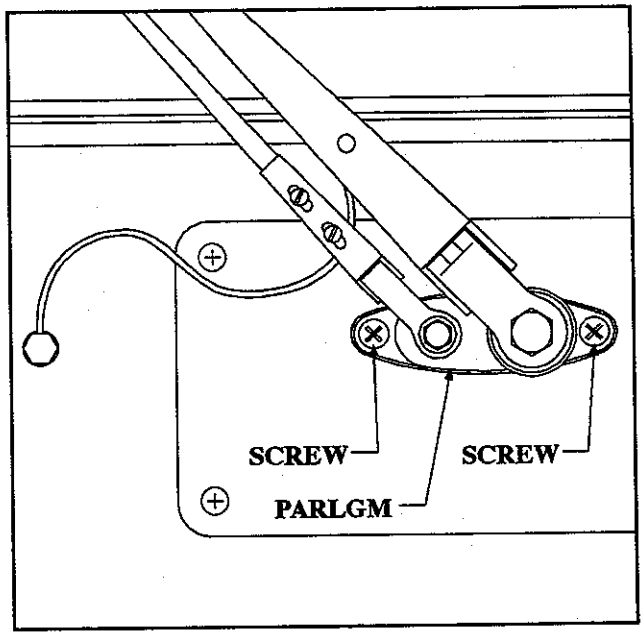

Figure 1—Front Access Panel

5. Disconnect the electric wiper motor in two places.
6. Remove the gasket. Discard if necessary. (If discarded, replace with a new gasket.)
7. Remove one screw from the motor bracket. (See Figure 2—Screw Behind Parlgm.)
8. Remove the electric motor.

Figure 2—Wiper Parlgm

- **Wiper System Installation**

Note

There is a left side and a right side for the installation of the motor.

1. Install one screw to the motor bracket. (See Figure 2—Screw Behind Parlgm.)

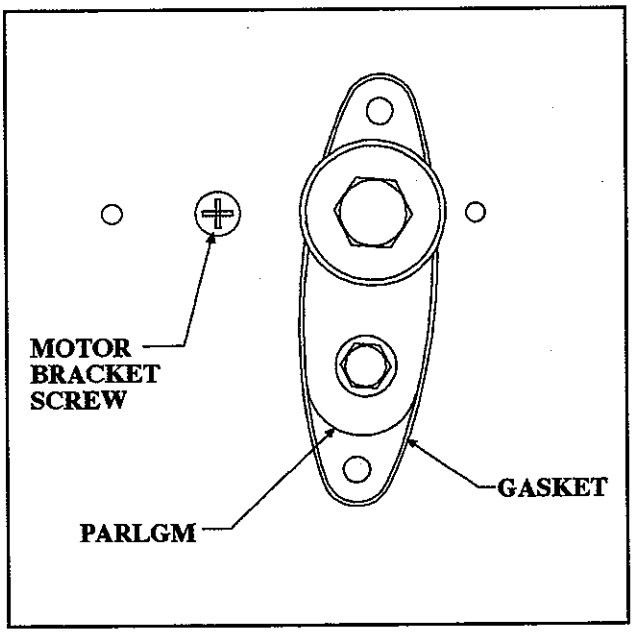

Figure 2—Screw Behind Parlgm

2. Install the gasket.
3. Install two screws to the parlgm. (See Figure 1—Front Panel Access.)
4. Install the new sealant tape.
5. Connect the electric motor.
6. Install the front panel.

Wiper Arm Mechanism

- **Removal of wiper blade**

1. Remove the bolt from the bracket assembly on the wiper arm. (See Figure 3—Windshield Wiper Blade Assembly Bracket.)
2. Replace the wiper blade.

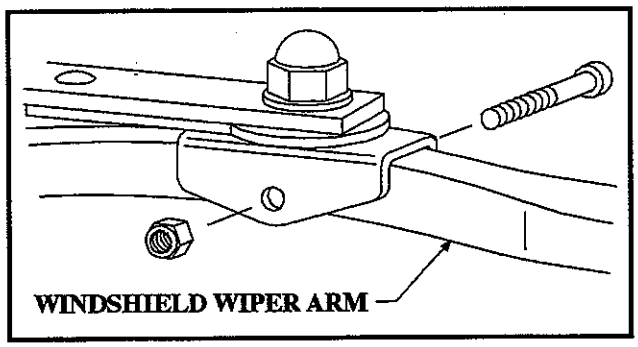

Figure 3—Windshield Wiper Blade Assembly Bracket

3. Adjust the wiper blade for correct alignment. (See Figure 4—Blade Arm Alignment.)
4. Start the wipers and washer to ensure proper cycling.

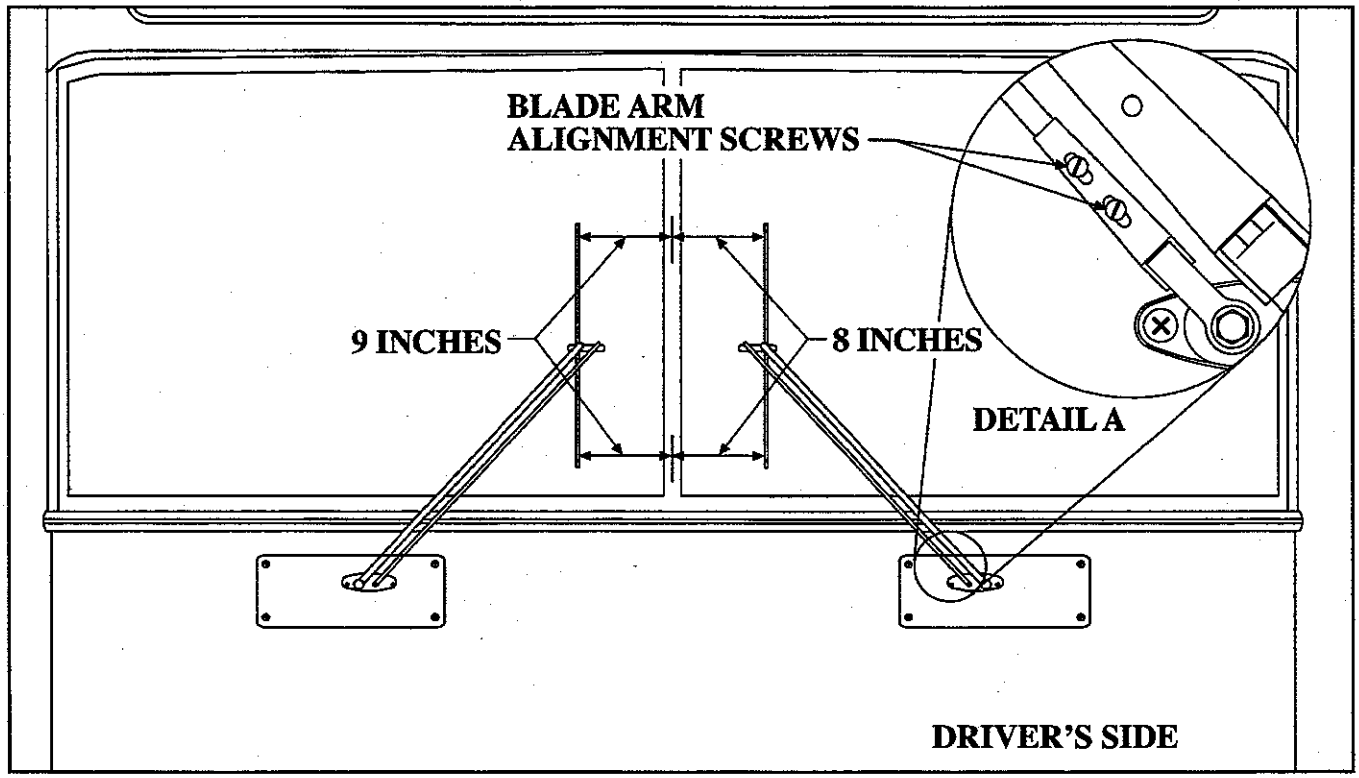

Figure 4—Blade Arm Alignment

Windshield Wiper Reservoir Removal

- **Five quart (4.73 L) plastic bottle**

1. Disconnect the plastic hose from the reservoir.
2. Remove the nuts and bolts from the bracket.

LTC Lights

Table of Contents

Table of Contents

List of Tables

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Introduction

These procedures were documented using a Blue Bird LTC bus with a Cummins M11 engine and an Allison B500 World Transmission.

Preparatory Work

Disconnect the battery.

Description of Operation

Blue Bird's LTC is equipped with a variety of lights designed for individual safety and comfort. For light bulb replacement, see Table 1—LTC Required Light Bulb Replacement.

Spare Light Bulb Replacement	
Description	**Part Number**
Bulb 193	0002120
Bulb fe8t9-cw Main Roof Running	0001252
Bulb GE 168	0002123
Bulb 1156	2255651
Amber Clearance Light	1280601
Driving Light GE h9411	4580379
Driving Light Hella Clear	3959079
Bulb 67	2255735
Bulb 53	2277721
Bulb 1157	2255669
Red Clearance Light	1281369
High Mount LED Brake Light	1888804
Single Halogen Headlamp	1949510
Bulb 12V/5 Watt 6418	0011062
Bulb 12V/12 Watt 2005	0011061
Bulb Fluorescent 13 Watt Parcel Rack	0009173
Bulb 12Volt/10Watt	0011167
T-Bulb 2-Pin Base	20011061

Table 1—LTC Required Light Bulb Replacement

LTC Emergency Equipment

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

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Introduction

These procedures were documented using a Blue Bird LTC bus with a Cummins M11 engine and an Allison B500 World Transmission. The emergency equipment consists of a First Aid Kit, Fire Extinguisher, Lugwrench and Triangular Warning Device. Generally, these devices are located on the LTC just behind and to the immediate left of the driver's seat.

First Aid Kit

The First Aid Kit is attached to the rear of the shifter cabinet, near the driver's left elbow. Size and contents of first aid kits may vary by option package or differing state specifications. The contents of the kit should be inspected weekly.

Fire Extinguisher

The fire extinguisher is normally located to the left of the driver's seat, on the floor. Your unit may be equipped with a 2.75, 4.5, 5, or 6-pound extinguisher. Inspect the pressure guage 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.

Lug wrench

The lugwrench is located in the driver's luggage compartment. Inspect the installation-mounting fasteners every thirty days to ensure that the installation is accessible, unobstructed, and tight.

Triangular Warning Device

For states that require triangular warning devices, the devices are located in the driver's luggage compartment. Inspect contents of the kit (as well as the mounting fasteners) every 30 days, or as required by the local code.

For the recommended warning device positioning, see Figure 1—Triangular Warning Device Positioning.

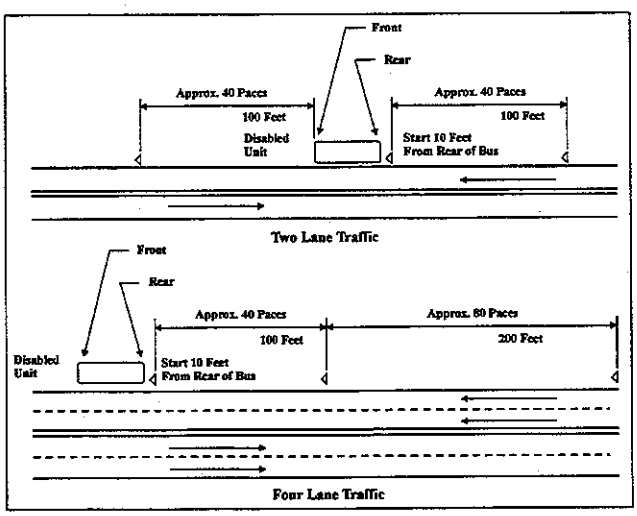

Figure 1—Triangular Warning Device Positioning

LTC Luggage Compartments

BLUE BIRD

Table of Contents

Table of Contents

List of Figures

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Introduction

The luggage compartment section on your Blue Bird LTC has six compartments.

Description of Operation

The doors are easy open doors with a 200 foot-pound gas spring to do the work of opening. Each luggage compartment has a key lock for safety.

General Maintenance

See Figure 1—Maintenance Locations and Part Removal.

While maintenance is performed every three (3) months, visual inspections are performed weekly.

Note

Required general maintenance includes cleaning and lubrication.

- **Seals**

General maintenance required includes weekly inspections for evidence of wear or cracking. Cleaning should be done with a nonabrasive degreaser.

- **Top Linkage Assembly**

1. General maintenance required includes weekly inspection and cleaning with a nonabrasive degreaser.

2. Quarterly, lubricate assembly with a graphite type lubricant or a spray type lubricant, such as LPS.

- **Locks**

1. General maintenance required. Weekly, inspect and clean with a nonabrasive degreaser.

2. Quarterly, lubricate locks with a graphite type lubricant or a spray type lubricant, such as LPS.

Installing and Adjusting Luggage Compartment Doors

1. Install bearing composite (6) and bearing flange (5) on mounting luggage door bracket (1,2). (See Figure 1—Pantograph Luggage Door Assembly.)

Note

Part number will depend on the compartment the door is required for (i.e., driver's compartment, luggage bay, etc.).

Note

It is important not to over tighten the bolts on the bearing flange. They must be left loose enough to allow the composite bearing to spin freely inside.

2. Install one mounting door linkage bracket (1,2).

Note

Part number will vary depending on the compartment.

3. Install the shaft collar (4) on linkage assembly.

4. Install the second mounting luggage door linkage bracket (1,2) with linkage assembly (3).

Note

They must be installed together.

5. Install male thread rod end (11) into linkage assembly (3).with jam nut (14).

6. Preset linkage assembly to 18 inches from face of tube to center of rod end. (See Figure 2—Install Latch)

7. Install gas spring rear brackets (8 and 9).

8. Install gas spring stud (16).

9. Install 200 lbf gas spring stud (10).

Note

The spring will need to be compressed approximately 2 inches before installing. A homemade compression tool will suffice.

10. Install gas spring clip (15) on gas spring.

11. Install linkage assembly. Preset the length to 20 inches from center to center of ball joint.

12. Install door assembly. The door can now be fine tuned to fit. Secure all fasteners.

Note

Front to rear adjustment can be accomplished by moving the collar shafts forward or rearward. (See Figure 1—Pantograph Luggage Door Assembly.)

Luggage Compartment Removal

For removal of luggage compartment, reverse installation procedures.

Warning

Gas Spring under pressure. Use compression fixture for removal. Energy from compressed spring is dangerous. Use extreme caution to prevent personal injury.

