Transmission

The Allison 2000 Series™ transmission is fully automatic, torque converter driven, and electronically controlled. The transmission offers 5 forward speeds and 1 reverse gear. All the clutches in the transmission are hydraulically actuated and spring released, and feature automatic compensation for wear. The gearing is of the helical type, arranged in planetary sets. Electronic control signals provide automatic gear selection in each drive range and automatic engagement of the torque converter (lockup) clutch.

The transmission has 4 major control systems, connected by the Blue Bird wiring harness: The Transmission Control Module (TCM), engine throttle position sensor (accelerator), 3 separate speed sensors and a control valve module which contains solenoid valves and a pressure switch module. The accelerator, speed sensors, and pressure switch module transmit information to the TCM. The TCM processes this information and then sends signals to actuate specific solenoids on the control valve module in the transmission. These solenoids control both oncoming and offgoing clutch pressures to provide closed loop shift control. This is accomplished by matching RPM during a shift to a previously established profile that is programmed into the TCM.

The 2000 Series™ electronic control system has an "adaptive shifting" feature which helps optimize shift quality. The feature monitors critical characteristics of clutch engagement and makes continuous adjustments to improve the next shifting sequence. The transmission shift calibration is based on several different types of shifts, (full throttle, partial throttle, closed throttle, upshifts, downshifts, etc.). Each shift is associated with specific speed and throttle positions. To optimize each type of shift for normal driving, the shift controls need to experience operation and shifting in a wide variety of conditions. A "drive in" period under varying driving conditions is required for the Adaptive Controls to begin to optimize shifting under all conditions. It may take as many as 5 shifts of each type to establish the automatic optimization sequence.

Torque Converter

The torque converter has 3 main elements: a pump, the turbine, and the stator. The pump is the input component; it is driven directly by the engine. The turbine provides the output of the transmission; the pump hydraulically drives it. The stator multiplies the torque. When the pump is turning faster than the turbine, the torque converter is multiplying the torque. As the turbine reaches the speed of the pump, the stator starts to rotate and torque multiplication stops. The torque converter then acts as a fluid coupling device.

Series 2000™ torque converters have a torque converter clutch (a lockup clutch). When this lockup clutch is engaged, it causes the pump and turbine to be "locked" together so they rotate in unison, at engine speed. This provides direct drive through the transmission. This type of operation maximizes engine braking and fuel economy. The lockup clutch is regulated by the shift controls and operates automatically. The lockup clutch releases at lower speeds or when the TCM senses conditions requiring it to be released. The torque converter clutch features a damping mechanism, which reduces the transmittal of engine induced torsion vibration through the transmission.

Planetary Gears and Clutches

A series of 3 helical planetary gear sets and shafts provide the mechanical gear ratios and direction of travel necessary for the bus. These planetary gear sets are controlled by 5 multiple clutches that work in pairs to produce 5 forward speeds and 1 reverse gear. The clutches are controlled hydraulically in response to electronic signals from the TCM to the individual solenoids.

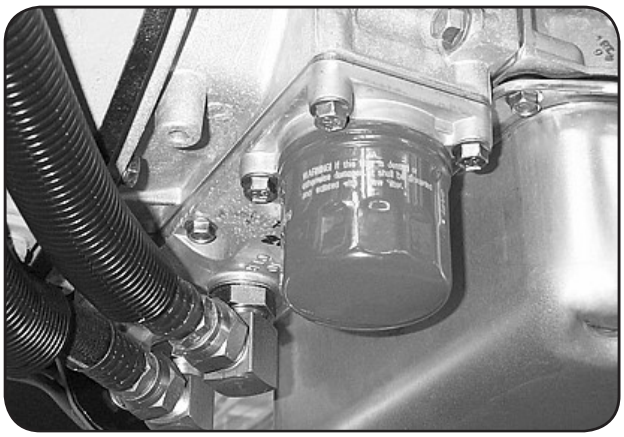
Cooler

Excessive heat in the transmission is dissipated by circulating the transmission fluid through a section of the radiator. The transmission cooler lines connect directly to the bottom of the radiator.

