

Allison Cycling Transmissions

Operators Manual



**Detroit Diesel
Allison**

**CRT 3321
CRT 3331
CRT 3531
CRT 3630
CRT 5530
CRT 5630
CRT 5631**

OPERATING INSTRUCTIONS

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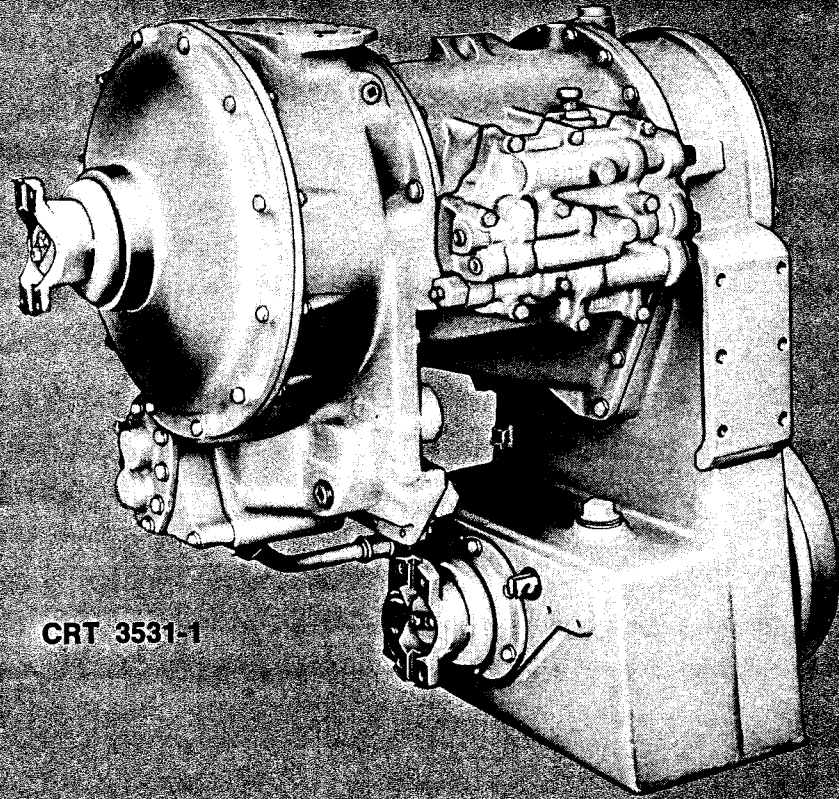
OPERATING INSTRUCTIONS

A LOOK AT THE CRT 3000 SERIES

Matched to engines in the 70 to 185 horsepower class, these reversing transmissions provide every desirable feature for cycling operations.

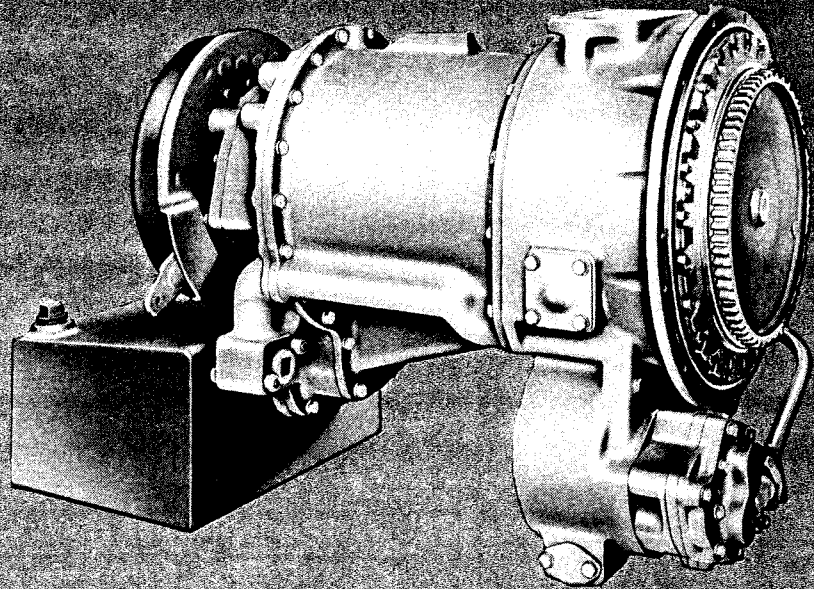
Rugged and compact, these units contain all the transmission elements in a single package. This package contains a torque converter, a forward and a reverse planetary gear set—and either one or two range planetary gear sets, depending on the model. The hydraulic actuated clutches provide smooth, fast full-power shifting in each range and a smooth transition between forward and reverse operation.