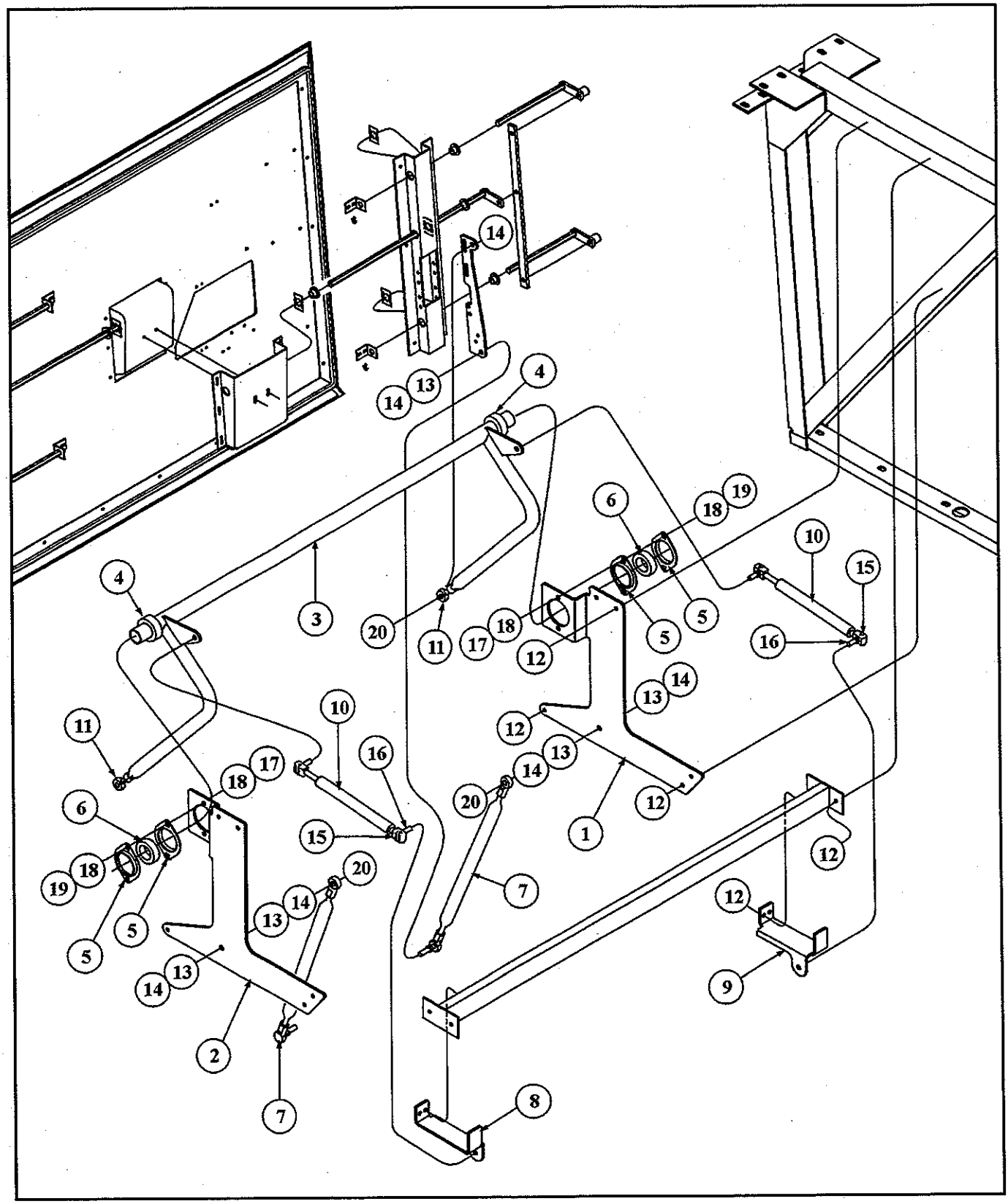


Figure 1—Maintenance Locations and Part Removal

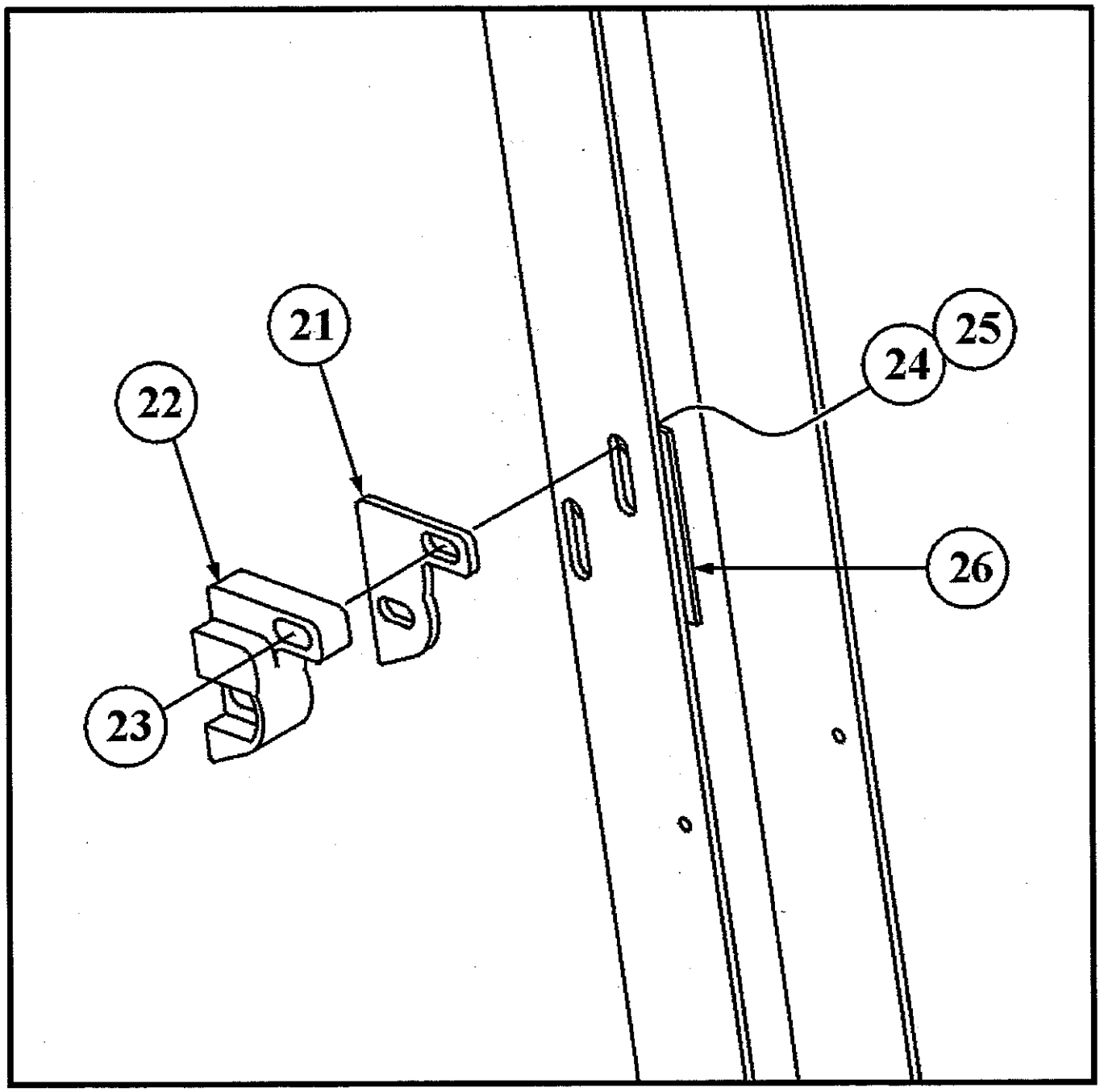
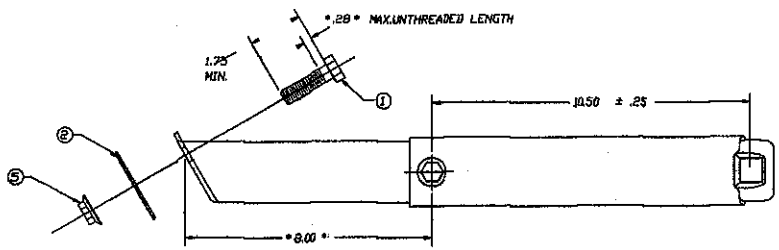
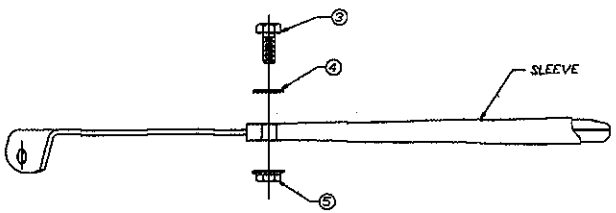
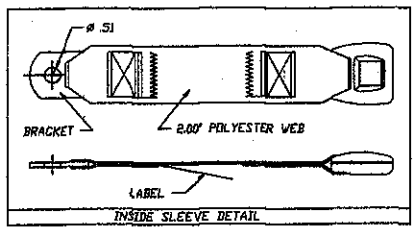


Figure 2—Install Latch

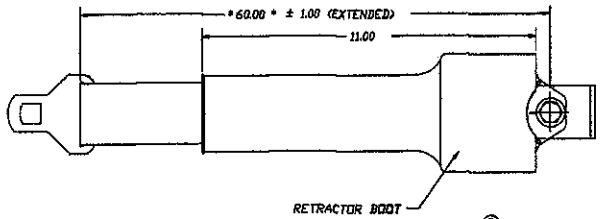
MOUNTING HARDWARE		
KEY	DESCRIPTION	QTY
1	BOLT, 7/16-20, MINIMUM LENGTH 1.75, MINIMUM GRADE-5 (UNASSEMBLED)	2
2	REINFORCEMENT PLATE, 2.50 DIA X .070 MIN THICK, Ø.47 CENTER HOLE (UNASSEMBLED)	2
3	BOLT, 7/16-20 X 1.0, GRADE-5	2
4	FLAT WASHER, 7/16"	3
5	LOCKNUT, 7/16 - 20 (DEFORMED THREAD TYPE) (2-UNASSEMBLED)	4
6	MOUNTING BRACKET, ANGULAR (85°)	1

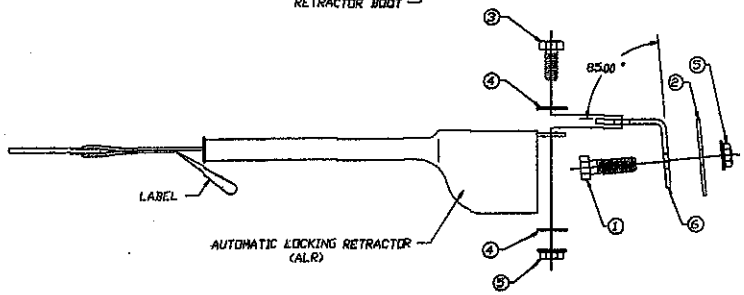






INSIDE SLEEVE DETAIL





NOTE:
1. ASSEMBLY TO MEET FMVSS 208, 209, 302
2. ALL HARDWARE TO MEET PERFORMANCE REQUIREMENTS AS SPECIFIED IN SAE J141.
3. THIS DRAWING IS A REPRESENTATION OF INDIANA MILLS P/N F07270.

MATERIAL: FLAT SIZED

FINISH: RAW ☐ PAINT ☐ NONE ☐ OTHER ☐ COLOR OR TYPE

TOLERANCE OF ALL DECIMALS EX. PLUS .06 IN INCHES .08 UNLESS OTHERWISE SPECIFIED. DO NOT SCALE.

PRINTWHEEL NBR. 1271667

REV			DATE	BY
A	—	REDRAWN ON DATA WITH CHANGES	05/05/98	JJ
LTR	WAS	REVISIONS	DR.	APP.

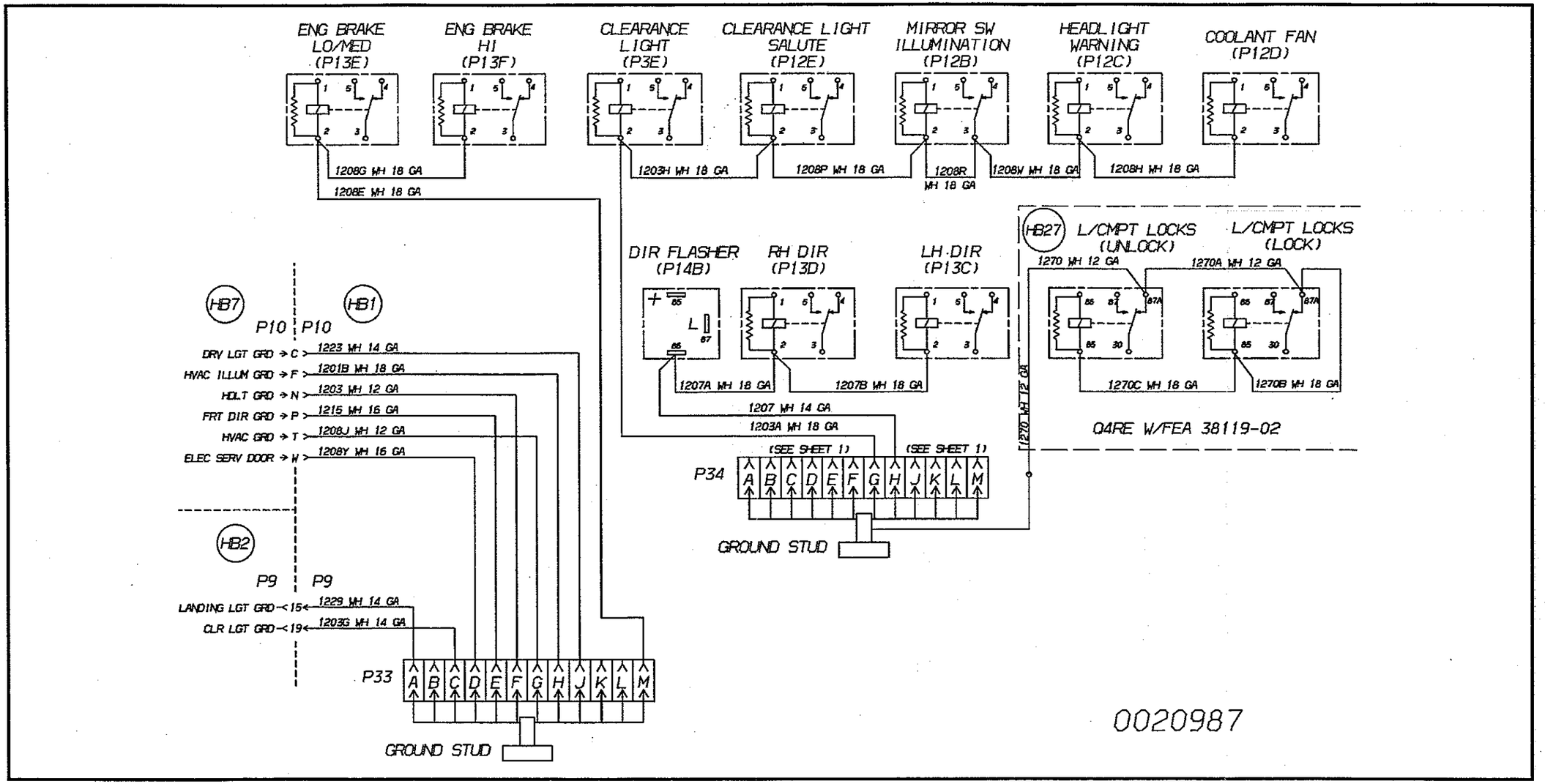
CAGE CODE 9S30 — BLUE BIRD CORPORATION, FORT VALLEY, GEORGIA, U.S.A. — SCALE NONE