Filters

An outboard filter is located near the front of the transmission on the driver's side (Blue Bird part number 0033381). This spin-off canister type filter must be replaced after the first 5,000 miles (8000 km) and thereafter, at 50,000 miles (80000 km) or 24 months intervals, whichever is the first to occur. Use only Transynd™ synthetic transmission fluid or TES 295 equivalent.

The internal filter needs to be changed only during transmission overhaul.



Transmission Maintenance

Daily

- Check that the engine will not start with the shifter lever in any position other than "N" neutral.
- Before the trip; check the transmission fluid level. See the "cold fluid level check" below for instructions.
- Check the transmission fluid level at the end of the trip to accomplish the "hot level check", below.
- Notice if there is a burned odor to the transmission fluid.
- Notice if the transmission shifts rough or fails to shift.

5,000 miles (8000 km) or 6 months

- Clean and inspect the linkage; look for missing cotter pins, locknuts, etc.
- Carefully inspect the transmission and all hoses; look for signs of leaks, wear and abrasion.
- Check for worn or frayed electrical connectors or wires.
- Check the throttle wiring for loose or frayed wires or connectors.
- Check the breather (vent) screen at the top rear of the transmission. See Transmission Removal illustration.

- Obtain fluid analysis for maximum efficiency. Refer to the Technician's Guide for Automatic Transmission Fluid, publication number SA2055, for more details.

Fluid Oxidation Measurement Limits	
Viscosity	± 20% change from new fluid
Carbonyl Absorbance	+ 0.3 A*/0.1mm change from new fluid
Total Acid Number	+ 0.3 change from new fluid
Solids	2% by volume maximum
*A=Absorbance Units	

100,000 miles (160,000 km) or 48 months

- Ascertain the oil vent (breather) is clean and free of dirt. Do not spray the vent with steam or cleaning solvents.
- Change both the filter and the transmission fluid. Use only Transynd™ synthetic transmission fluid, or TES295 equivalent. Use Blue Bird spin-on filter cartridge number BB 0033381. Observe all applicable, environmental, health and safety regulations. See the Introduction section of this service manual. Drain the fluid while the transmission is at normal operating temperature; 160°–200° F (71°–93° C). Use caution to avoid serious burns. Hot oil flows more quickly and drains more completely.

1. Remove the drain plug from the oil pan and allow the fluid to drain into a suitable container.
2. Examine the fluid to determine if there are metal fragments in it.
3. Remove the canister filter.
4. Remove the magnet from the top of the filter or the filter attachment tube.
5. Clean any metal debris from the magnet; anything larger than dust sized particles is cause for serious concern.
6. Install the magnet onto the filter attachment tube.
7. Lubricate the gasket of the new filter with new transmission fluid.
8. Install the spin on filter, by hand, until the gasket touches the converter housing.
9. Tighten the filter ONE FULL TURN, ONLY AFTER THE GASKET MAKES CONTACT WITH THE CONVERTER.
10. Install the drain plug and sealing washer. Torque the drain plug to 22–30 ft. lbs. (30–40 Nm).

11. Refill the transmission. The capacity is approximately 7.4 quarts (7 L). The transmission refill capacity is substantially less than the initial fill because a large amount of fluid remains in the transmission cavities after draining.

12. After filling the transmission to the cold check level on the dip stick, start the engine and allow it to idle for about a minute.

13. With the service brakes applied, shift to "R" for a few seconds, back to "N" for a few seconds, to "D" for a few seconds and then back to "N".

14. Allow the engine to idle at about 500–800 RPM and slowly release the service brakes.

15. With the engine running, remove the dipstick and wipe it clean.

16. Insert the dipstick into the tube and remove it. Check the fluid level indicated on the dipstick. Repeat at least twice for accuracy.

17. If the fluid level is still within the cold check band, the transmission may be operated until the fluid is up to operating temperature.

18. If the fluid level is not within the cold check band, you must drain or add fluid until it is before operating long enough to reach normal temperature.