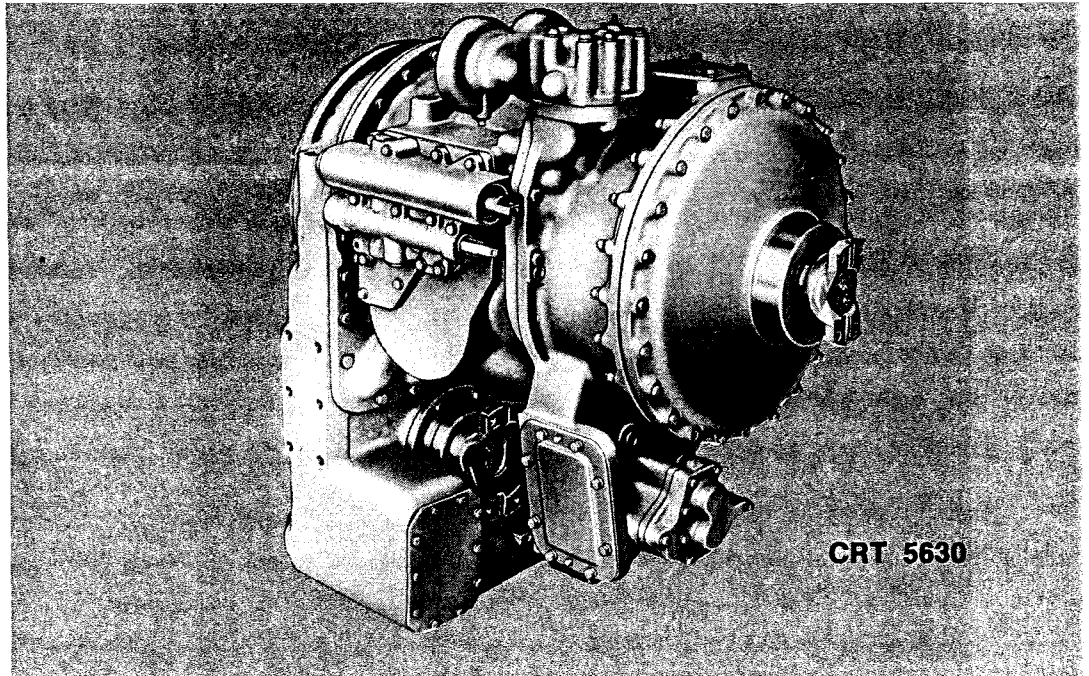
Optional features: remote mount or direct engine mount—flex disk or grease ring drive—clutch cutoff control valve (air or hydraulic)—inching control valve—steer pump drive—speedometer drive—governor drive—remote or transmission mount oil filter—remote or direct mount oil cooler—parking brake—front output disconnect—heavy duty front output shaft—choice of popular flanges—remote mount sump—power takeoff—three converter ratios—straight-through or drop-box models—remote torsional dampener coupling.



CRT 3531-1

CRT 3331-3





A LOOK AT THE CRT 5000 SERIES

These transmissions set the standard for reliability and high work output. ALLISON CRT's are reversing transmissions that provide: full-power crowd and bucket loading ability—continuous, sensitive feel of the load—hydraulic clutch cutoff—smooth handling of off-balance loads—positive positioning for load spotting—faster reversing.