SEAT BELT ASSY, SINGLE ALR, BUCKLE RISER, A/CINCH

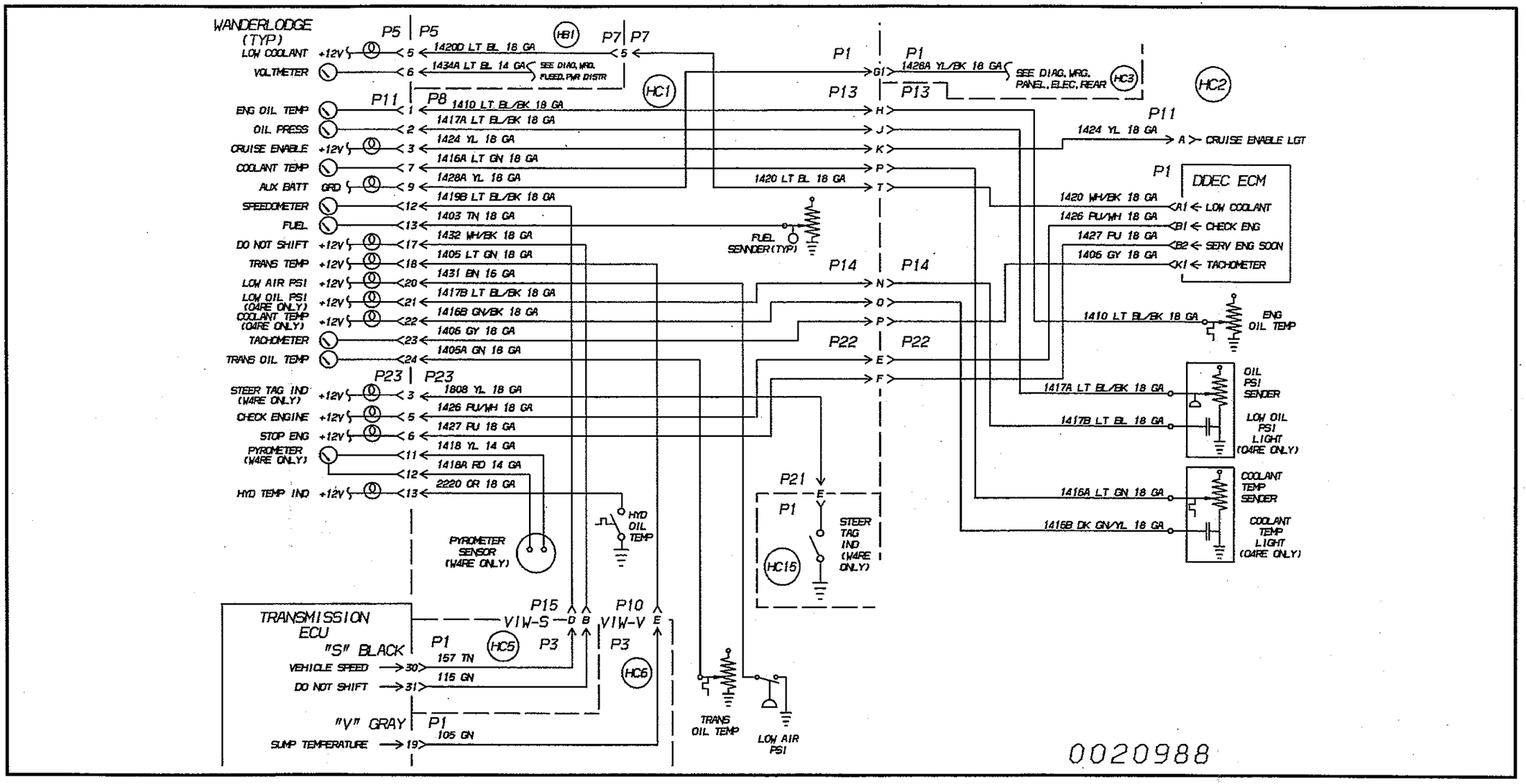
DR. 04/03/98 BY JJF
APP. 04/3/98 BY JMB

C | 1497502

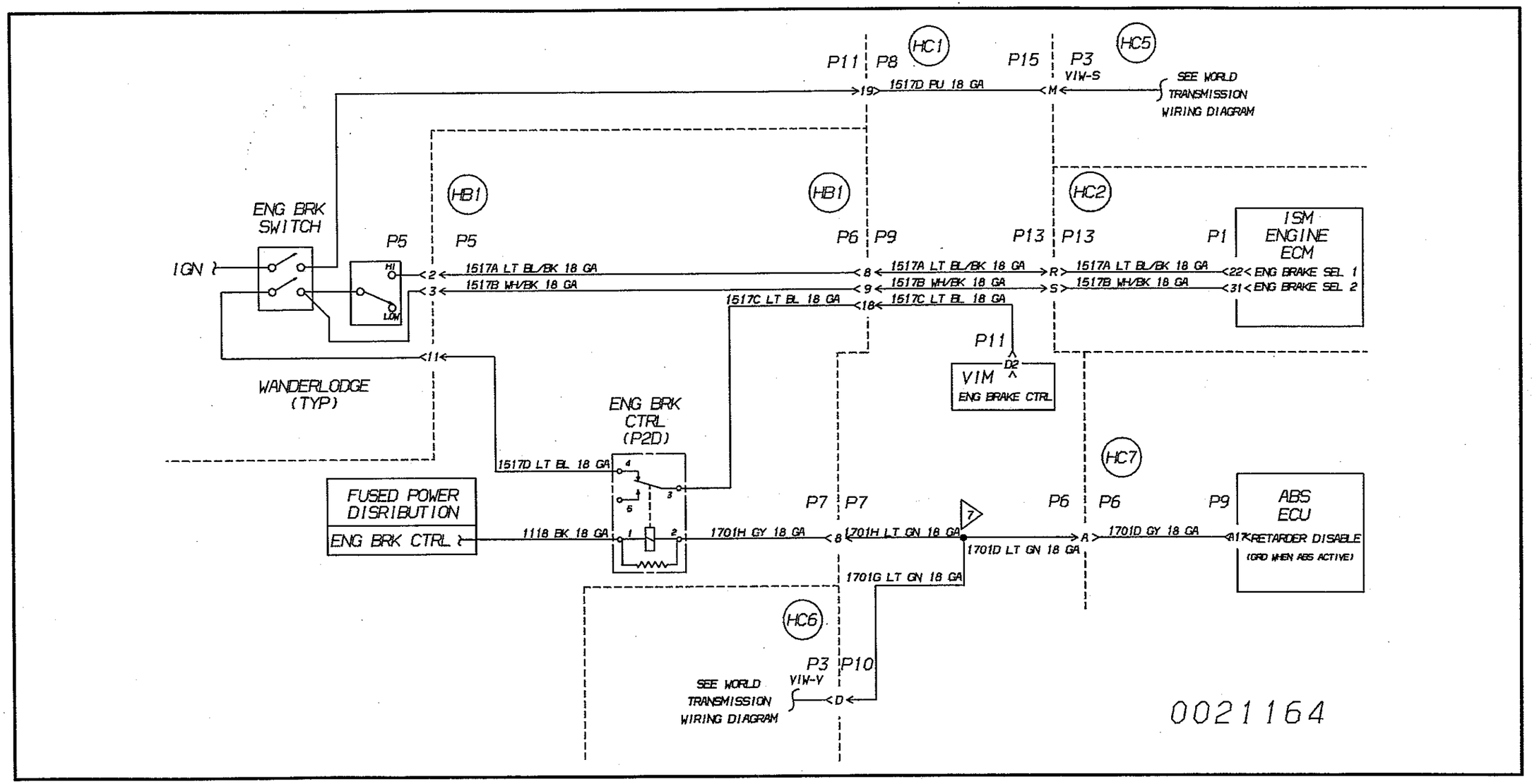
PAGE 1 OF 1



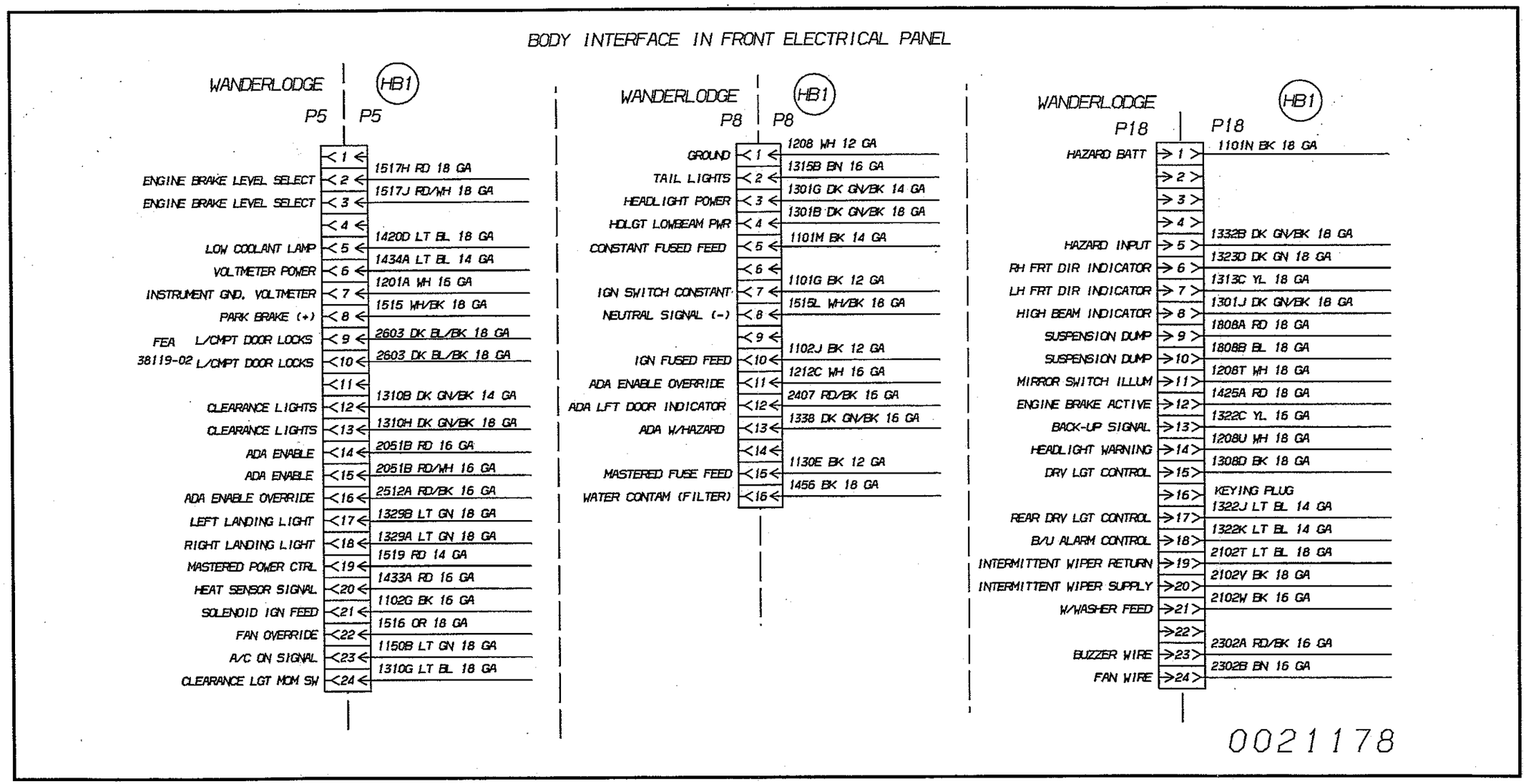
Schematic 52—Ground Distribution DDEC



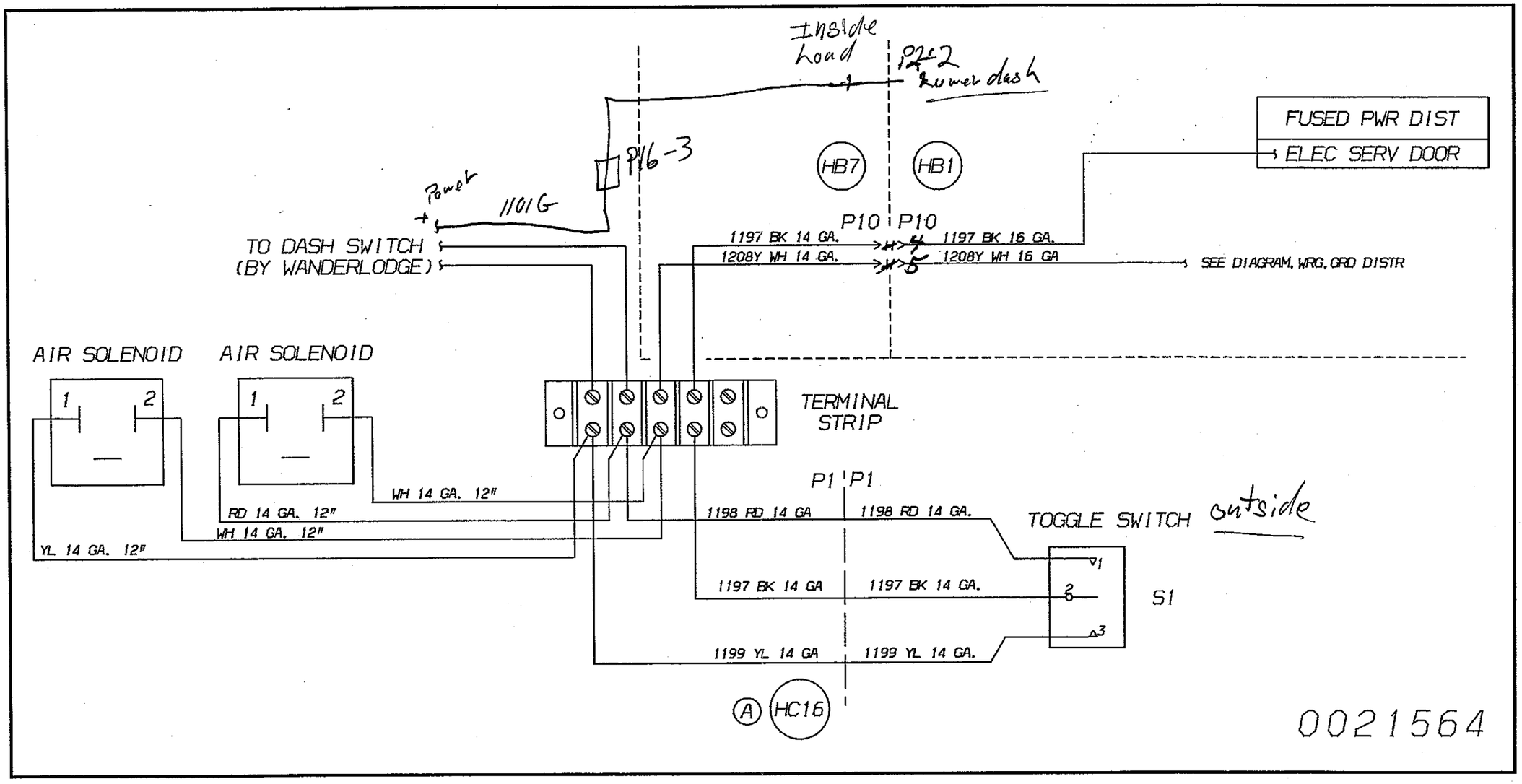
Schematic 53—Warning Light Gauges DDEC



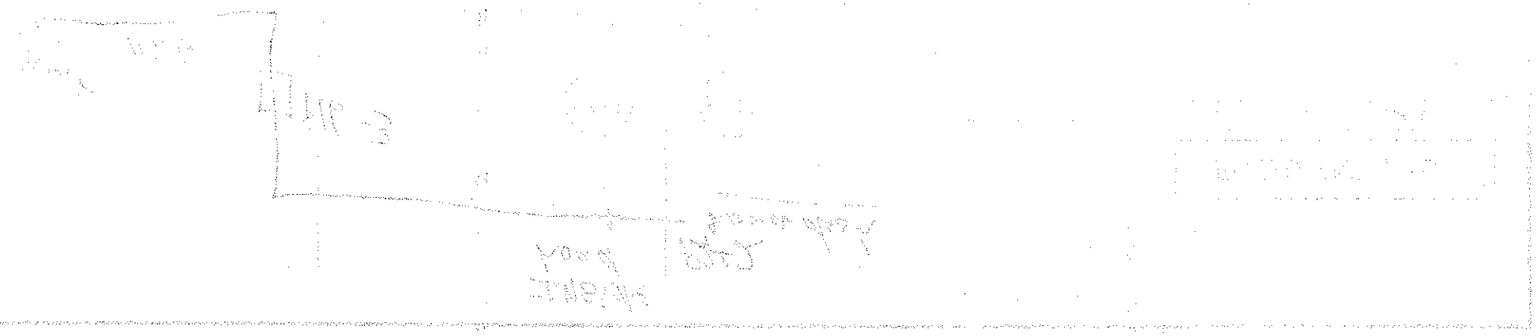
Schematic 54—Engine Brake Control Cummins