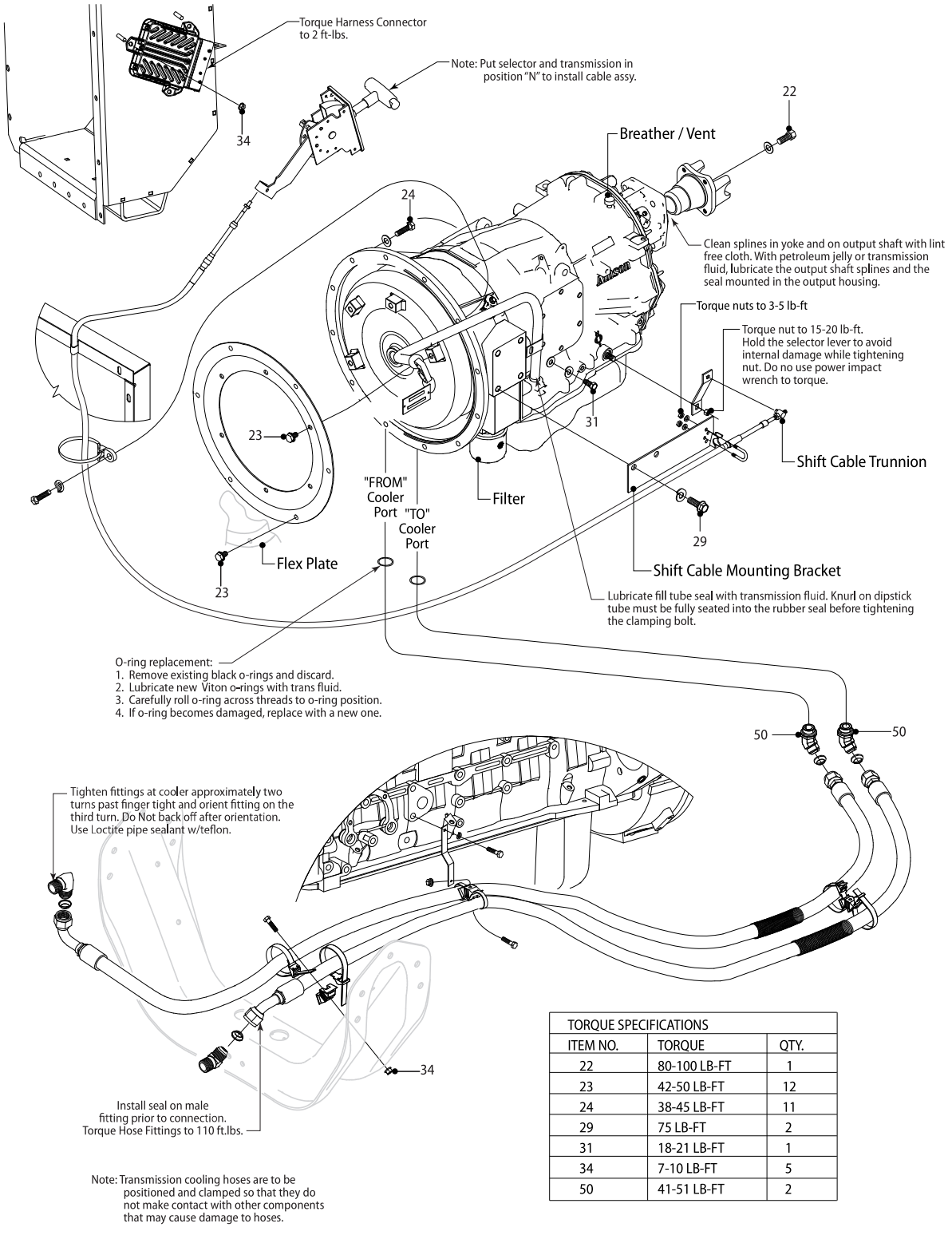
19. Perform the hot check at the first opportunity after the transmission has been operated for about an hour and reached the normal operating temperature of 160°–200° F (71°–93° C).

For more technical information, consult the appropriate Allison publication or visit the Allison web site: www.allisontransmission.com.