Matched with engines in the 175 to 350 horsepower class these rugged and complete units contain all transmission components in one compact package. This package consists of a torque converter for powerful starting torque, a forward and reverse planetary gear set and two range planetary gear sets. Hydraulic actuated clutches provide smooth fast, full-power shifting in each of the three forward and three reverse ranges and smooth transition between forward and reverse operation.

Optional features include: remote mount or direct engine mounted—parking brake—oil filter remote mount or on transmission—speedometer drive—choice of popular flanges—power takeoff—implement pump drive—clutch cutoff valve (air or hydraulic)—choice of 7 torque converter ratios.

TRANSMISSION CONTROL LEVERS

The following shift patterns show the sequence of the shift levers for the directional control and the range control for all models.

Directional Lever	Range Lever
● F (FORWARD)	● N (NEUTRAL)
● N (NEUTRAL)	● L (LOW)
● R (REVERSE)	● I (INTERMEDIATE)
	● H (HIGH)

OPERATING TIPS

Starting Engine

Place the selector lever in neutral position before starting the engine. If the transmission is equipped with a neutral start switch, the switch will prevent the engine from starting unless the selector lever is in neutral. If the starter will not operate in neutral, or will operate in any range other than neutral, call this to the attention of your maintenance personnel.

Pressures, Temperatures

When gages are provided for indicating transmission pressures and temperature, check them frequently to determine if readings are within normal range. Normal operating range is 180° to 200°F. The oil temperature should not exceed 250°F. Should the temperature reach this limit, the vehicle should be stopped, shifted to neutral, and the engine operated at 1200 to 1500 rpm. The temperature should fall to normal before operating the vehicle any further. If the high temperature persists, stop the engine and have the overheating condition investigated by your maintenance personnel.

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

The transmission oil pressure gage indicates clutch application pressure. The needle will vary with transmission shifting and speeds but should return to normal at normal engine operating speeds. Shut the engine off if the pressure remains abnormal and have the condition investigated by your maintenance personnel.

Speed Limitations When Shifting

The transmission can be upshifted or downshifted even at full throttle. There is no speed limitation on upshifting. However, a downshift must not be made if the vehicle speed exceeds maximum speed normally attainable in the next lower gear. Downshifting at excessive speed will overspeed the engine.

Changing Direction of Travel

When shifting from forward to reverse, or reverse to forward, the throttle should be closed and the vehicle braked to a slow (creeping) speed. Then the shift to the opposite direction may be made, and the throttle reopened when the vehicle begins to move in the opposite direction.

Sense-Feel Operation

Some transmissions are equipped with a "sense-feel" valve which provides a definite hydraulic retarding force against shifting the directional lever from neutral to forward or from neutral to reverse. The retarding force persists until full clutch engagement occurs, then is automatically cancelled. The operator has the sensation of "picking up" the load, and can more accurately gage the application of the clutch.

Inching Control

Some transmissions are equipped with an inching control feature. This is a valve which is controlled by the operator separately from the range selector and the directional selector.

This valve is manipulated by the operator to accurately control the application of main pressure to the forward or reverse clutch. Thus, the operator has a feel of the load pick up and precise "inching" of the load.

Clutch Cutoff Control

Some transmissions are equipped with a clutch cutoff, or "declutch" device. This control eliminates the need to shift to neutral when full engine power is needed to drive accessory equipment, such as a bucket. The device is activated when the operator fully applies the service brakes. After the brake pedal passes through the first portion of the stroke (some linkages have a detent), the clutches are completely released. When the brake pedal is released the clutches are re-applied. Some installations are equipped with an on-off switch which allows the operator to lock out the clutch cutoff when it is not wanted. For example, when "roading" the vehicle over long distances, or when inching the vehicle forward or backward in tight quarters and the clutch cutoff, with each brake application, is not wanted.