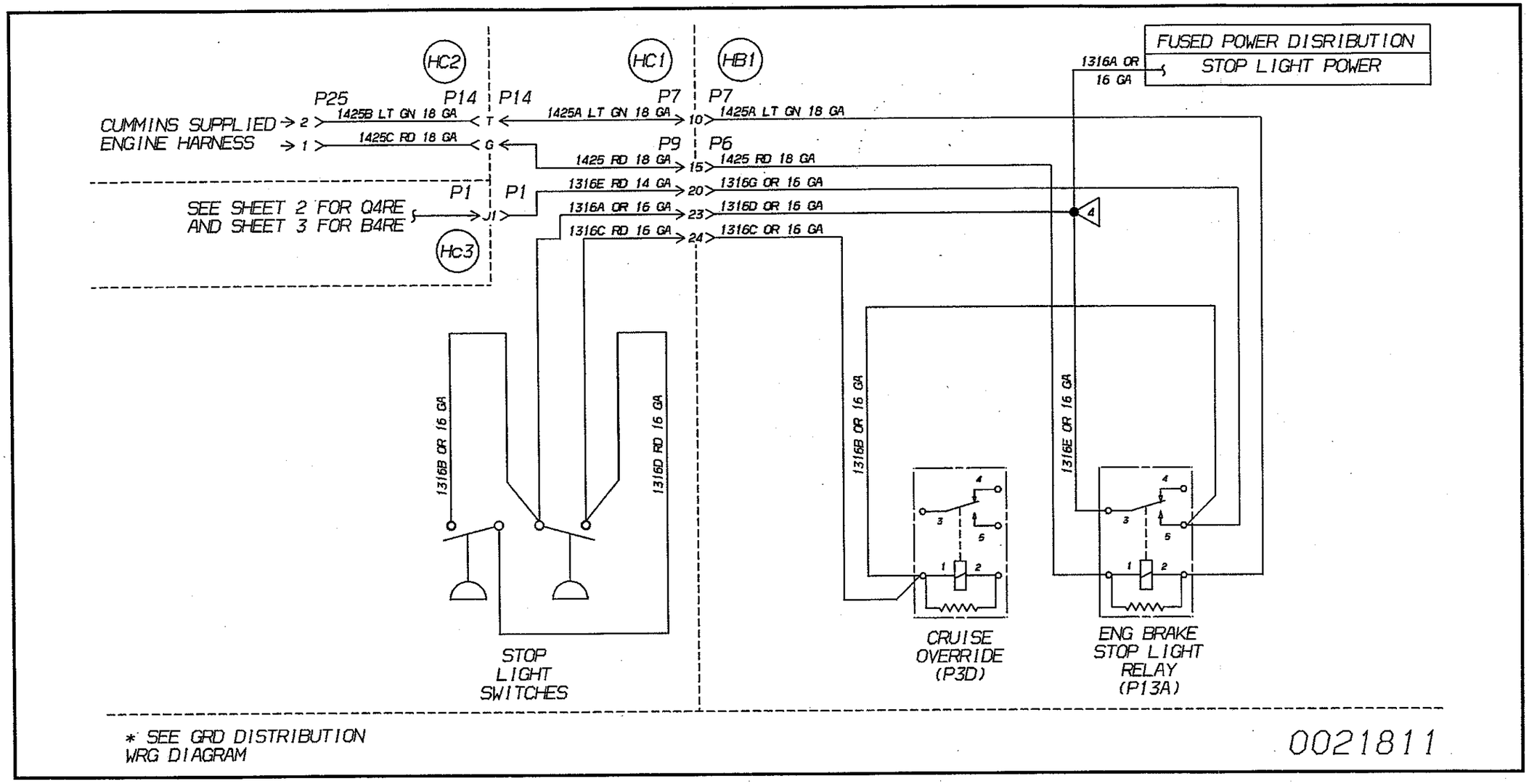


Schematic 55—Wanderlodge Interface DDEC

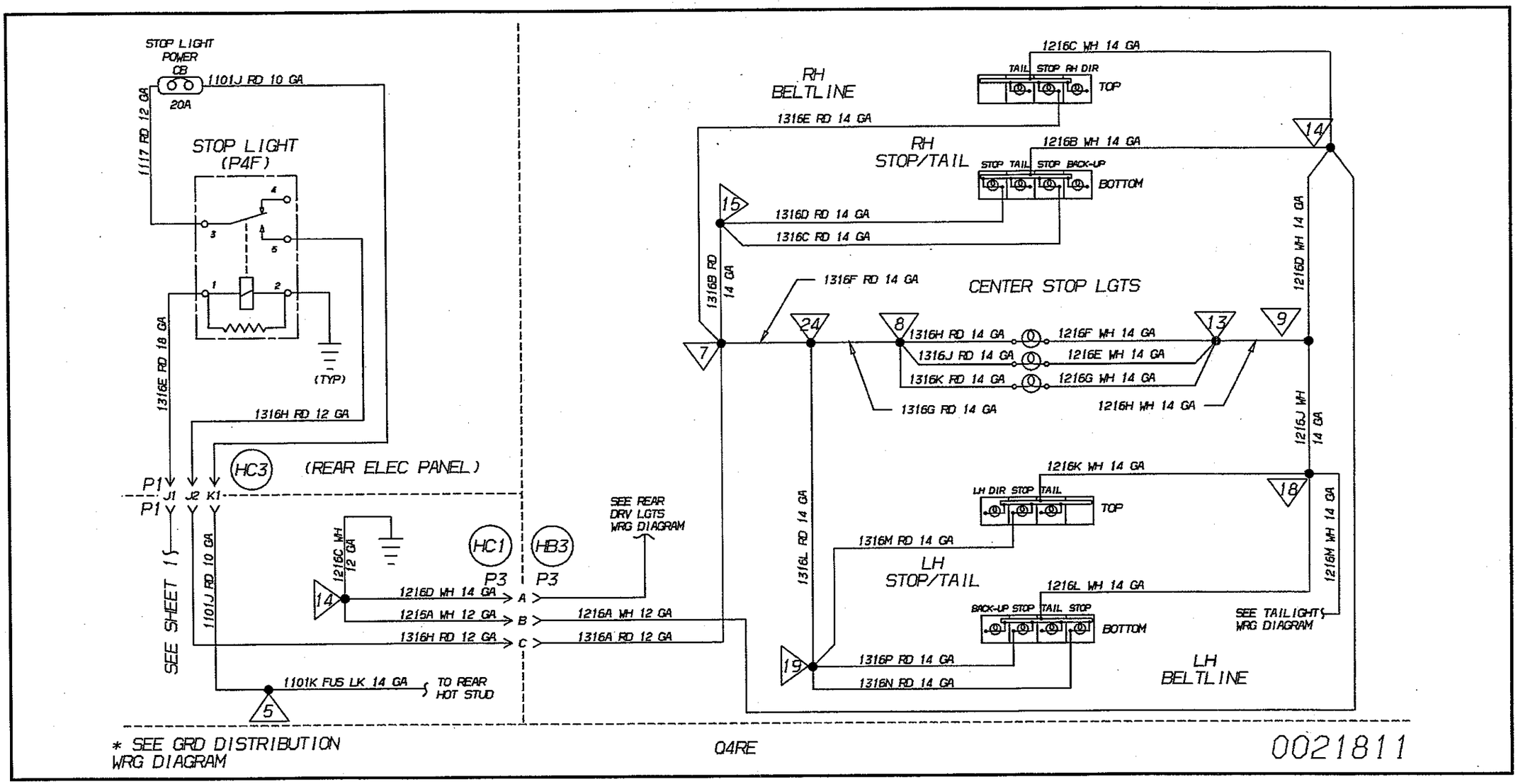


Schematic 56—Service Door

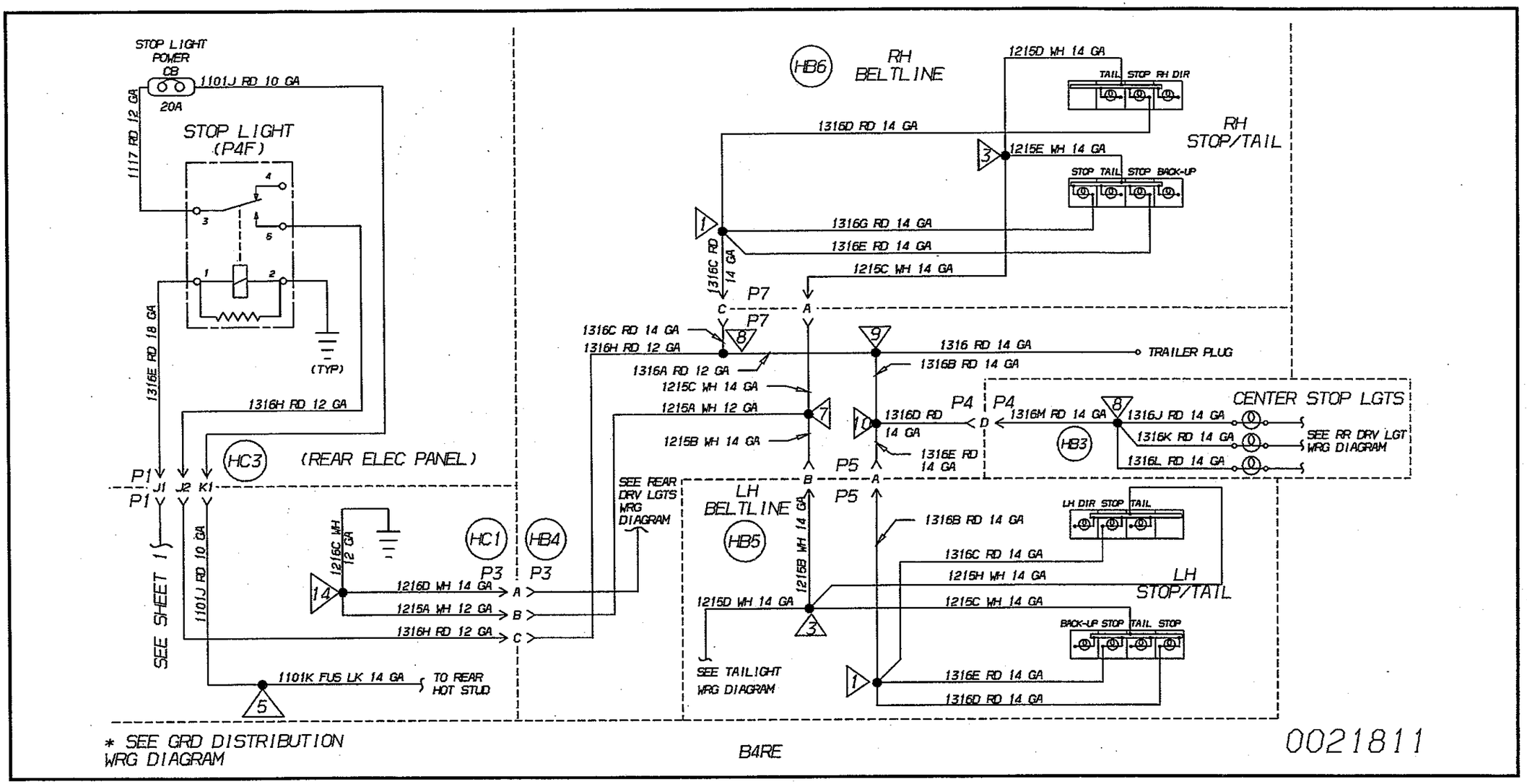




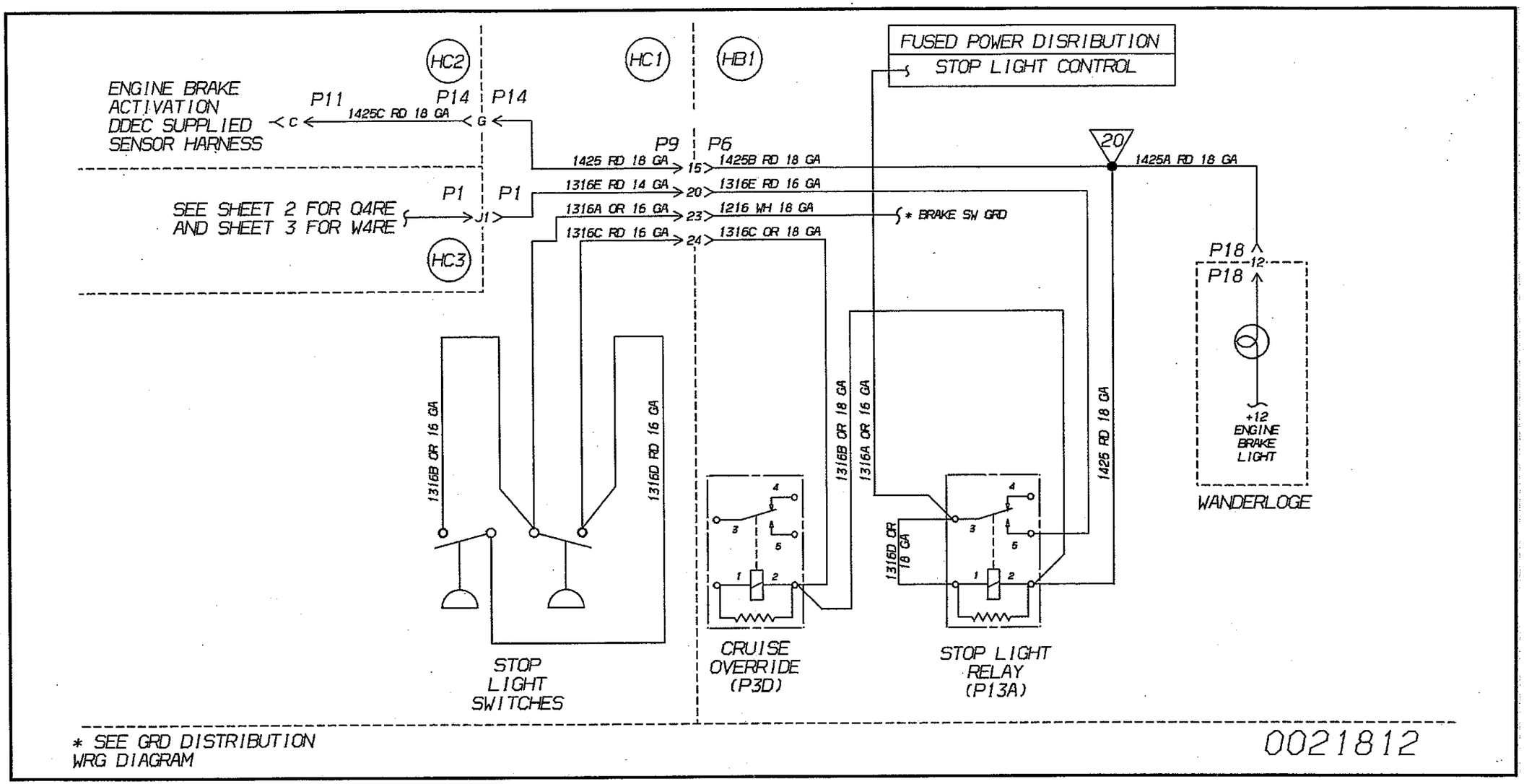
Schematic 57—Stop Lights Cummins



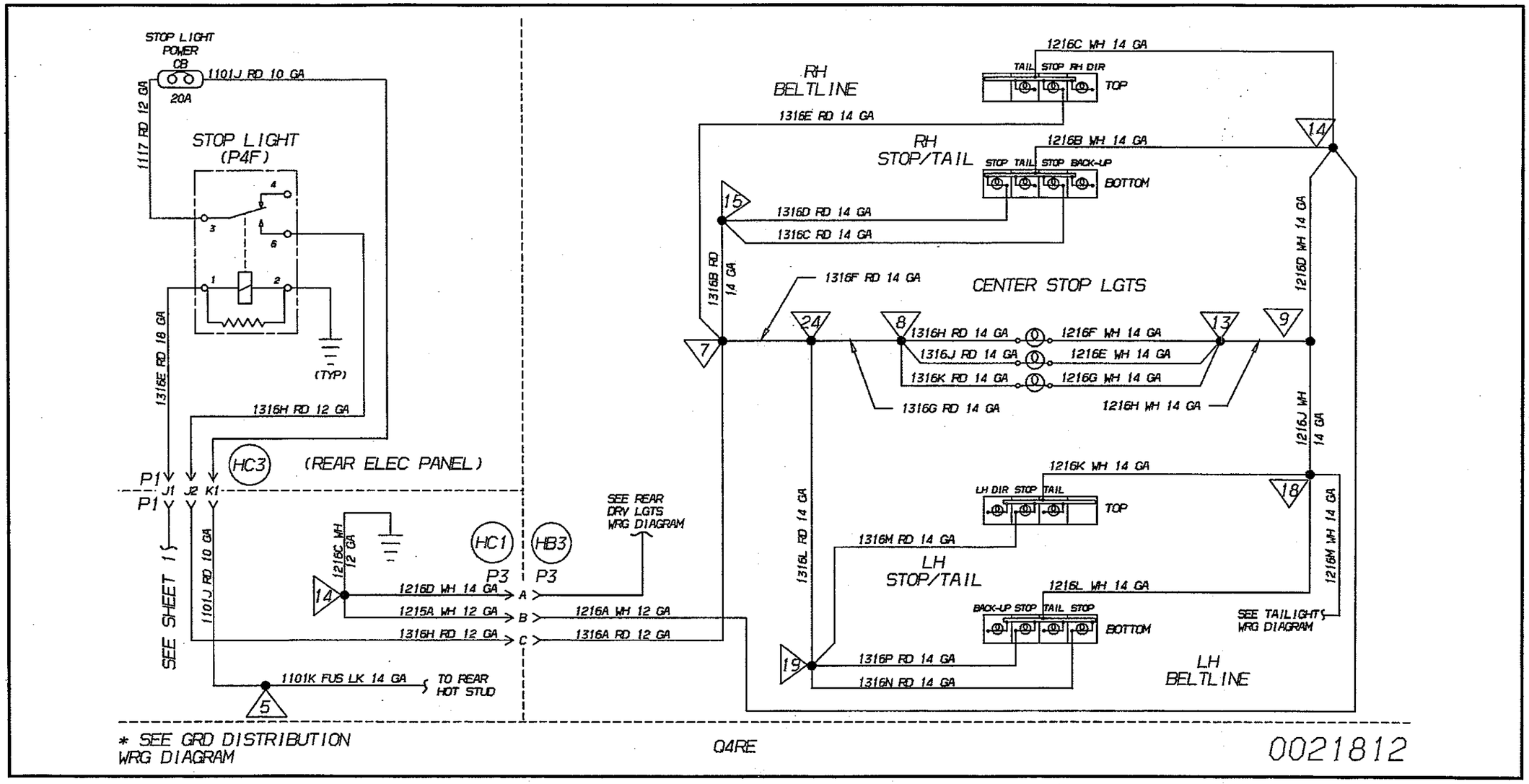
Schematic 58—Stop Lights Cummins



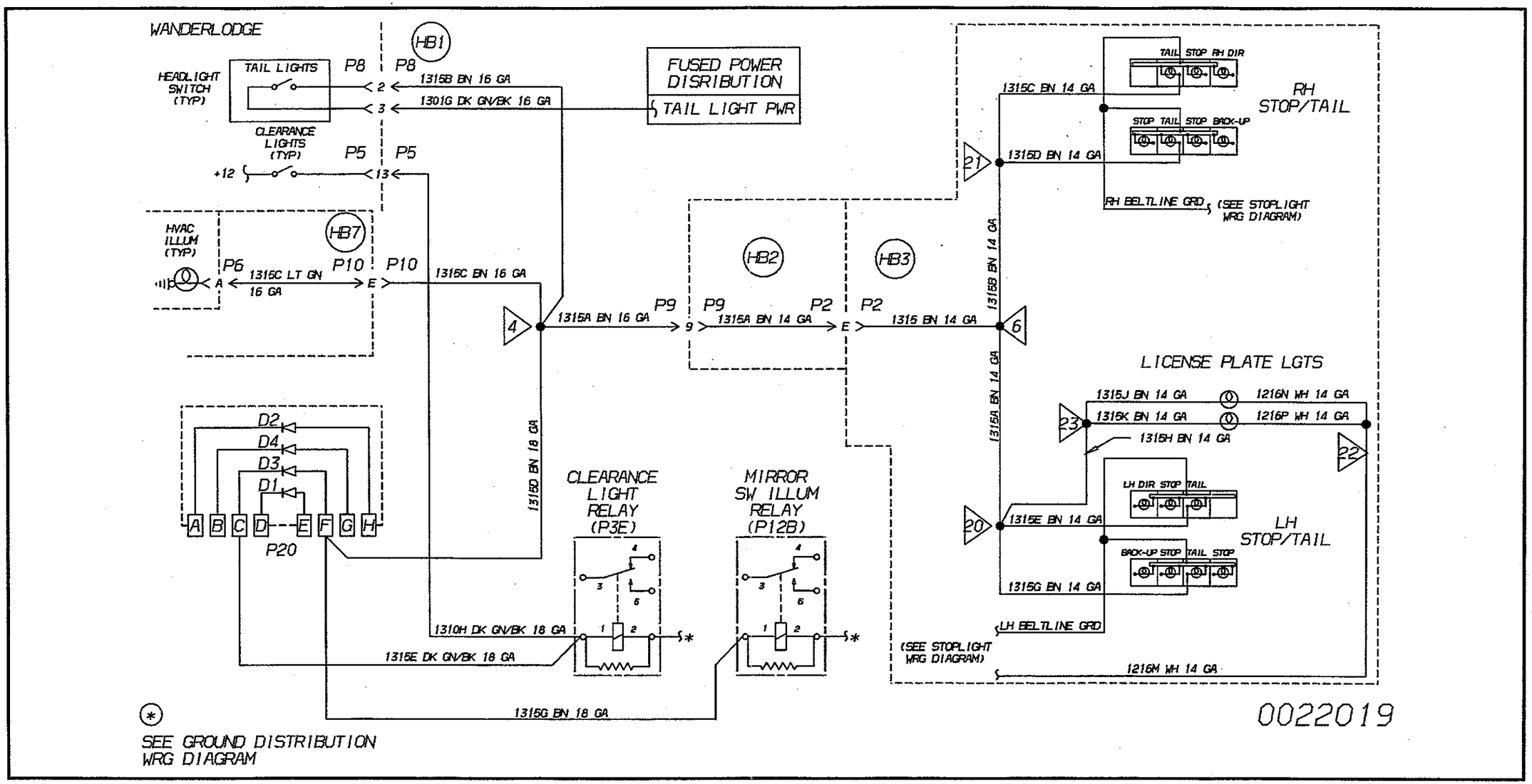
Schematic 59—Stop Lights Cummins



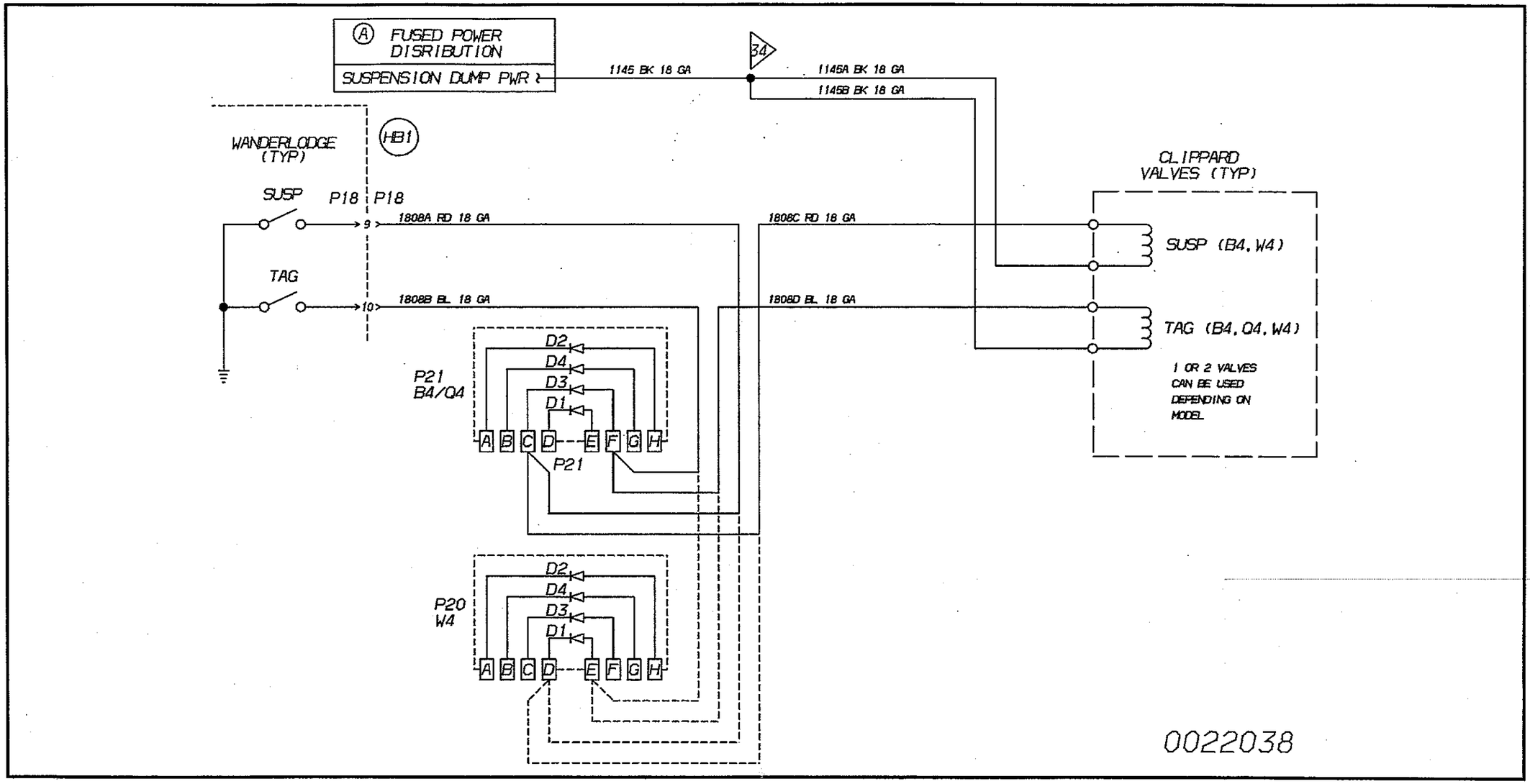
Schematic 60—Stop Lights DDEC



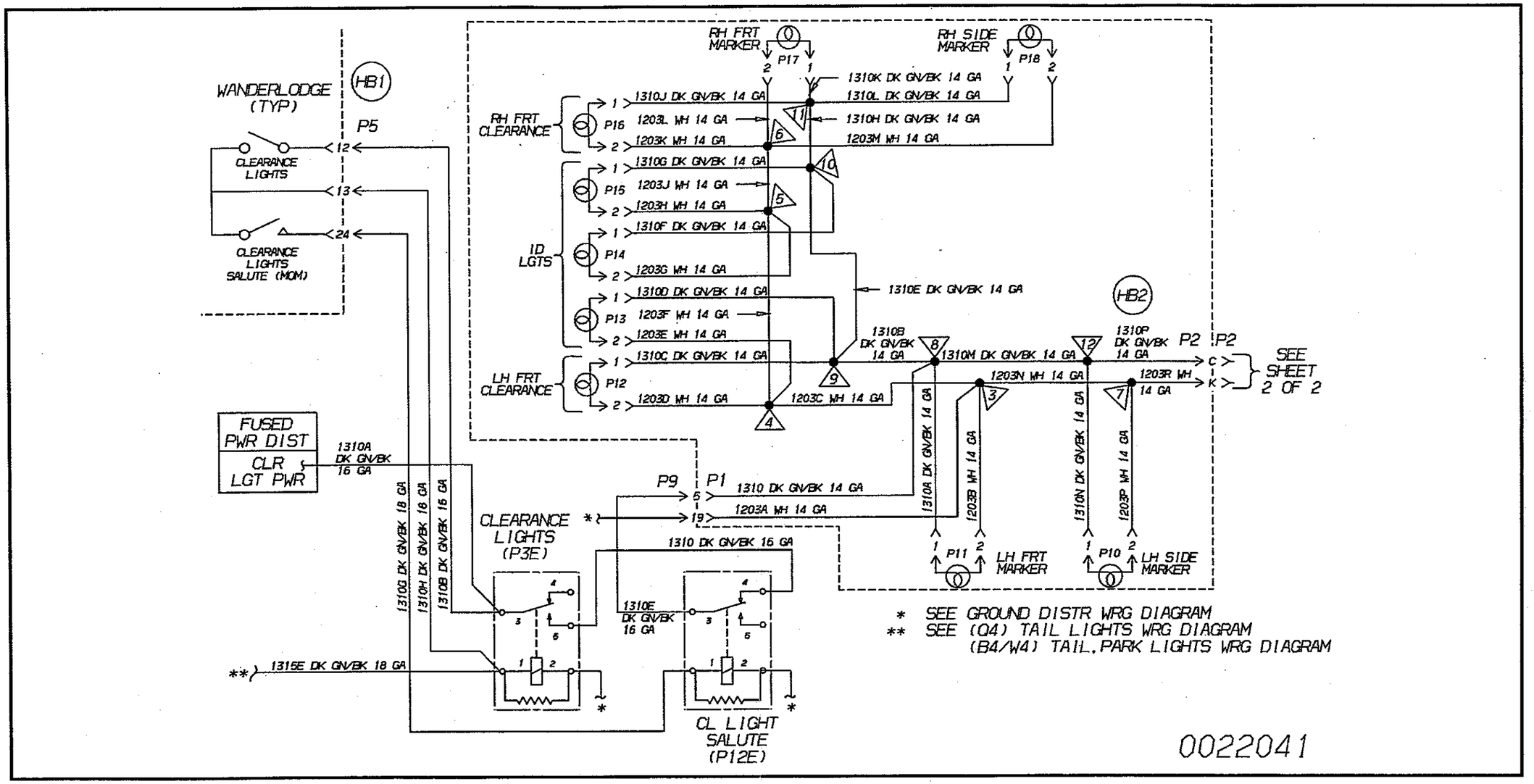
Schematic 61—Stop Lights DDEC



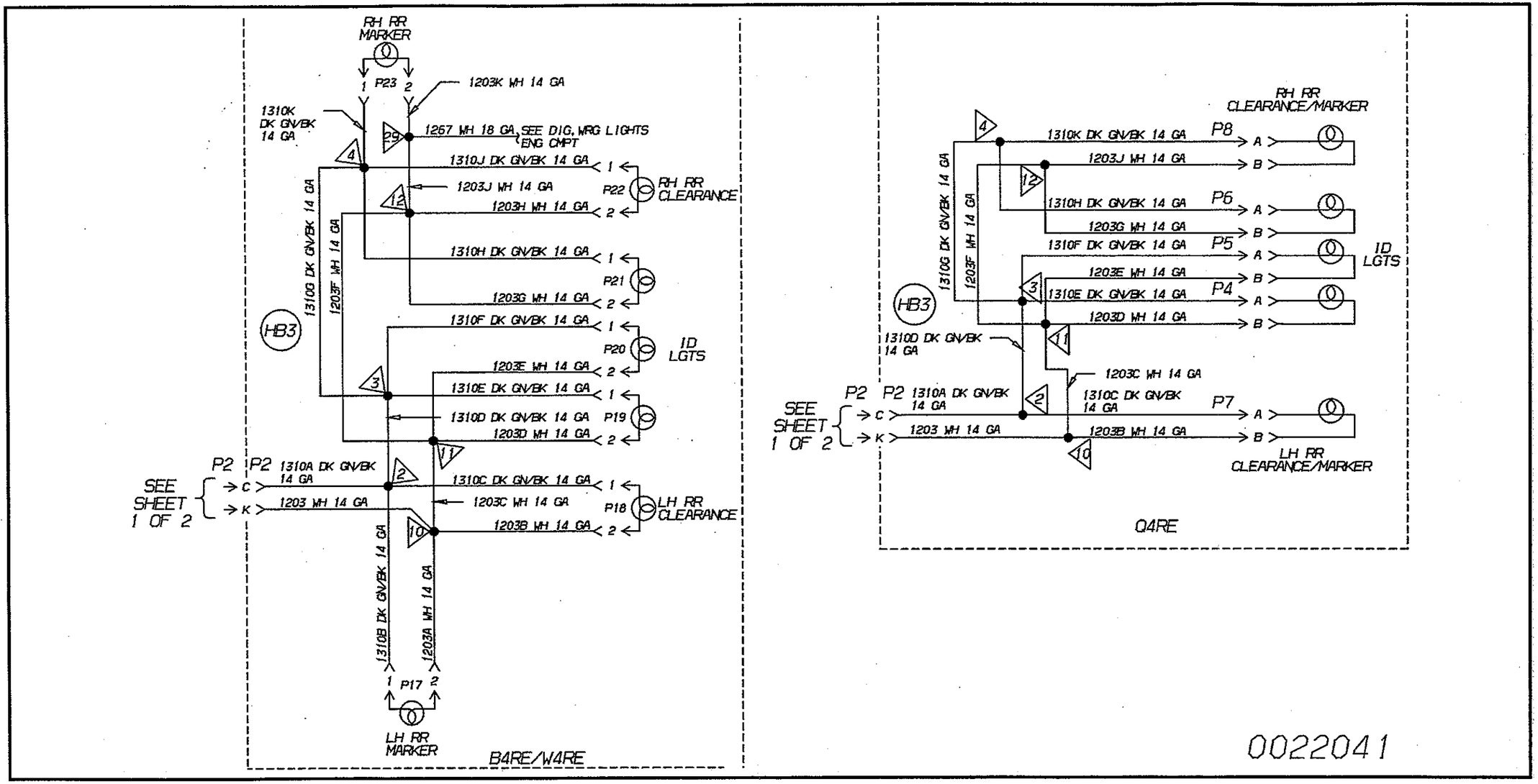
Schematic 62—Tail Lights



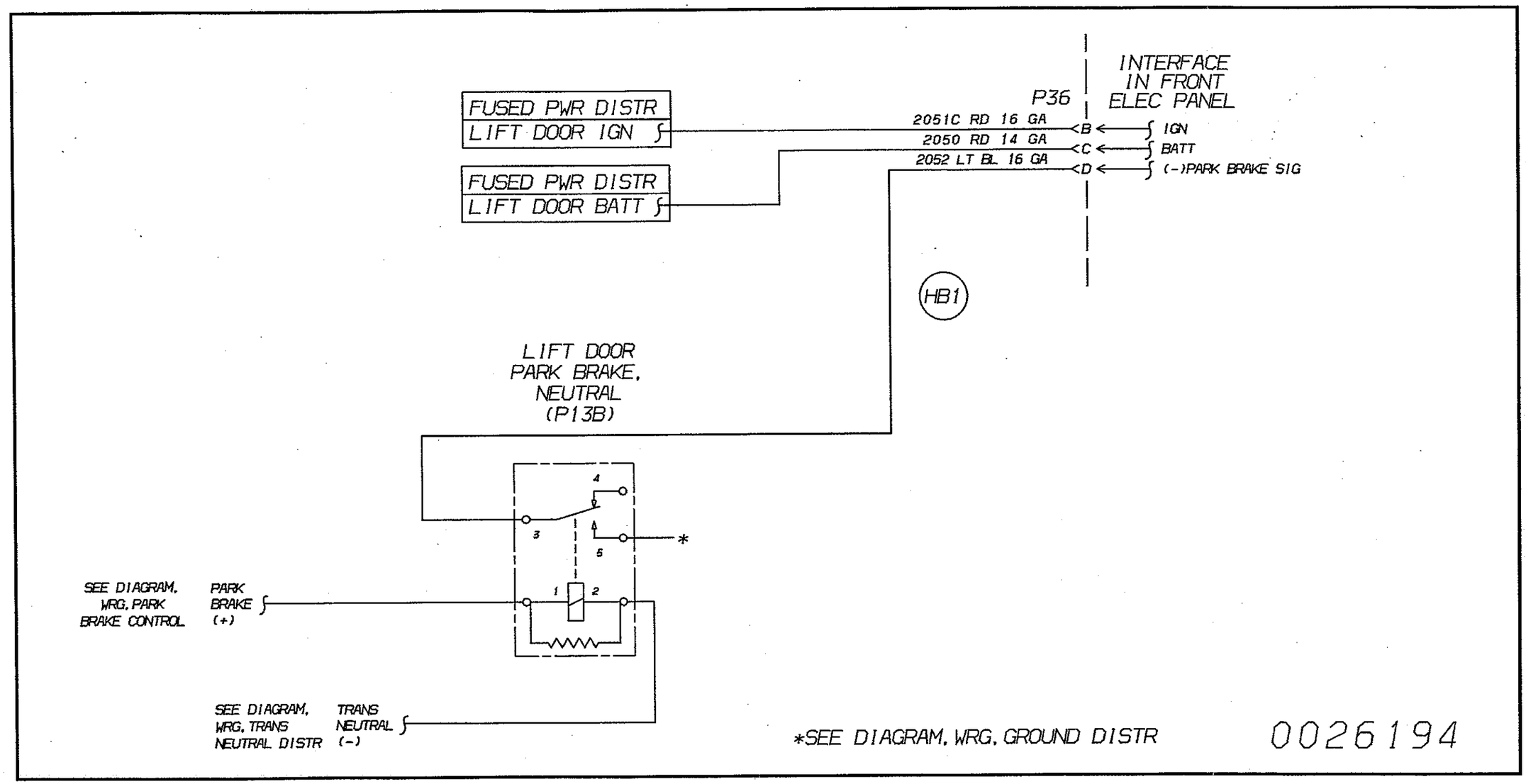
Schematic 63—Suspension Dump



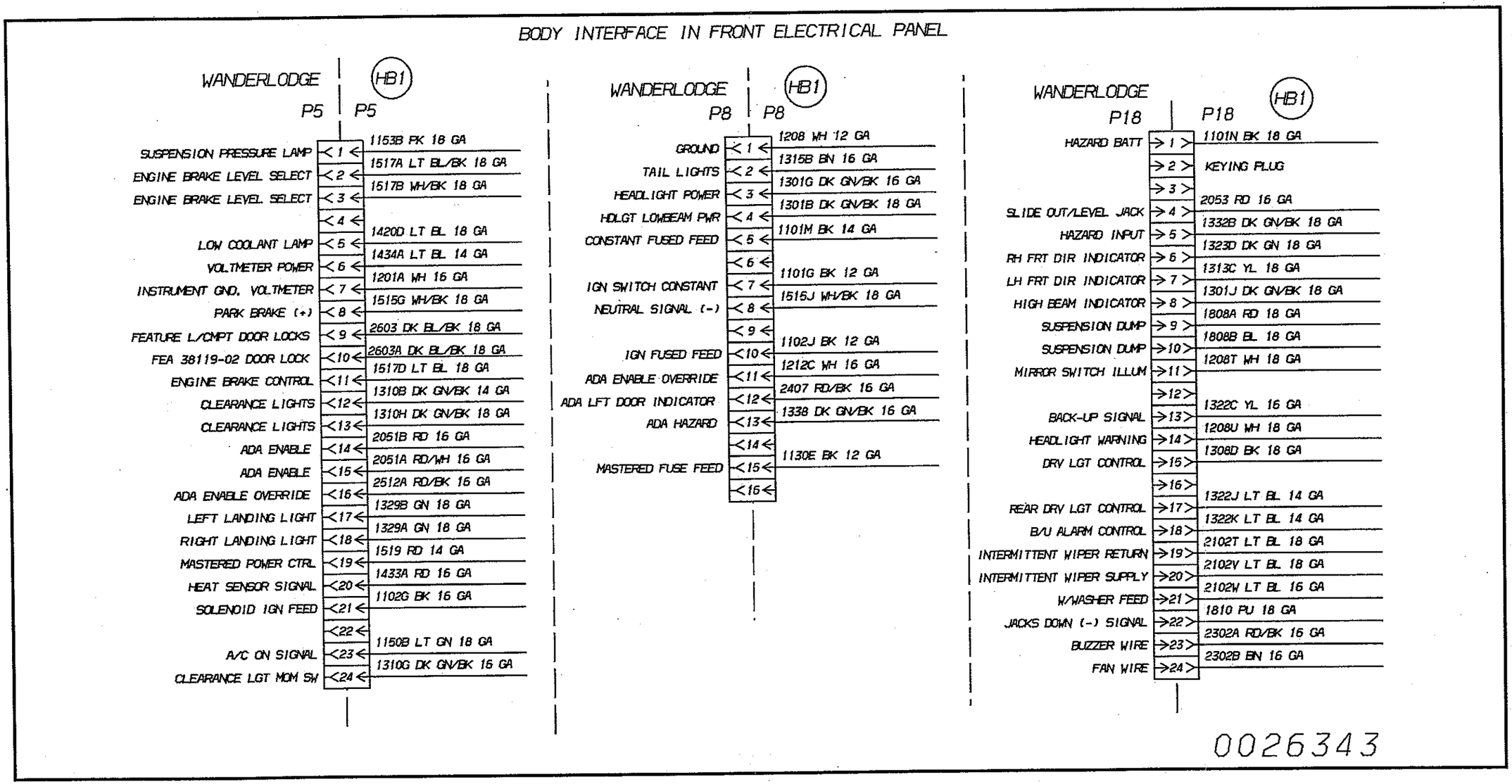
Schematic 64—Marker Lights



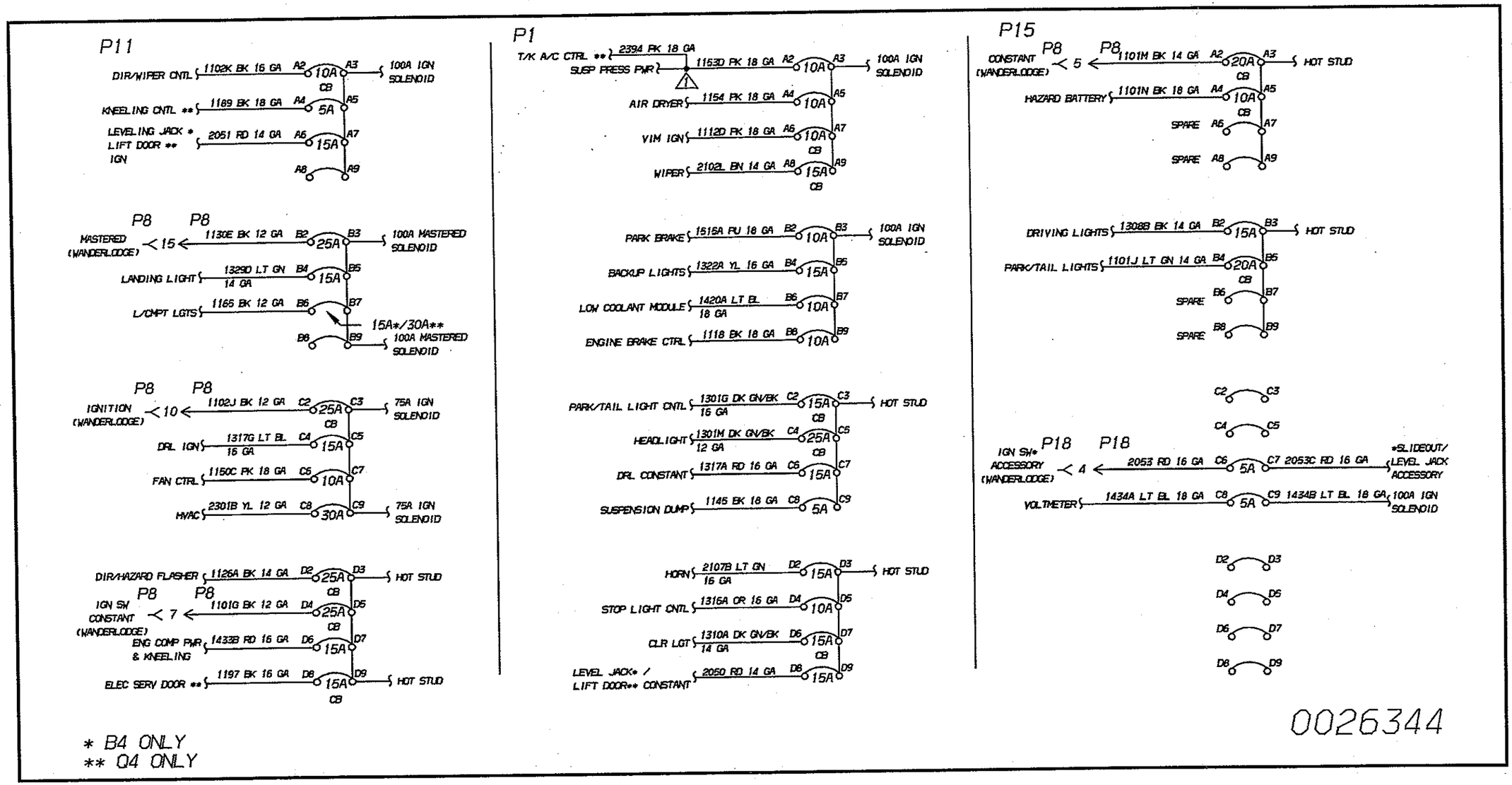
Schematic 65—Marker Lights



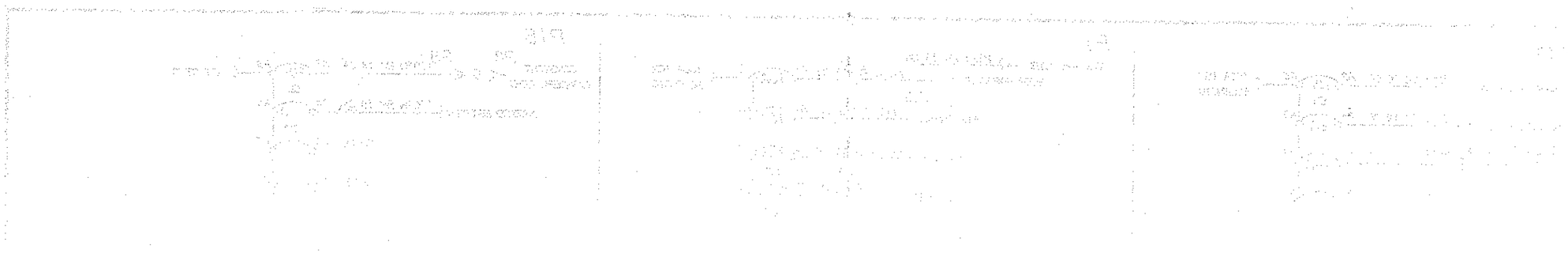
Schematic 66—Interlock Power/Lift Door

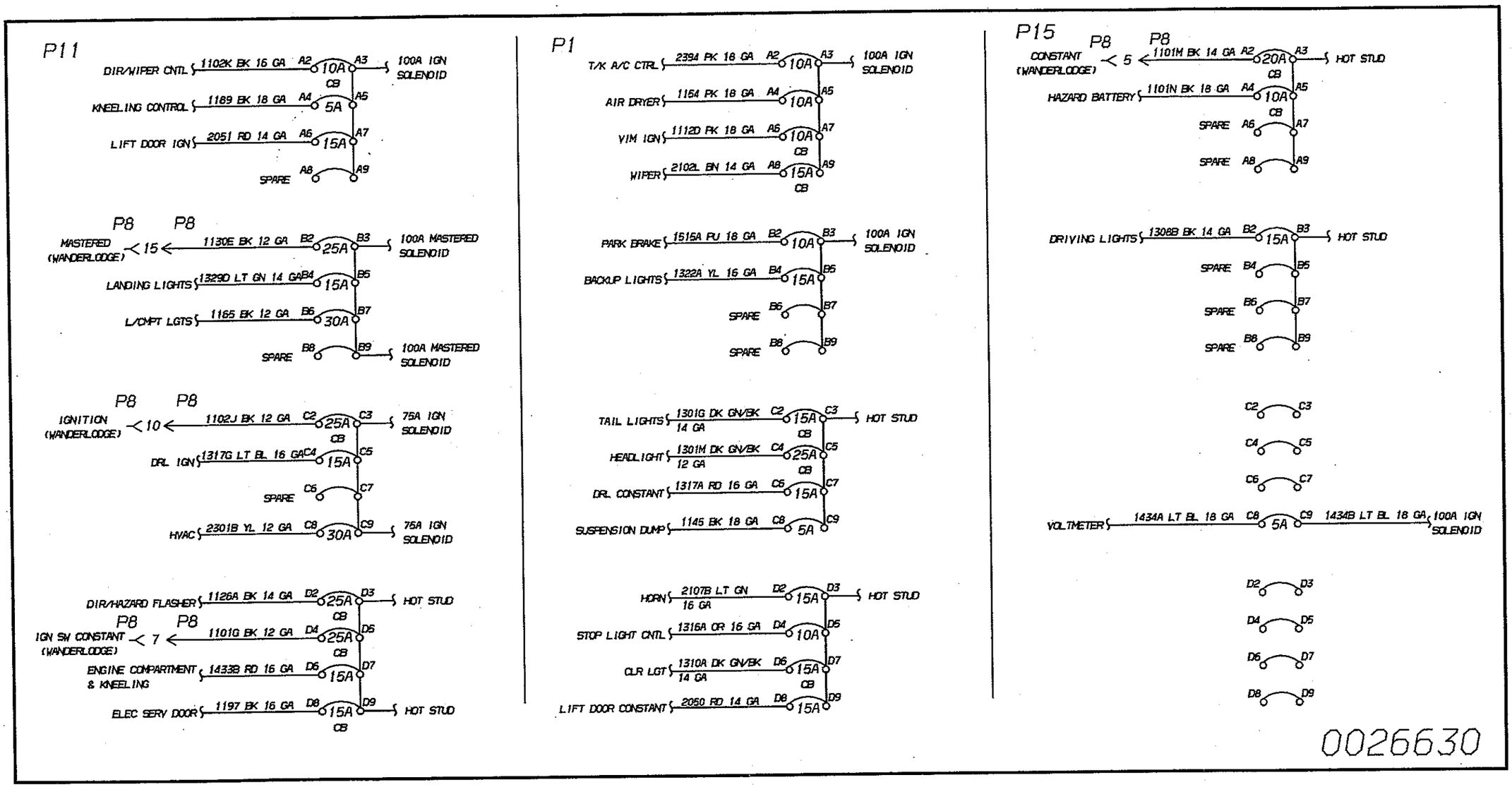


Schematic 67—Body Interface Front Electrical Panel

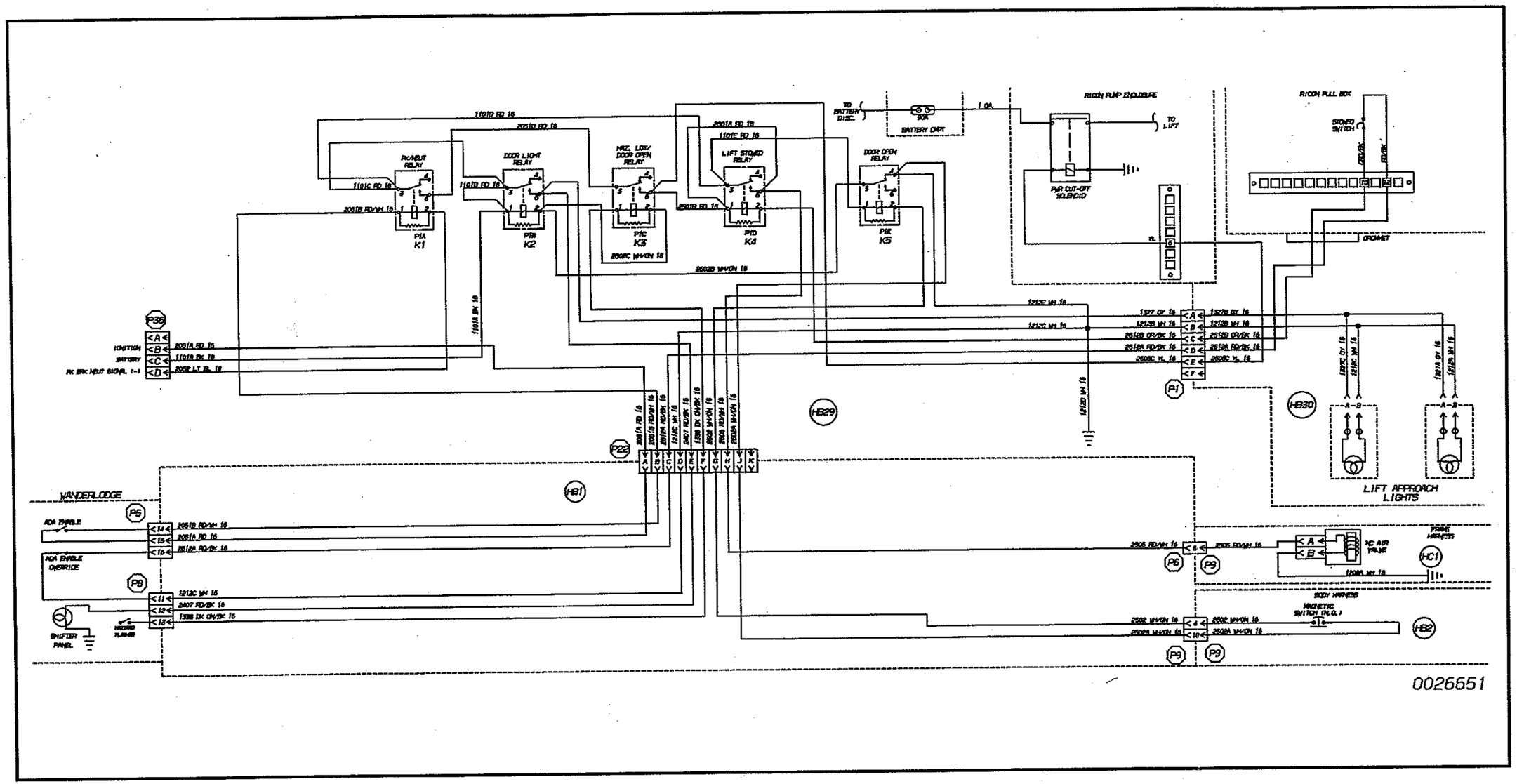


Schematic 68—DDEC Fused Power Distribution

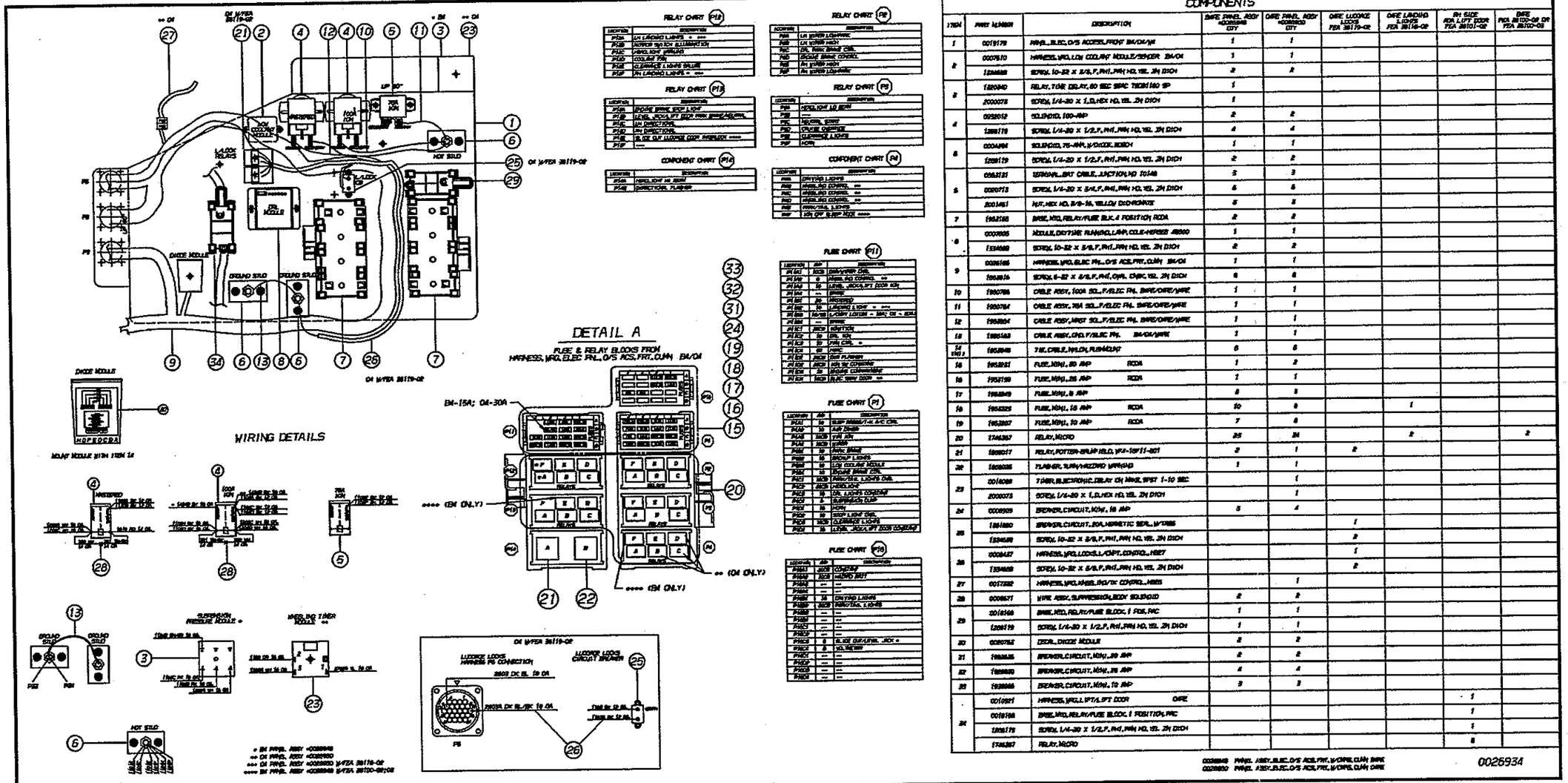




Schematic 69—DDEC Fused Power Distribution



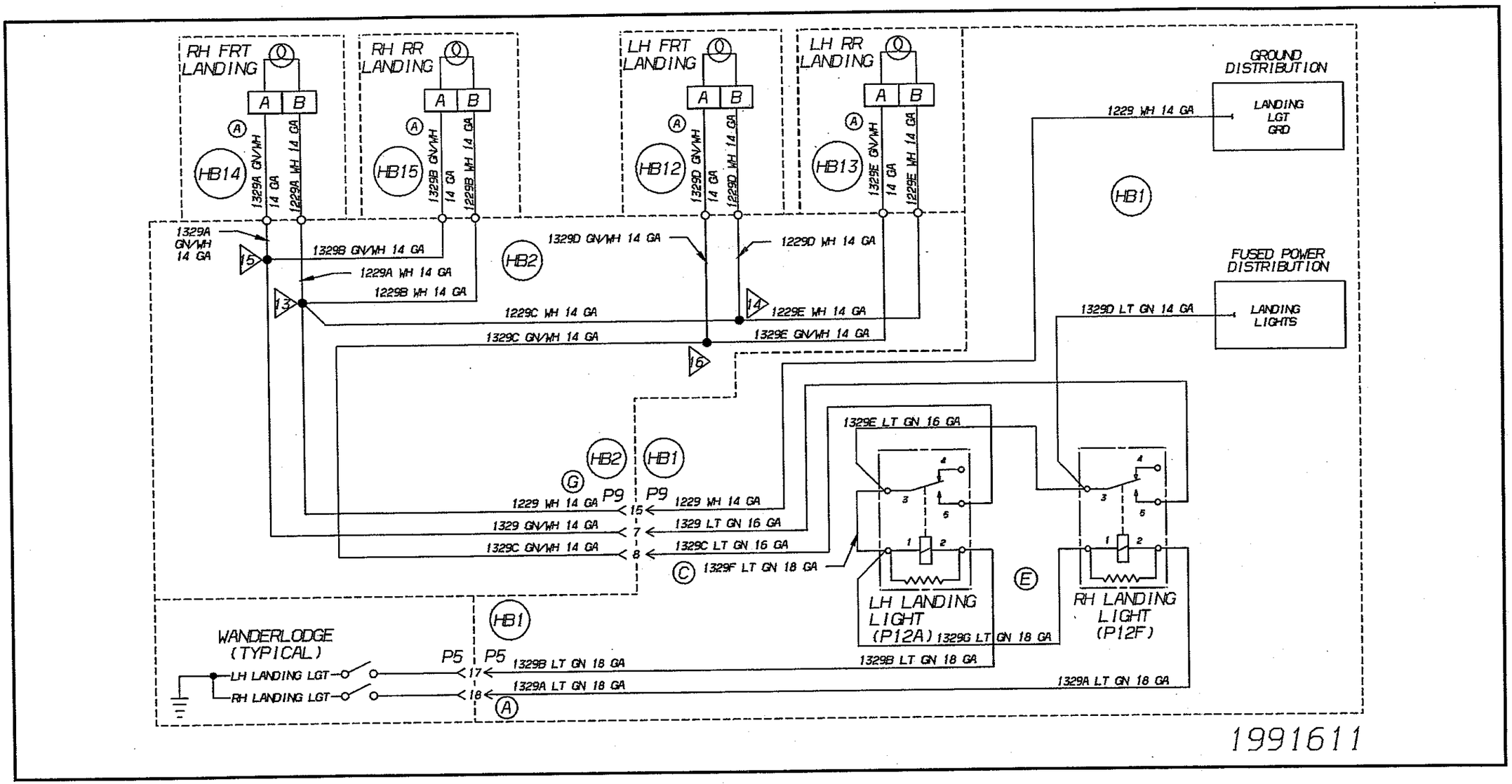
Schematic 70—Lift and Lift Door



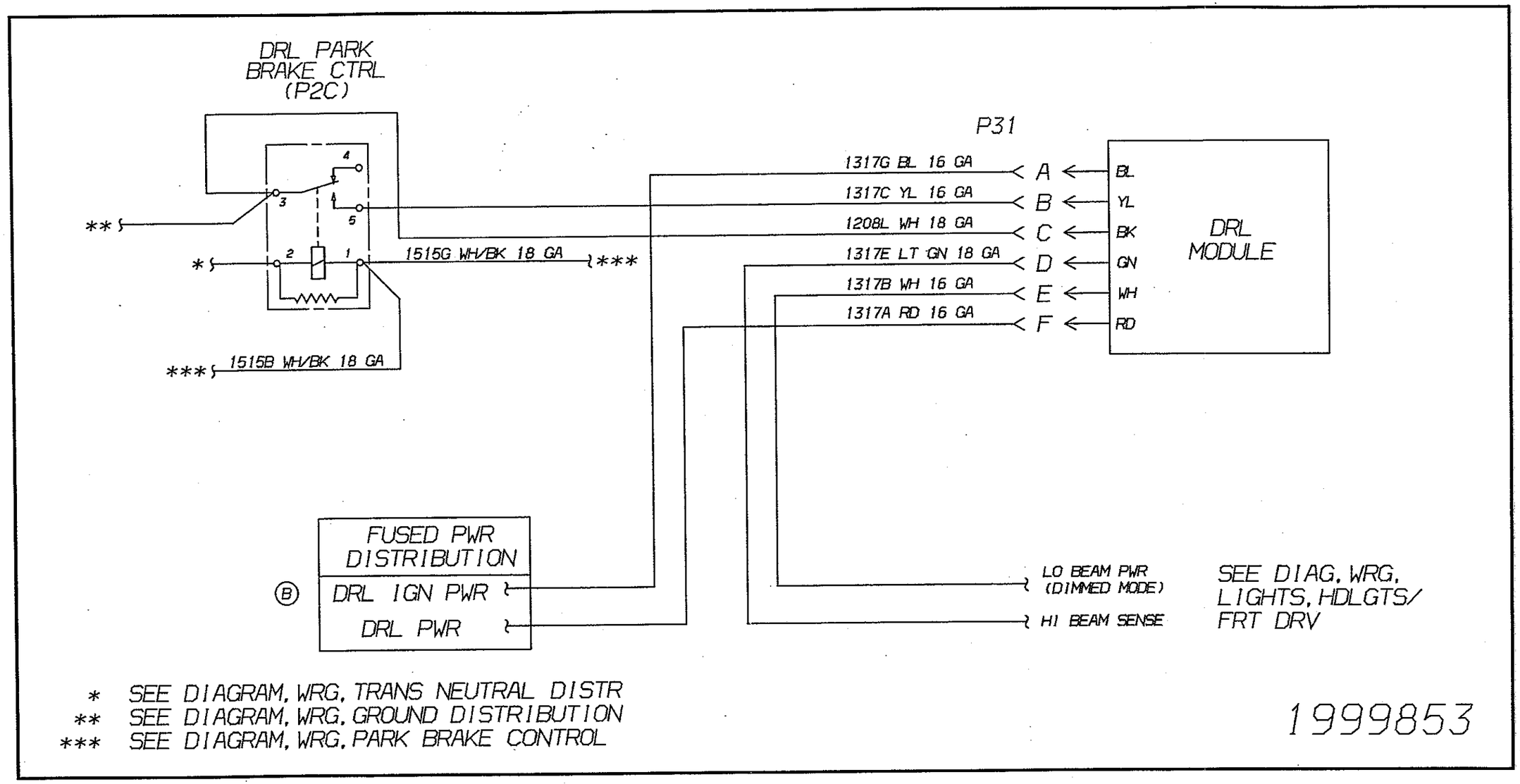