TITLE	PUBLICATION
Service Manual	**SM3191EN**
Parts Catalog	**PC3062EN**
Parts Catalog CD	**CD3062EN**
Electronic Troubleshoot	**TS3192EN**
Operation Principals	**PO3065EN**
Mechanics Tips	**MT3190EN**

The above publications are available from:

SGI, Inc.
Attn: Allison Literature Fulfillment
8350 Allison Avenue
Indianapolis, IN 46268
Toll Free: 888.666.5799
International: 317.471.4995



Note: Transmission cooling hoses are to be positioned and clamped so that they do not make contact with other components that may cause damage to hoses.

TORQUE SPECIFICATIONS		
ITEM NO.	TORQUE	QTY.
22	80-100 LB-FT	1
23	42-50 LB-FT	12
24	38-45 LB-FT	11
29	75 LB-FT	2
31	18-21 LB-FT	1
34	7-10 LB-FT	5
50	41-51 LB-FT	2

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Transmission

Transmission Removal

Observe all safety precautions and warnings in the Introduction chapter of this manual.

1. Remove the drain plug at the bottom of the transmission fluid pan to drain the transmission fluid into a suitable container for lawful disposal.

2. Drain the transmission cooler hoses and the transmission cooler section of the radiator by removing the cooler hoses at the transmission fittings. If the adapter fittings are removed from the bottom of the radiator, mark the orientation of each to facilitate assembly.

3. Remove the top dipstick bracket clamp.

4. Remove the shift cable trunnion from the shift lever at the transmission. Discard the cotter pin.

5. Remove the shifter cable mounting bracket. Discard split ring lock washers.

6. Remove cable clamps as necessary to position the shifter cable out of the way.

7. Remove the capscrew (31) at the bottom dipstick bracket. Discard the split ring lock washer. Store the dipstick tube and dipstick in a safe location.

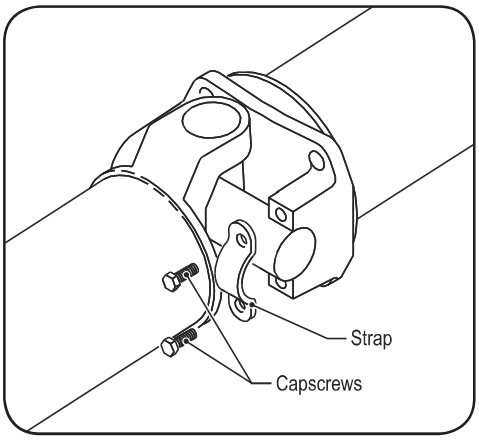
CAUTION ***Ensure all openings and hoses are sealed to prevent contamination.***

8. Remove all wiring harness connections.

9. Secure the driveline with nylon straps before continuing.

10. Remove the yoke straps at the driveline. Discard capscrews and straps. Refer to the Driveline section of this service manual for more information.

11. If the unit is equipped with a mechanical park brake, refer to the Park Brake section of this Service Manual, for removal, adjustment and installation of the Park Brake.



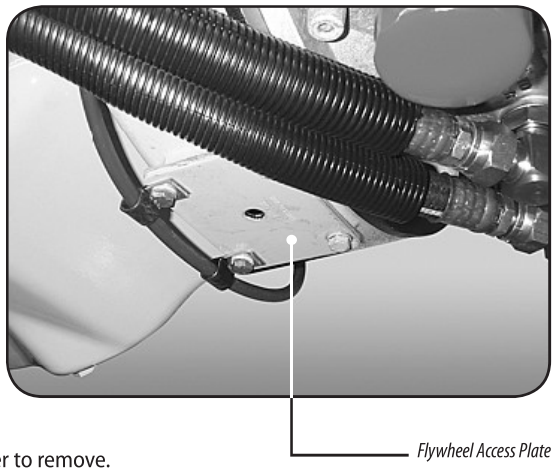
WARNING ***The transmission must be supported before proceeding.***

12. Remove the access plate on the bottom of the flywheel housing.

13. Remove the 6 capscrews (23) from the adapter ring. Index the engine to access all the capscrews.

14. Remove capscrews (24) from 12 places around the torque converter bell housing. Discard the splitring lock washers.

15. Carefully pull the transmission away from the engine and lower to remove.



For information regarding the repair of the Allison 2000 Series™, please refer to the appropriate Allison publication and your Blue Bird Dealer.