Power Takeoff Operation

All transmissions have provisions for a power takeoff (PTO) at the front of the transmission. It is engine driven and rotates whenever the engine is running.

In most applications, the power takeoff is continuous and is used to drive a hydraulic pump which supplies hydraulic pressure for the operation of various accessories.

In addition to the engine driven power takeoff, mentioned above, the CRT 5600 series may also have a power takeoff driven by the transmission output. This allows the operator to operate the power takeoff in either low-, intermediate- or high-range as well as forward or reverse. A mechanical disconnect allows the operator to engage or disengage the power takeoff. The power takeoff will not operate when:

- The rear disconnect is in the OFF position
- The range selector lever is in NEUTRAL
- The directional lever is in NEUTRAL
- The clutch cutoff is in the ON position and the service brakes are applied.

Towing or Pushing

Before towing the vehicle, be sure to lift the drive wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing. Because of the design of the hydraulic system, the engine cannot be started by towing or pushing the vehicle.

Parking Brake

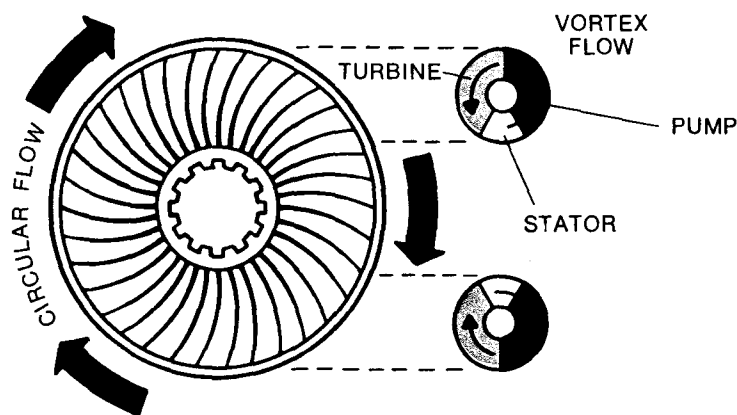
Since there is no “park” position in the shift pattern, the parking brake must be applied to hold the vehicle when it is unattended.