ITEM	PART NUMBER	DESCRIPTION	SHOE PANEL ASSY ASSEMBLY QTY	CAB PANEL ASSY ASSEMBLY QTY	CAB LUGGAGE LOCKS FOA 38119-02	CAB LANDING LIGHTS FOA 38116-02	RH SIDE ACS, LFT DOOR FOA 38101-02	SHOE FOA 38100-02 OR FOA 38102-02
1	0019179	PANEL, ELEC, O/S ACCESS, FRONT BM/04/M	1	1				
2	0007510	HARNESS, WRG, LCH COOLANT MODULE/SENDER BM/04	1	1				
	1204888	SCREW, 10-32 x 3/8, F, PHIL, PAN HD, YEL. ZN DICH	2	2				
3	1820840	RELAY, TIME DELAY, 60 SEC SPAC TRDB160 SP	1					
	2000078	SCREW, 1/4-20 X 1, D, HEX HD, YEL. ZN DICH	1					
4	0032012	SOLENOID, 100-AMP	2	2				
	1208178	SCREW, 1/4-20 X 1/2, F, PHIL, PAN HD, YEL. ZN DICH	4	4				
5	0004494	SOLENOID, 75-AMP, W/DIODE, BOSCH	1	1				
	1208179	SCREW, 1/4-20 X 1/2, F, PHIL, PAN HD, YEL. ZN DICH	2	2				
6	0003231	HARNESS, BAT CABLE, JUNCTION, NO 70148	3	3				
	0020713	SCREW, 1/4-20 X 3/4, F, PHIL, PAN HD, YEL. ZN DICH	6	6				
	2001461	NUT, HEX NO, 3/8-16, YELLOW DICHROMATE	5	5				
7	1962188	BASE, MTD, RELAY/FUSE BLK, 4 POSITION RCDA	2	2				
8	0003805	MODULE, DAYTIME RUNNING LAMP, COLE-HERSEE 48000	1	1				
	1204888	SCREW, 10-32 X 3/8, F, PHIL, PAN HD, YEL. ZN DICH	2	2				
9	0026186	HARNESS, WRG, ELEC PNL, O/S ACS, FRT, CUMM BM/04	1	1				
	1963816	SCREW, 6-32 X 3/8, F, PHIL, OVAL CSKC, YEL. ZN DICH	8	8				
10	1960786	CABLE ASSY, 60A SOL, F/ELEC PNL, SHOE/CAB/ENG	1	1				
11	1960784	CABLE ASSY, 70A SOL, F/ELEC PNL, SHOE/CAB/ENG	1	1				
12	1960804	CABLE ASSY, 60A SOL, F/ELEC PNL, SHOE/CAB/ENG	1	1				
13	1960163	CABLE ASSY, GND, F/ELEC PNL, BM/04/ENG	1	1				
14 THRU 17	1960848	TIE, CABLE, NYLON, PLN40J6F	6	6				