Transmission Reinstallation

1. With the repaired transmission on an appropriate cradle, roll it carefully into position. Lubricate the nose of the torque converter (where it pilots into the crankshaft hub adaptor) with NLGI Grade 2 grease.

2. Install the adapter ring to the torque converter with 6 capscrews (23). Torque as you go to 42–50 ft. lbs. (56.94–67.79 Nm).

3. Install access plate and shift cable clamps. Torque the capscrews to 20 ft. lbs. (27.12 Nm).

4. Install 12 capscrews (24); use new split ring lock washers. Torque as you go to 38–45 ft. lbs. (51.52–61.01 Nm).

5. Position the driveline journals in the yoke. Using new straps and hardware, torque to 45–60 ft. lbs. (61.01–81.35 Nm).

6. Connect all electrical harnesses.

7. If equipped with a mechanical Park Brake, connect and adjust it according to instructions in the Hydraulic Brakes chapter of this manual.

8. Position the shift cable trunnion in the hole of the shift lever at the transmission. Secure it with a new cotter pin. Bend each leg of the cotter pin at least 45° to secure it.

9. Install the shift cable mounting bracket with 2 capscrews, using new split ring lock washers. Torque to 75 ft. lbs. (101.69 Nm).

10. Position the dipstick tube in the transmission.

11. Install the bottom dipstick tube bracket with capscrew (31); use a new split ring lock washer. Torque to 18–21 ft. lbs. (24.40–28.47 Nm).

12. Install the top dipstick tube bracket clamp. Torque the bolt to 20 ft. lbs. (27.12 Nm).

13. Install the dipstick.

14. Connect all wiring harnesses.

15 If the cooler hose adapter fittings have been removed, replace them. Tighten the adapters to finger tight; then using an open end wrench, tighten to 41–51 ft. lbs. (55.59–69.15 Nm). Ensure the fittings are oriented as marked at removal. If adapter fittings have not been removed, skip to next step.

16. Install the transmission cooler hoses. Install new seal on the male fitting prior to connecting the hose fitting. Torque the fittings at both ends of both hoses to 110 ft. lbs. (149.14 Nm). Do not use an adjustable wrench or pliers to tighten the fittings.

17. Ensure the drain plug and its sealing washer are in place in the transmission and tightened to 22–30 ft. lbs. (30–40 Nm).

18. Install a new main (canister) filter. Ensure the magnet is installed on the top of the new filter. Lubricate the new canister with a small amount of new transmission fluid, and spin on until the canister just touches the converter. Then tighten the filter ONE FULL TURN ONLY.

19. Install no more than 3.5 US gallons (12 L) for a new or rebuilt transmission. Check repeatedly with the dipstick to ascertain the level is within the "cold check" band.

20. Add or drain fluid to achieve the fluid level within this range before starting the engine.

21. Proceed with the checking, filling and draining operation as described in the instructions for the 100,000 mile/160,000 km/48 month maintenance procedure.

22. Check the system for leaks after the cold level check, and after the transmission fluid has stabilized at operating temperature.

Shifter Removal

To remove the shifter lever from the driver's area:

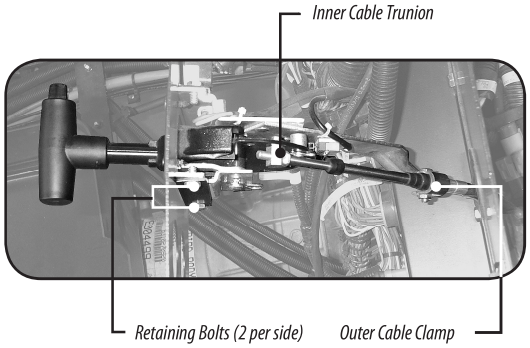
1. Remove 4 screws from the corners of the dash, housing the shifter cover.