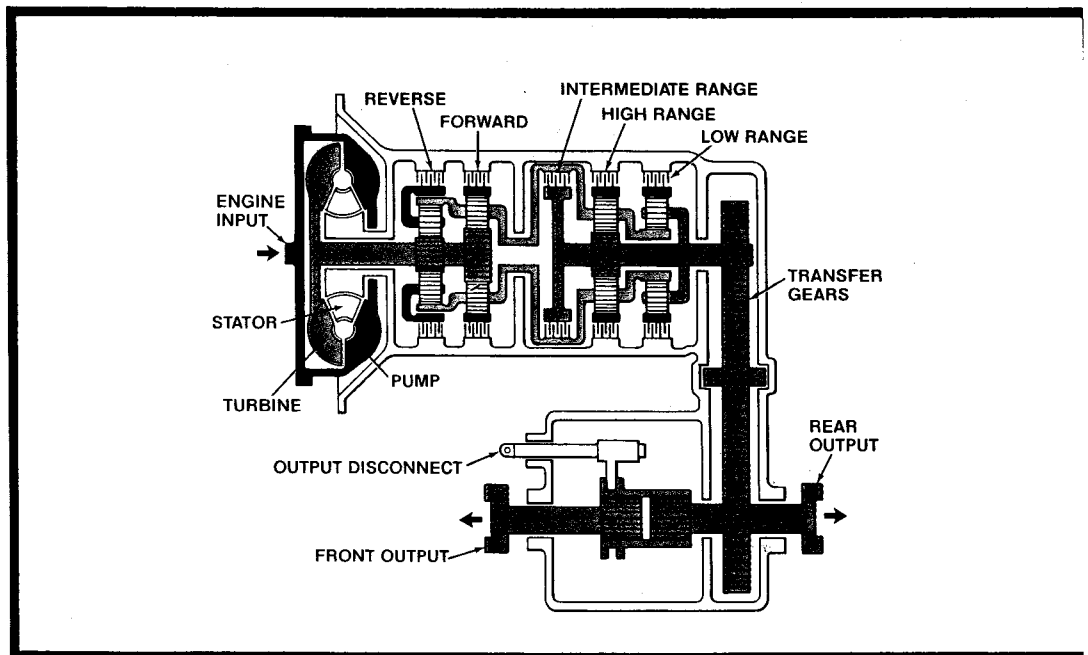
MAINTENANCE INSTRUCTIONS

OPERATION AND FUNCTION OF THE TORQUE CONVERTER

The torque converter, driven by the engine, is the input member of the transmission. It multiplies engine torque and provides a hydraulic cushion between the engine and the load. No disconnect clutch is needed.

The torque converter includes the pump, stator and turbine. The engine drives the pump, which throws oil against the turbine vanes. The turbine transmits torque to the transmission gearing. The stator redirects the oil to the pump in a direction which will assist pump rotation. This redirection of oil is the key to torque multiplication.





INSIDE THE CRT 3000 SERIES

Torque Converter

The torque converter includes the pump, stator and turbine. It functions as a torque multiplier, or as a fluid coupling, depending upon load and operating conditions.

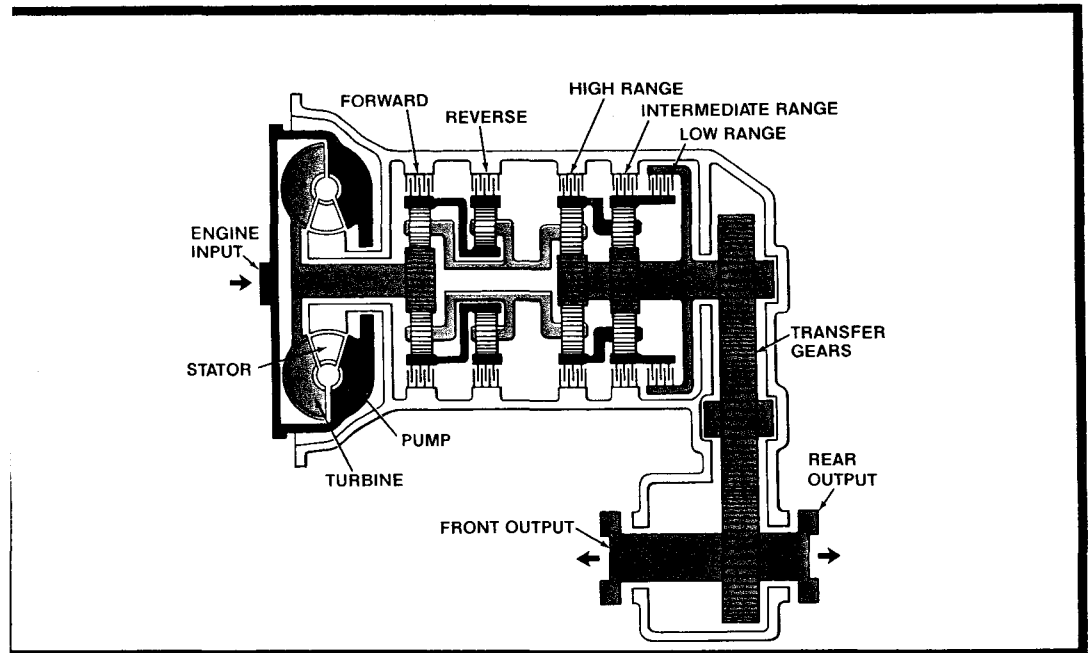
Planetary Gearing

In all models (except CRT 3321) the planetary gear train consists of a forward planetary gear set, a reverse planetary gear set and two range planetary gear sets. These are combined with five clutches to provide three forward ranges and three reverse. The CRT 3321 has a forward planetary gear set, a reverse planetary gear set and one range planetary set. These are combined with four clutches to provide two forward ranges and two reverse.