16	1963251	FUSE, MINI, 20 AMP RCDA	1	2				
18	1963199	FUSE, MINI, 25 AMP RCDA	1	1				
17	1960849	FUSE, MINI, 5 AMP	5	5				
18	1963325	FUSE, MINI, 15 AMP RCDA	10	9		1		
19	1963307	FUSE, MINI, 10 AMP RCDA	7	6				
20	1746357	RELAY, MICRO	25	24		2		2
21	1959017	RELAY, POTTER-BRUM HLD, YP4-1DF11-601	2	1	2			
22	1959036	FLASHER, TURN/HAZZARD WRNING	1	1				
23	0016088	TIMER, ELECTRONIC, DELAY ON WAKE, SPST 1-10 SEC		1				
	2000073	SCREW, 1/4-20 X 1, D, HEX HD, YEL. ZN DICH		1				
24	0008909	BREAKER, CIRCUIT, MOM., 15 AMP	3	4				
25	1961880	BREAKER, CIRCUIT, 20A, HERMETIC SEAL, W/WIRE			1			
	1934688	SCREW, 10-32 X 5/8, F, PHIL, PAN HD, YEL. ZN DICH			2			
26	0008427	HARNESS, WRG, LOCKS, L/CAPT, CONTRO., HEET			1			
	1934689	SCREW, 10-32 X 5/8, F, PHIL, PAN HD, YEL. ZN DICH			2			
27	0017332	HARNESS, WRG, WIPER, PKG/DC CONTRO., HEET		1				
28	0008671	WIRE ASSY, SLAMMERBOX, BODY SOLENOID	2	2				
29	2016168	BASE, MTD, RELAY/FUSE BLOCK, 1 POS, PKC	1	1				
	1208179	SCREW, 1/4-20 X 1/2, F, PHIL, PAN HD, YEL. ZN DICH	1	1				
30	0020752	TIMER, DIODE MODULE	2	2				
31	1960835	BREAKER, CIRCUIT, MOM., 30 AMP	2	2				
32	1960880	BREAKER, CIRCUIT, MOM., 25 AMP	4	4				
33	1930866	BREAKER, CIRCUIT, MOM., 10 AMP	3	3				
34	0010921	HARNESS, WRG, LIFT/LIFT DOOR CAB					1	
	0019198	BASE, MTD, RELAY/FUSE BLOCK, 1 POSITION, PKC					1	
	1208178	SCREW, 1/4-20 X 1/2, F, PHIL, PAN HD, YEL. ZN DICH					1	
	1746357	RELAY, MICRO					8	