2. Remove the cotter pin from the top shifter inner cable trunnion.

3. Pull the trunnion free of the shift selector. Mark the hole in the shifter plate from which the trunnion was removed to facilitate assembly.

4. Remove the clamping bolt and nut assembly from the outer cable clamp.

5. Remove the 4 retaining bolts (two each side) from the shift selector mounting bracket and pull the shifter straight out.



Shifter Reinstallation

Installation of the shifter is, essentially, the reverse order of the removal.

1. Position the shifter in the shifter mounting bracket. Install 4 mounting bolts. The threads must not protrude into the shifter assembly more than .38 inches (9.652 mm). Torque the retaining bolts to 6–9 ft. lbs. (8.13–12.20 Nm).

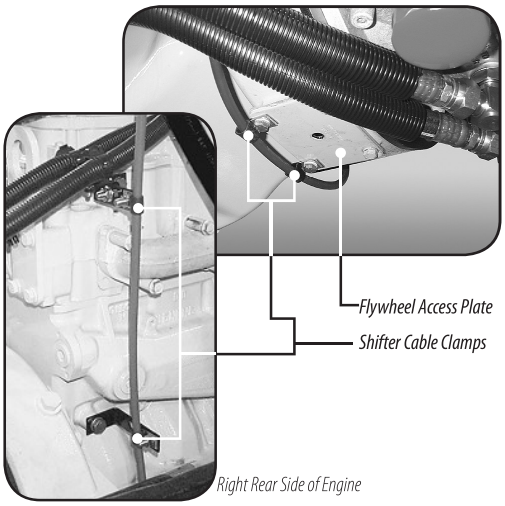
2. Loosely route the shifter cable through the outer cable clamp and position the top trunnion in the previously marked hole of the shift selector. Install a new cotter pin; bend each leg at least 45° to hold it in position.

3. Ensure that both the shift selector lever and the transmission are in the "N" (neutral) position.

4. Torque the outer cable clamp bolt assembly to 6–9 ft. lbs. (8.13–12.020 Nm).

5. Ensure the shift selector operates properly.

6. Position the plastic dash cover onto the metal mounting bracket and secure with 4 screws.



Right Rear Side of Engine

Shift Cable Removal

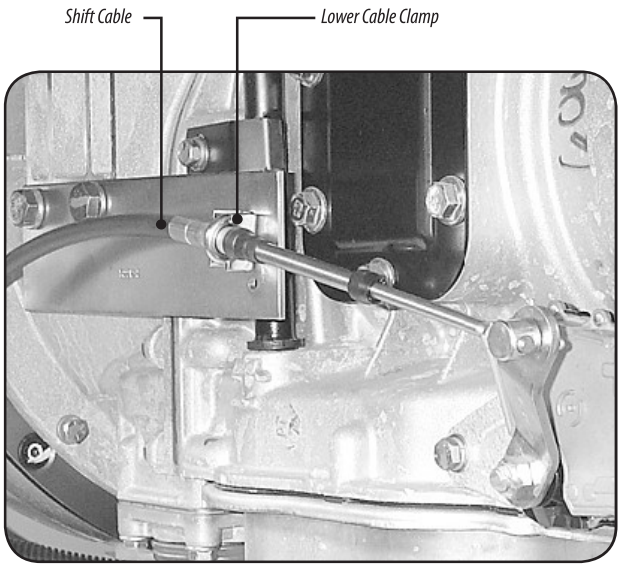
1. Remove the shift cable in accordance with Shifter Removal steps 1 through 5 above.

2. Using a utility knife, carefully remove the silicon sealant where the shift cable passes through the grommet in the firewall behind the dash.

3. Remove cable clamps as necessary.

4. Remove the lower shift cable clamp.

5. Remove the cotter pin from the bottom shift cable trunnion and pull it free of the transmission shift selector lever.



Shift Cable Reinstallation

To reinstall a shift cable, reverse the removal procedure above.