Some models of the CRT 3000 series are equipped with a transfer gear (drop-box) configuration which places the transmission output on a lower level than the input. This will permit a forward output as well as a rear output. A front output disconnect is available on the CRT 3000.

Hydraulic System

A single integral hydraulic system serves the converter and the range gearing. Oil for all hydraulic operations is supplied by the same integral sump and is returned to it.



INSIDE THE CRT 5000 SERIES

Torque Converter

The torque converter includes the pump, stator and turbine. It functions as a torque multiplier, or as a fluid coupling, depending upon load and operating conditions.

Planetary Gearing

The planetary gear train consists of four constant mesh planetary gear sets. The front set is the forward set, followed by the reverse, the high-range and the intermediate-range set. These planetaries are combined with five clutches to provide three forward ranges and three reverse. The operator controls the application of the various clutches by moving the directional control lever and the range control lever. The transmission output is a transfer gear case (drop-box) which permits both a forward and a rear output. A parking brake mounted on the rear output is available as an option.

Hydraulic System

A single integral hydraulic system serves the converter and the range gearing. Oil for all hydraulic operations is supplied by the same integral sump and is returned to it.

CARE AND MAINTENANCE

Periodic Inspections

A minimum of maintenance is necessary on your ALLISON POWERSHIFT transmission. However, careful attention should be given to all control linkages and to the oil level. For easier inspection, the transmission should be kept clean. Make periodic inspections for loose bolts, leaking oil lines or wet split lines.

Importance of Proper Oil Level

Maintaining the proper oil level is very important. Transmission oil cools, lubricates, and transmits power. If the oil level is too low the converter and clutches will not get a proper oil supply, resulting in poor performance. If the oil level is too high the oil will become aerated, causing overheating.

Daily Pre-start Checks

Control Linkage

1

Check the transmission shift control linkage and the directional linkage to ensure that the linkages are free and that the selector levers are properly positioned. The shift levers should engage in all shift tower positions freely. Inspect the linkages for binding, wear, cracks, breaks or defective cotter pins.

Cold Oil Level Check

2

The cold check (engine not running) is made to determine if there is sufficient oil to safely start the engine—especially if the vehicle has been idle. The oil level should be at or near the full-level check plug. Some transmissions have one plug, others have two plugs—an ADD and a FULL plug.

Hot Level Check

3

Oil level must be checked with the engine running at 1000 rpm, transmission in neutral and with the transmission at normal operating temperature (180° to 200°F). The upper check plug (if there are two plugs) indicates the full oil level while the lower plug is the add level. The oil must be maintained at the FULL level. If there is only one check plug, the oil level must be maintained at this level. Add oil if necessary to bring the level to the FULL mark.

NOTE: Observe the type of flow from the plug opening. If it is aerated or flows freely in a full stream, allow the oil to drain down to the full level before replacing the plug.

Oil, Filter Change

The oil should be changed every 1000 hours of operation or sooner, depending upon operating conditions. Also, the oil must be changed whenever there are traces of dirt or evidence of high temperature indicated by discoloration or strong odor. The filter screen in the sump should be removed and cleaned with mineral spirits at each oil change.

The filter elements should be replaced at each oil change and at 200 hour intervals between oil changes. The filter shells should be cleaned. New gaskets and seal rings must be used when replacing filter elements. After installation, check the filter for oil leakage while the vehicle engine is running.

Keeping Oil Clean

It is absolutely necessary that the oil put in the transmission be clean. Oil must be handled in clean containers, filler etc., to prevent foreign material from entering the system.

Filling Transmission

At temperatures above -10°F , pour hydraulic transmission fluid type C-2 into filler opening. At temperature below -10°F , an auxiliary pre-heat is required to raise the temperature in the sump. Use only C-2 fluids from approved manufacturers. See your dealer for this approved list.