0026934

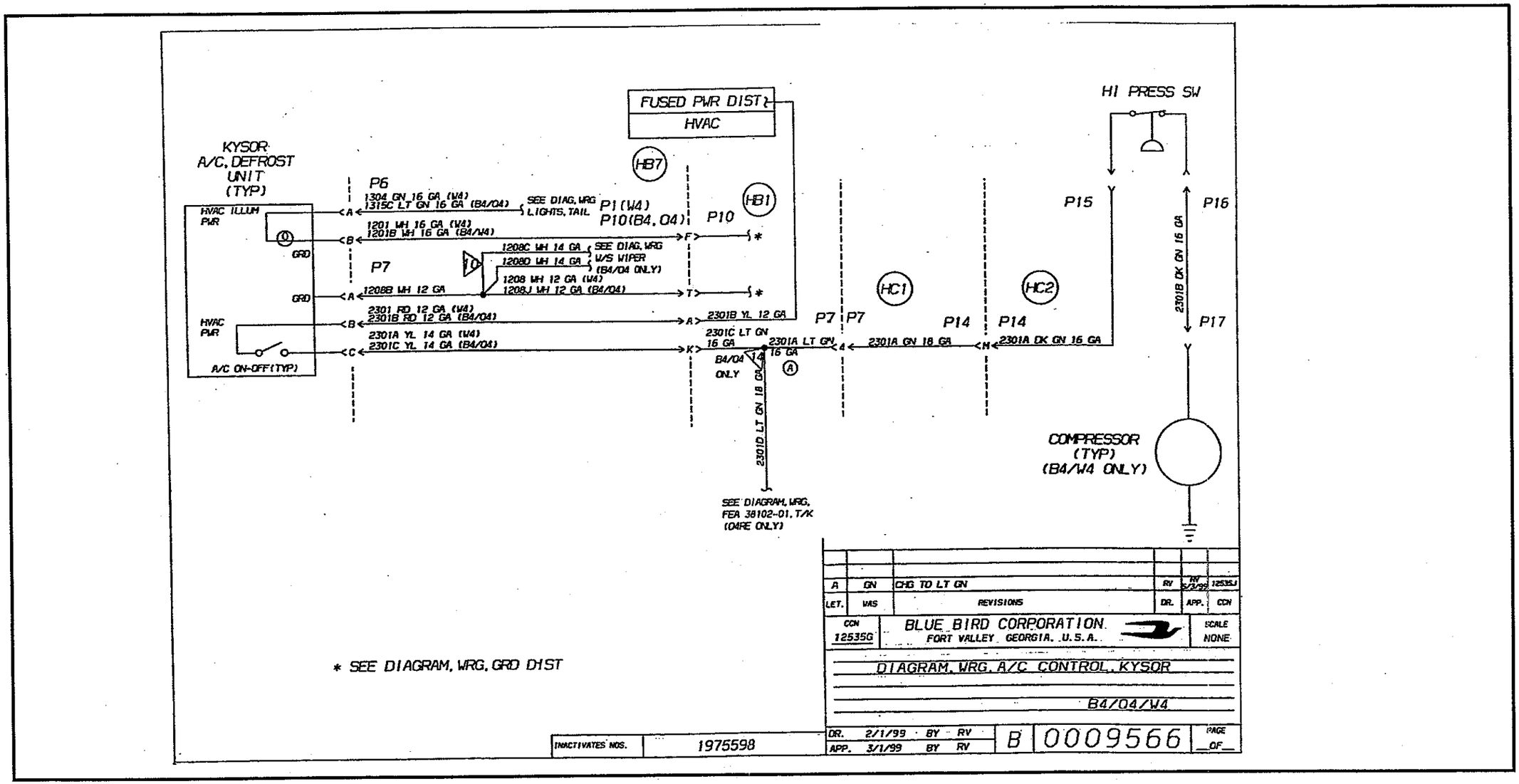
Schematic 71—Front Panel Electrical Assembly



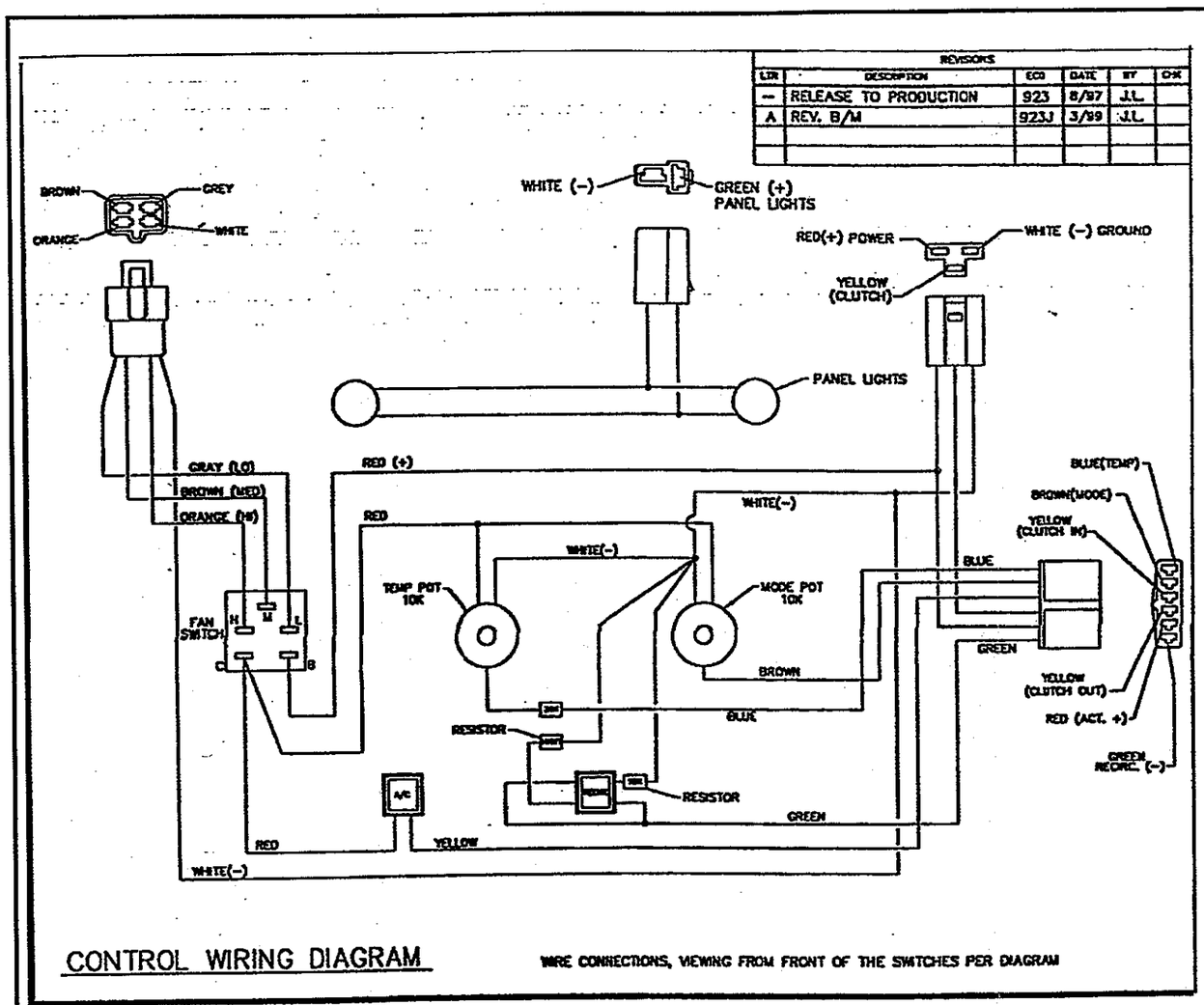
Schematic 72—Landing Lights



Schematic 73—Daytime Running Lights



Schematic 74—Kysor® Air Condition Control



ITEM	QTY	PART NUMBER	DESCRIPTION
16	1	222917	HARNESS – WIRE CONTROL
15	1	222916	ASSEMBLY – LIGHT SOCKET
14	1	222913	ASSEMBLY – WIRE GRD. RESISTOR
Ⓐ 13	2	222980	LAMP – 12V.
12	1	360881	PLATE – CONTROL
11	1	222912	ASSEMBLY – SWITCH MODE
10	3	380099	KNOB – CONTROL
9	1	222908	SWITCH – RECIRC.
8	1	222909	ASSEMBLY – SWITCH TEMP.
7	1	203819	NUT – SWITCH
6	1	222497	SWITCH – A/C
5	1	220635	SWITCH – FAN
4	2	203767	NUT – #10–32 LOCK
3	2	200943	SCREW – #10–32 X 5/8 BLACK
2	1	517999	BRACKET – LIGHT PANEL
1	4	360113	TIE – PLASTIC

PARTS LIST

METRIC

DO NOT SCALE DRAWING

DRAWN: J.L. 8/97

CHECKED:

APPROVED:

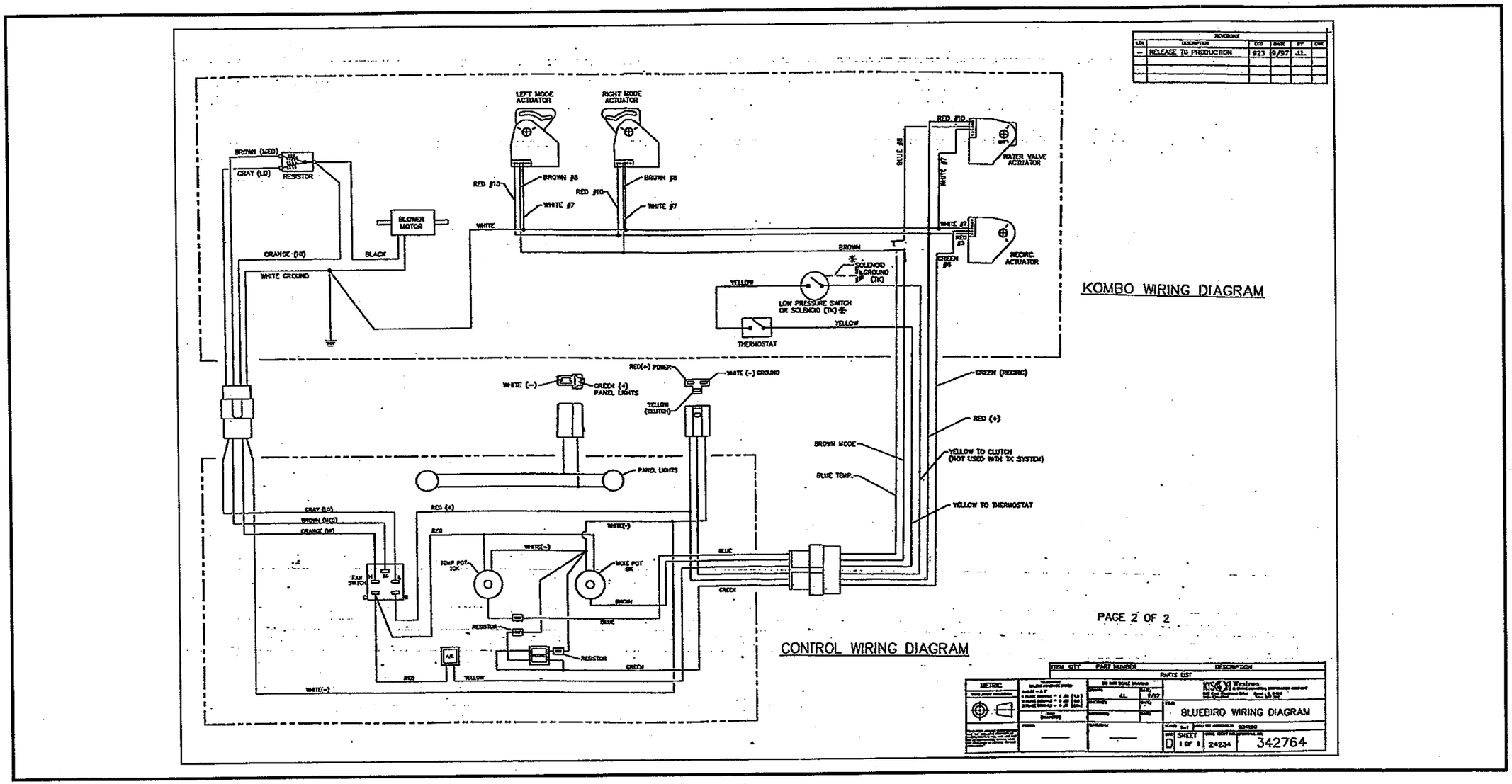
Kysor Westran

TITLE: ASSEMBLY – CONTROL

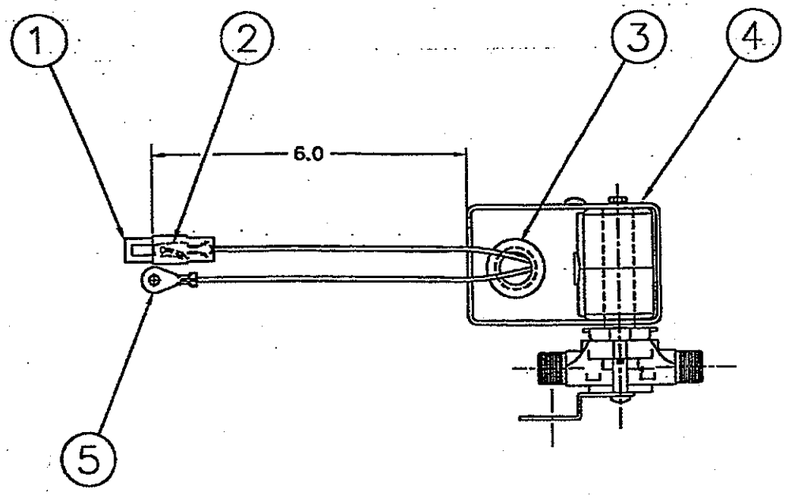
SCALE: 1=1 USED ON ASSEMBLY: 151778

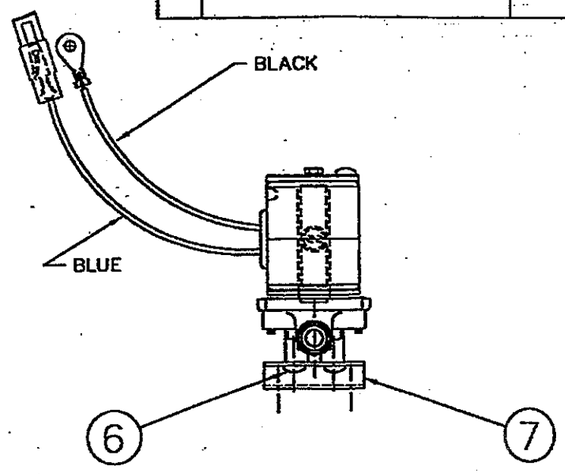
SIZE: D SHEET 1 OF 1 CAGE CODE NO. 24234 DRAWING NO. 250241

Schematic 75—Kysor® Air Condition Control



Schematic 76—Kysor® Air Condition Control





REVISIONS					
LTR	DESCRIPTION	ECO	DATE	BY	CHK
–	RELEASE TO PRODUCTION	923	7/97	J.L.	