Shift Cable Adjustment

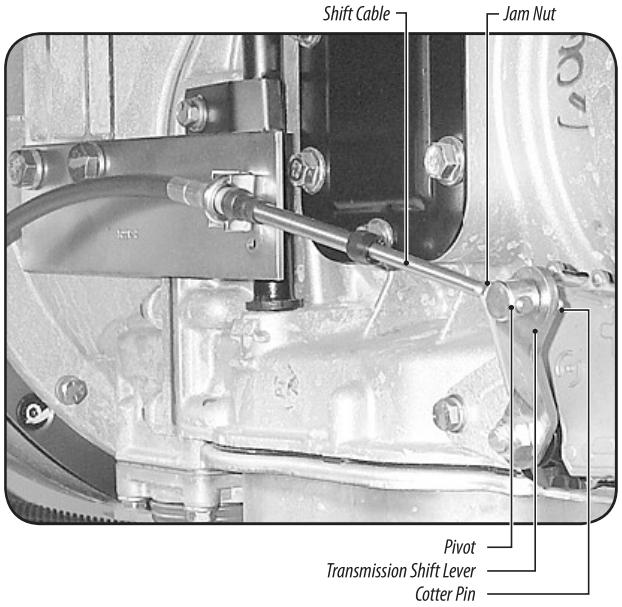
The shift cable must be inspected routinely and adjusted as needed to insure proper operation. *NOTE: All changes to the shift cable routing, including changes to the shift selector location, will affect the adjustment of the shift cable. Therefore, the shift cable must be readjusted if its routing is modified during transmission or vehicle service.*

When properly adjusted, the lever of the shift handle should be centered in each gate position when the transmission selector shaft is held in place by the internal transmission detent.

Follow procedure below to adjust the shift selector cable at shift lever on the transmission.

1. With the engine off, set the park brake and block the wheels to prevent vehicle movement.

2. Place both the shift selector and the transmission selector shaft in the Neutral position.



3. At the transmission end of the cable, push the cable to move the shift handle against the end of the shift selector Neutral gate. Note the position of the pivot at the end of the cable with respect to the hole in the transmission shift lever.

4. Pull the cable to move the shift handle against the opposite end of the shift selector Neutral gate. Note the position of the pivot at the end of the cable with respect to the hole in the transmission shift lever.

5. Center the position of the cable at the midpoint of travel determined by steps 3 and 4.

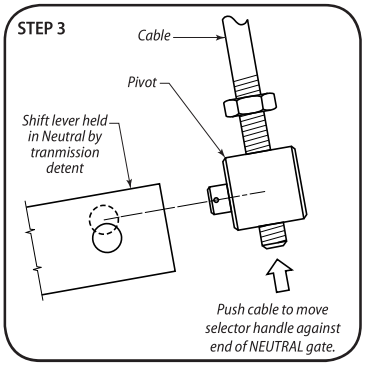
6. Holding the cable at the position determined in step 5, rotate the pivot on the threaded section of the cable end until it is aligned with the hole in the transmission shift lever.

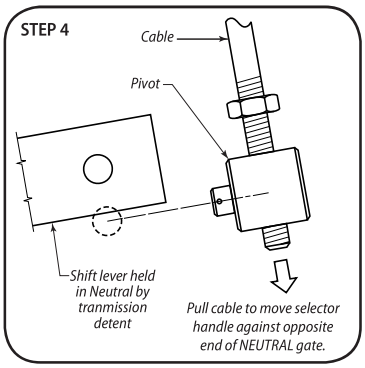
7. Verify that the attachment pin of the pivot does not bind in the transmission shift lever hole and that the detent in the transmission is positively engaged. This condition is sometimes called free-pin-fit, referring to lack of friction at the cable/shift lever interface once the transmission detent is engaged. Repeat steps 3 through 5 as necessary to create this condition.

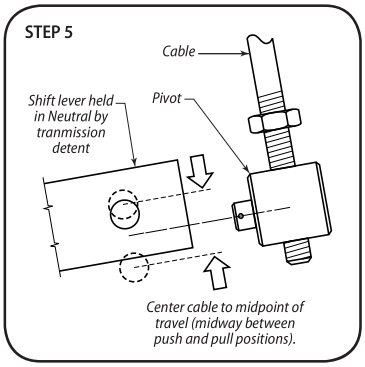
8. Attach the pivot to the shift lever and secure with the cotter pin. Torque the jam nut to 75 in.lbs. (8.5 N-m) locking the pivot to the cable end.