For the CRT 3000 series, the refill capacity is $5\frac{1}{2}$ US gallons for the straight-through models and 7 gallons for the drop-box models. For the CRT 5000 series, the refill capacity is $11\frac{1}{4}$ US gallons.

Make the Cold Oil Level Check and the Hot Level Check as described above.

Care of Breather

The breather should be kept clean at all times. It should be checked and cleaned regularly and as frequently as necessary, depending upon the operating conditions. A badly corroded or plugged breather restricts proper breathing, causing oil leaks.

Control Linkage Adjustment

Manual shift linkage must be adjusted so that the operator's control is positioned to exactly match the detent position of the selector valve on the transmission. Adjust the linkage so that it can be freely connected without moving either the valve or the operator's control. Then operate the range selector lever, the directional selector lever and the output disconnect (if applicable) through each position. Make minor adjustments, if necessary, to insure that each of the selector levers seats in each position of the operator's control. Then inspect the control linkage for binding wear or breaks.

Parking Brake Adjustment

The internal, expanding shoe-type of parking brake is mounted on the rear of the transmission housing at the output. Following is the procedure for adjusting the parking brake.

- Adjust the brake shoes for proper drum clearance by inserting a screwdriver or brake adjusting tool into a hole at the rear of the brake drum, and rotating the star wheel between the lower ends of the brake shoes. The star wheel should be rotated until 0.010-inch thick feeler gages are held snugly between the adjusting ends of the shoes and the brake drum. Use two thickness gages simultaneously—one on each shoe.
- Adjust the vehicle brake linkage by releasing the hand lever fully, and adjusting the connecting linkage so that it can be freely connected to the apply lever on the brake. All slack should be taken out of the brake, without actually moving the brake shoes, when the linkage adjustment is made.

TROUBLESHOOTING

A transmission malfunction should be investigated immediately to prevent further damage to the transmission. Some evidences of malfunctioning are overheating, poor performance or unusual sounds.

The following chart lists the possible causes of, and remedies for, transmission troubles. As indicated in the chart, the engine and transmission must be considered as a single package when searching for trouble.

Ⓐ LOW CLUTCH APPLY PRESSURE (transmission oil pressure gage)

Cause	Remedy
1. Low oil level	1. Add oil to correct level
2. Clogged oil strainer	2. Clean strainer
3. Clogged oil filter	3. Replace filter element
4. Inching control adjustment not fully retracted	4. Check, adjust linkage
5. Air leak at intake side of oil pump	5. Check pump mounting bolts
6. External oil leakage	6. Tighten bolts or replace gaskets
7. Brake hydraulic (or air) pressure applying clutch cutoff valve	7. Check brake residual pressure (brakes released); check brakes for full release
8. Internal failure	8. Overhaul transmission, or repair subassembly

Ⓑ OVERHEATING

1. High oil level	1. Restore proper oil level
2. Clutch failed	2. Rebuild transmission
3. Vehicle overloaded	3. Reduce load
4. Low clutch apply pressure	4. Refer to Ⓐ
5. Engine water overheated	5. Correct engine overheating
6. Cooler oil or water line kinked or clogged	6. Clean or replace line

Ⓒ AERATED (foaming) OIL

Cause

Remedy

- | | |
|---|---|
| 1. Incorrect type oil used | 1. Change oil; use proper type |
| 2. High oil level | 2. Restore proper oil level |
| 3. Low oil level | 3. Restore proper oil level |
| 4. Air entering suction side of oil pump | 4. Check oil pump bolts and gasket |
| 5. Air entering at clutch cutoff valve (air actuated) | 5. Check plug seal and sealing of valve |

Ⓓ VEHICLE WILL NOT TRAVEL

- | | |
|--|------------------------------|
| 1. Low clutch apply pressure | 1. Refer to Ⓐ |
| 2. Selector linkage broken or disconnected | 2. Repair or connect linkage |
| 3. Internal mechanical failure | 3. Overhaul transmission |