ITEM	QTY	PART NUMBER	DESCRIPTION
7	1	518003	BRACKET – SOLENOID
6	3	200711	SCREW – #8 PHILP.
5	1	230070	TERMINAL – RING NO. 10
4	1	404318	SOLENOID – 2 TON
3	1	300054	GROMMET – .62
2	1	230000	TERMINAL – MALE BLADE
1	1	220375	CONNECTOR – FEMALE 1–WAY

PARTS LIST

METRIC
THIRD ANGLE PROJECTION

TOLERANCES UNLESS OTHERWISE NOTED
ANGLES = ± 1°
1 PLACE DECIMALS = ± .06 [1.5]
2 PLACE DECIMALS = ± .03 [0.8]
3 PLACE DECIMALS = ± .01 [0.25]
INCH [MILLIMETER]

DO NOT SCALE DRAWING

DRAWN: J.L. DATE: 7/97
CHECKED: DATE:
APPROVED: DATE:

FINISH:
MATERIAL:

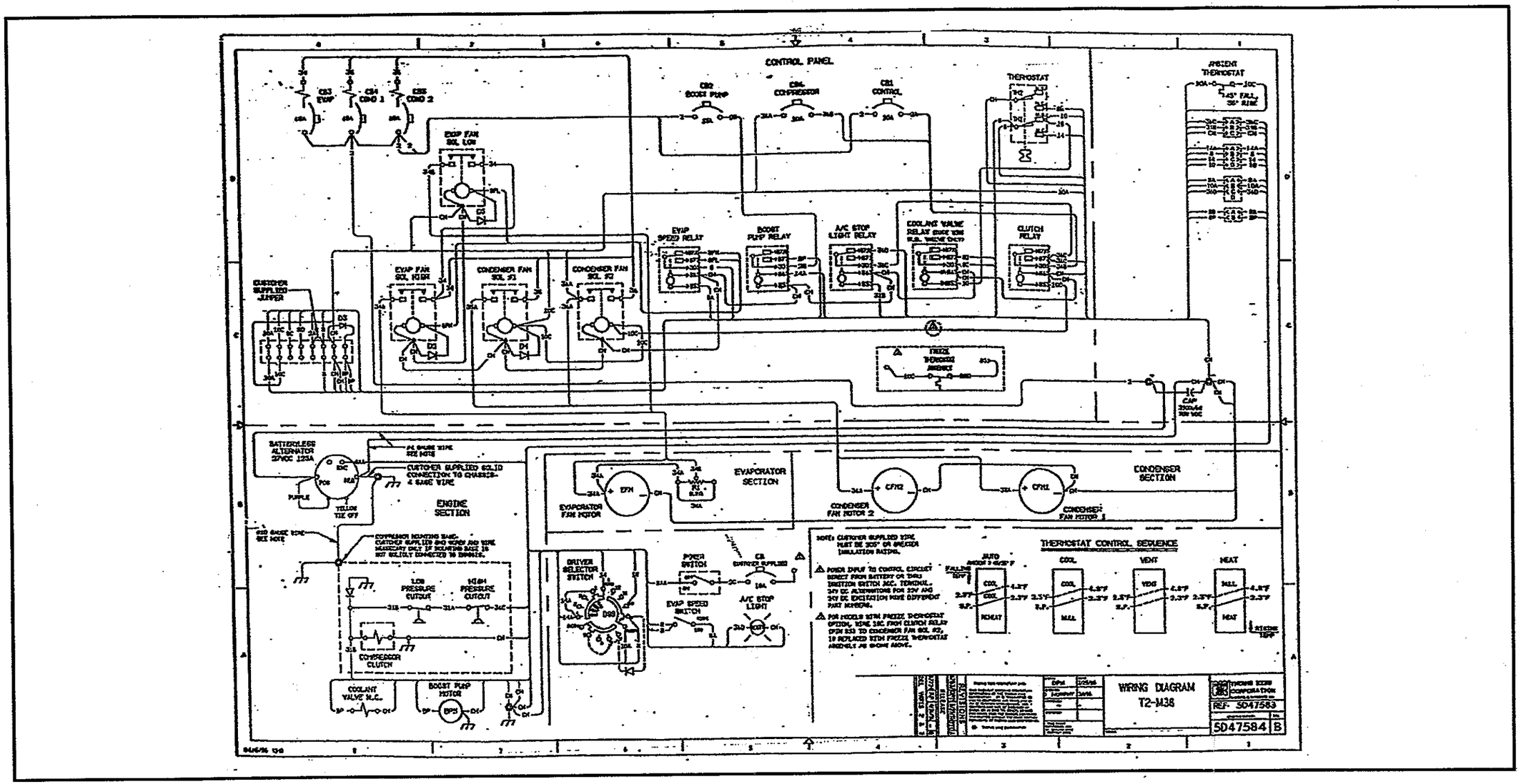
KYSOR Westron
A KYSOR INDUSTRIAL CORPORATION COMPANY
632 East Blackhawk Drive Byron, IL 61010
815-234-2811 Telex 257 352

TITLE: ASSEMBLY – SOLENOID 12V.

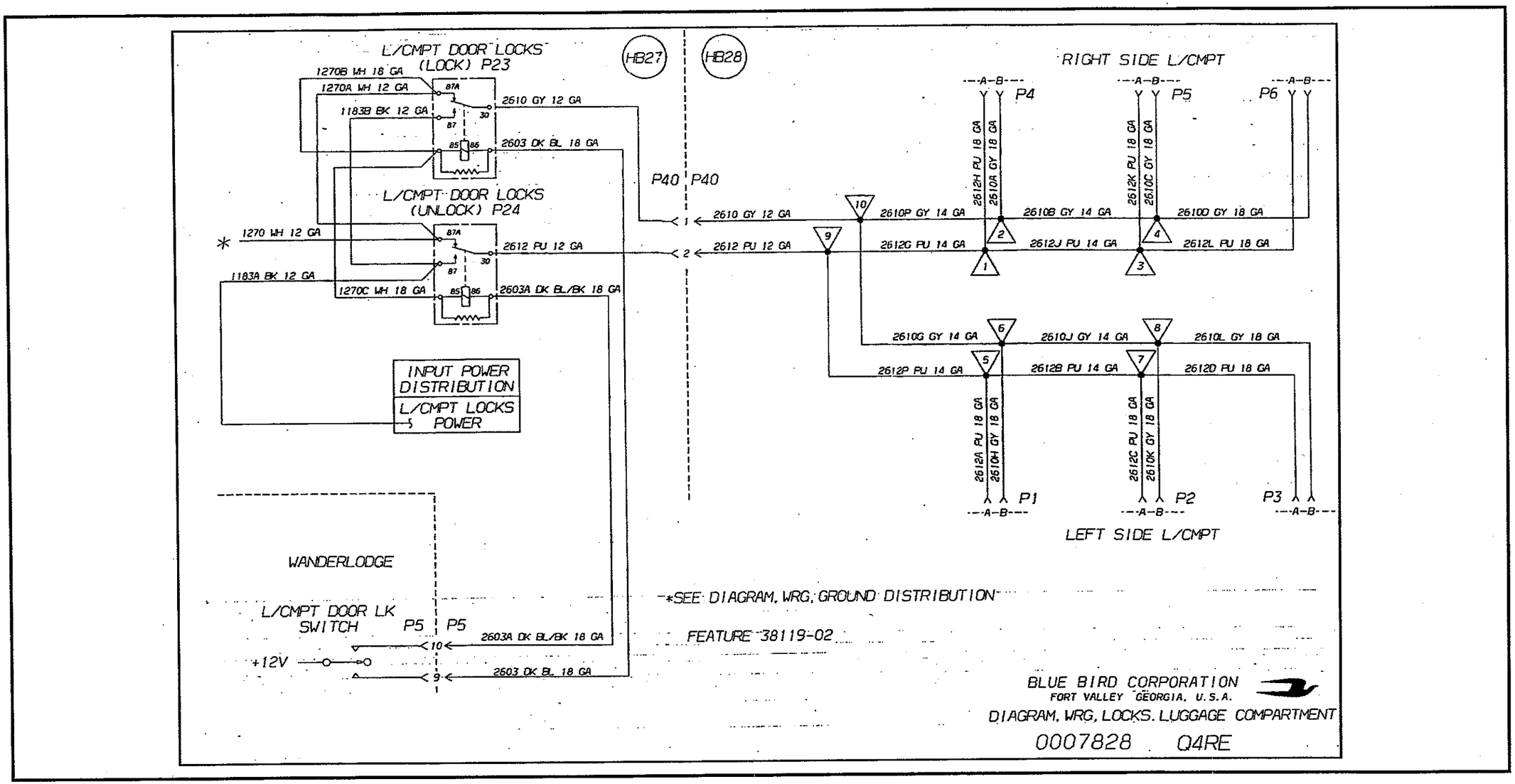
SCALE: 1=2 USED ON ASSEMBLY:

SIZE: B | CODE IDENT. NO.: 24234 | DRAWING NO.: 411413

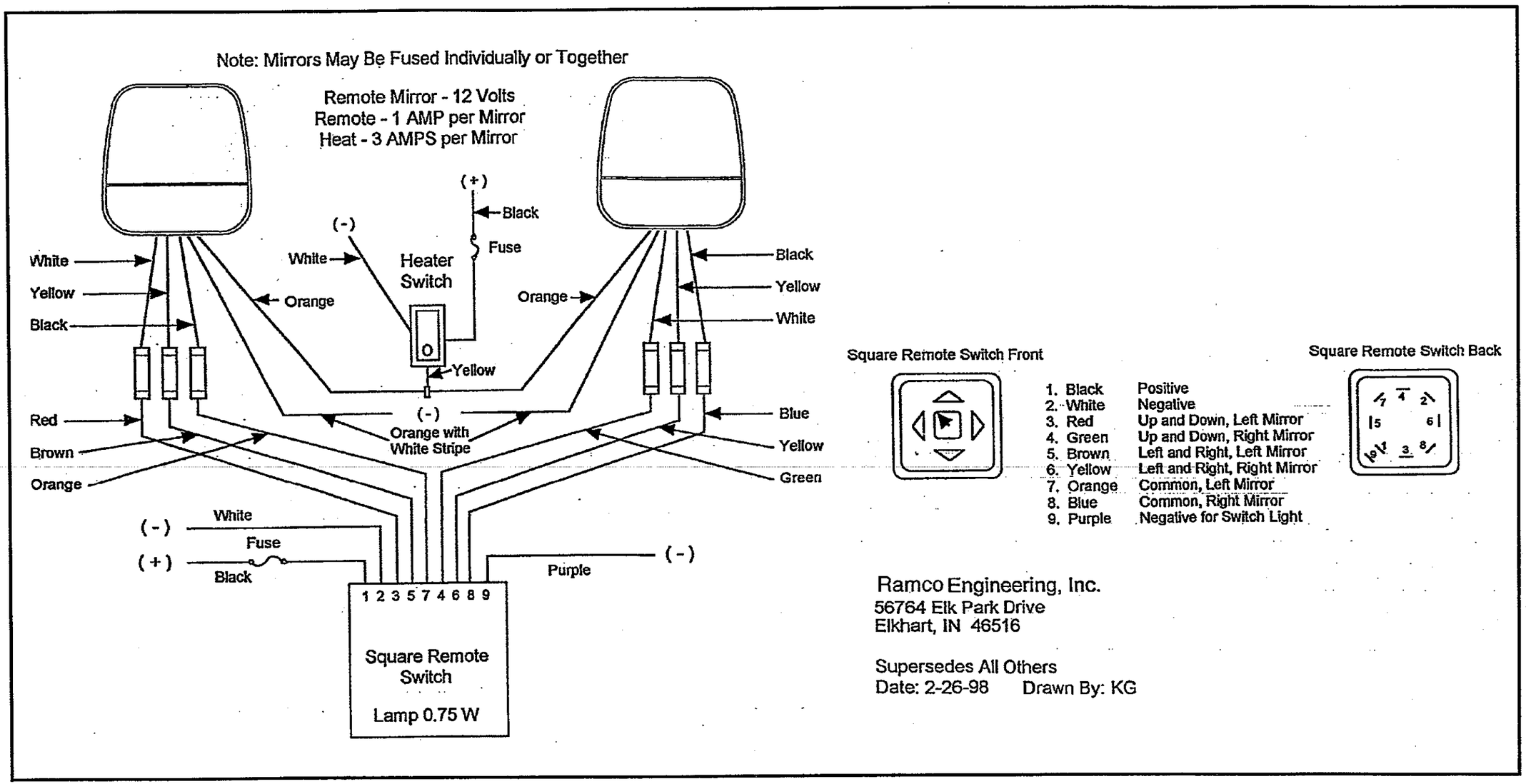
Schematic 77—Kysor® Air Condition Control



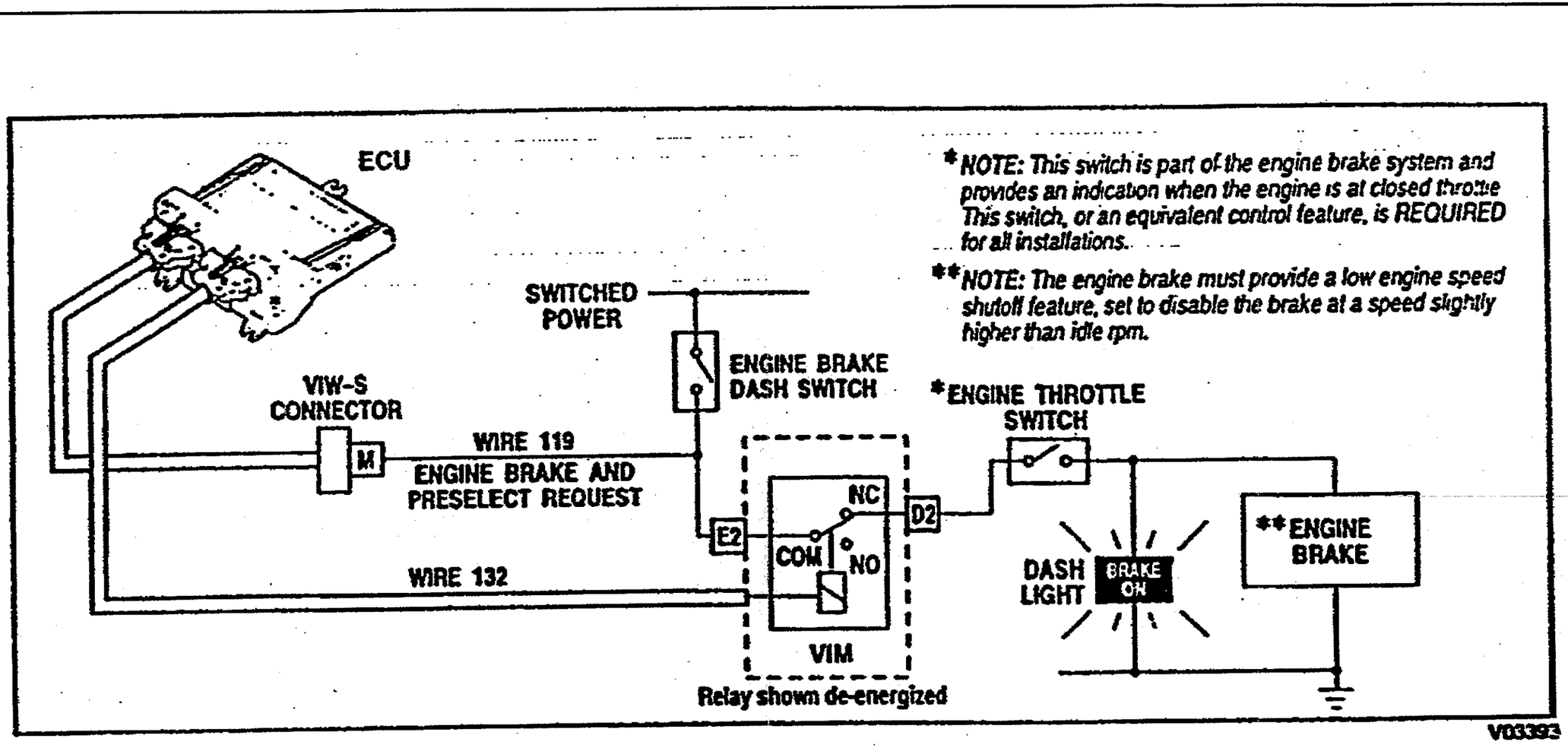
Schematic 78—Thermo King Air Condition T2 System



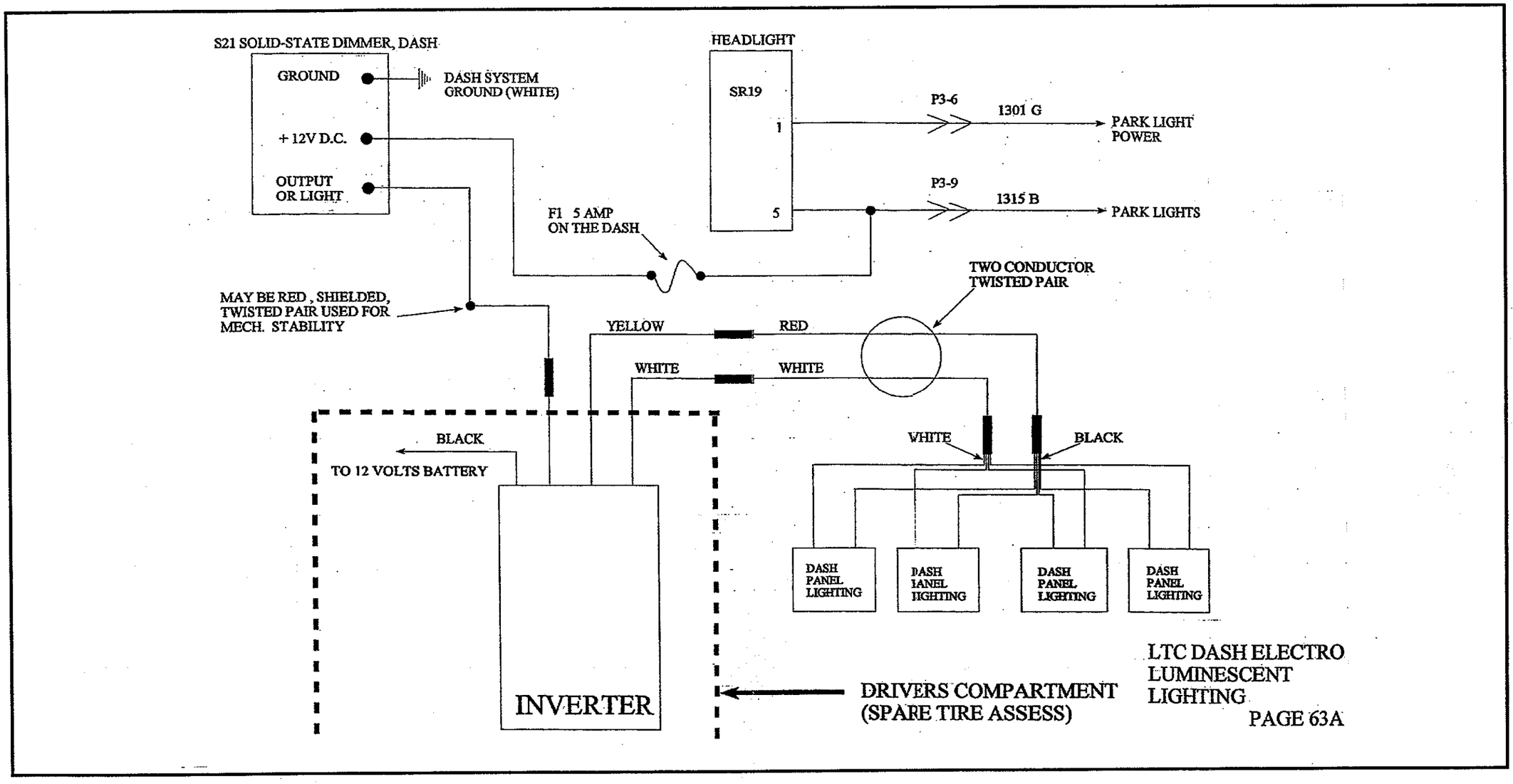
Schematic 79—Luggage Compartment Locks



Schematic 80—Ramco® Heated Mirrors



Schematic 81—Allison World Transmission Vehicle Interface



Schematic 82—Dash Electro Luminescent Lighting