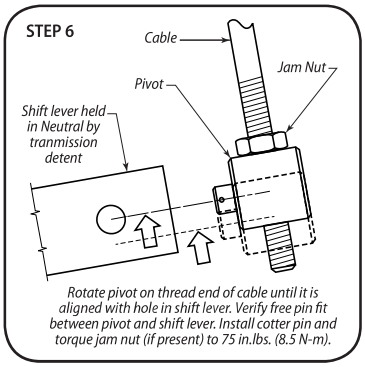
CAUTION ***Once the jam nut is tightened, the pivot pin should slide freely into the hole in the lever. Do not twist the cable to insert it into the lever. Loosen the jam nut, reorient the pivot to insert freely into the lever, then tighten the jam nut again.***

9. Once this attachment is made, move the selector through all the range positions at the operator's station. Verify that free-pin-fit exists in each range position, and that the position of the shift lever is determined by the internal transmission detent — not by tension or compression on the shift cable. Special attention should be given to the free-pin-fit in the Neutral position, in the lowest forward range (1), and, if available, in the Park or Park Brake position.



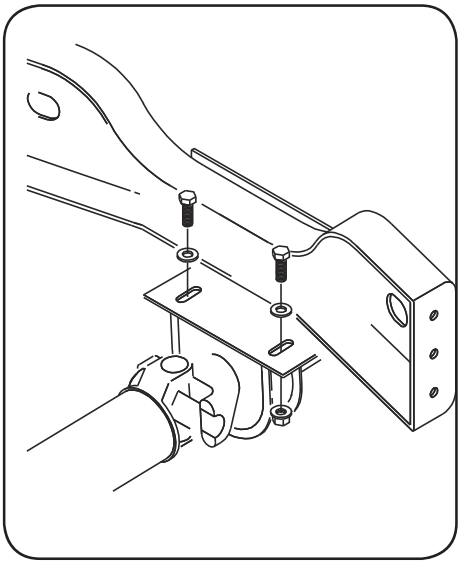






Drive Line

The purpose of the driveline is to transmit torque from the engine to the drive wheels of the vehicle.

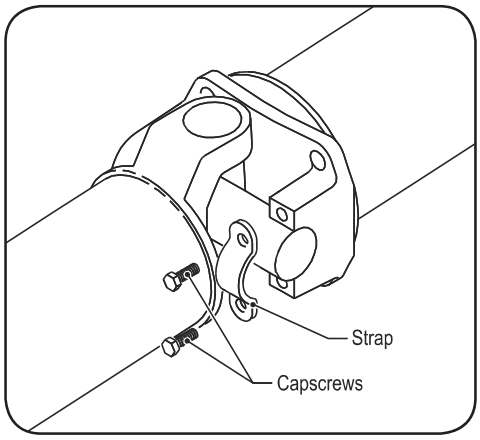


WARNING ***Before continuing with these instructions, please refer to the safety instructions in the Introduction Section of this Service Manual.***

Removal

To remove the driveline from the transmission:

1. Mark the driveline section to be removed, to show the installation orientation. The driveline must be replaced correctly to avoid out-of-phase problems.
2. Carefully support any driveline components that will be left without the normal operational support members (hanger bearings).
3. Remove and discard the capscrews and straps at the universal joints necessary to remove the desired driveline section.



Reinstallation

1. Carefully position the driveline components while observing the previously marked phase indications.
2. Install new straps and hardware at the universal joints. Torque the capscrews to 45–60 ft. lbs. (61.01–81.35 Nm).
3. Lube all grease fittings with NLGI number 2 EP lubricant.
4. Ensure all driveline guards are securely in place before starting the engine.
5. Never work under a bus with the engine running.

For more specific details on the Spicer Driveline components, see the Spicer Driveshafts Service Manual publication (DSSM-0100).

Spicer Life Series Service Manual

Spicer/Dana Publication DSSM-0100