Ⓔ VEHICLE TRAVELS IN NEUTRAL WHEN ENGINE IS ACCELERATED

- | | |
|---------------------------------------|--------------------------|
| 1. Selector linkage out of adjustment | 1. Adjust linkage |
| 2. Clutch failed (won't release) | 2. Overhaul transmission |

Ⓕ VEHICLE LACKS POWER AND ACCELERATION AT LOW SPEED

- | | |
|-------------------------------|---|
| 1. Low clutch apply pressure | 1. Refer to Ⓐ |
| 2. Low converter-out pressure | 2. Refer to Ⓐ |
| 3. Engine malfunction | 3. Check engine; refer to engine service manual |
| 4. Aerated oil | 4. Refer to Ⓒ |

Ⓖ CLUTCH CUTOFF VALVE INEFFECTIVE

- | | |
|---|---|
| 1. Valve or plug sticking | 1. Rebuild control valve body assembly |
| 2. Brake apply hydraulic pressure incorrect | 2. Check pressure at control valve (min-max limit—130-2000 psi) |
| 3. Brake apply air pressure not reaching air cylinder | 3. Check at air cylinder (35 lb force required to stroke valve) |
| 4. Plunger sticking in air cylinder | 4. Check operation of air cylinder |
| 5. Air entering at valve (air actuated) | 5. Check operation of air cylinder (seals) |

PRESERVATION AND STORAGE

Preservative Method Selection

When transmissions are to be stored or remain inactive for extended periods of time, specific preservative methods are recommended to prevent rust and corrosion damage. The length of storage will usually determine the preservative method to be used. Various methods are described below.

- (1) The following procedures will prepare a transmission for a month to 6 weeks storage, depending on the environment.
- (2) Drain the oil. Remove the transmission oil filter element(s).
- (3) Install the drain plugs and new filter element(s).
- (4) Fill the unit to operating level with any commercial preservative oil which meets the US Military Specification MIL-L-21260, Grade 1.
- (5) Operate the unit for at least 5 minutes at a minimum of 1000 rpm. Shift the transmission slowly through all selector positions to thoroughly distribute the oil, then shift to forward (high) range and stall the transmission output to raise the oil temperature to 225°F.

CAUTION: Do not allow temperature to exceed 225°F. If the unit does not have a temperature gage, do not stall for more than 30 seconds.

- (6) As soon as the unit is cool enough to touch, seal oil openings and breathers with moisture-proof tape.
- (7) Coat all exposed, unpainted surfaces with a good grade of preservative grease such as a petrolatum that meets US Military Specification (MIL-C-11796), Class 2

Storage, 1 Year -Without Oil

- (8) Repeat the above procedures ((5) through (7)) at monthly intervals for indefinite storage.

- (1) Drain the oil.
- (2) Seal all openings and breathers with moisture-proof tape.
- (3) Coat all exposed, unpainted surfaces with a good grade of preservative grease.
- (4) Atomize or spray 2 ounces of Motorstor*, or equivalent, into the transmission through the oil pan drain plug.
- (5) If additional storage time is required, (3) and (4), above, should be repeated at yearly intervals.

Storage, 1 Year -With Oil

- (1) Drain the oil. Remove the transmission oil filter element(s).
- (2) Install the drain plugs and new filter element(s).
- (3) Fill the transmission to operating level with a mixture of 30 parts type C-2 transmission fluid to 1 part Motorstor, or equivalent.
- (4) Operate the unit for approximately 5 minutes at a minimum of 1000 rpm. Shift the transmission slowly through all selector positions to thoroughly distribute the oil, then stall the converter to raise the oil temperature to 225°F.

Caution: Do not allow temperature to exceed 225°F. If the unit does not have a temperature gage, do not stall for more than 30 seconds.

- (5) As soon as the unit is cool enough to touch, seal all openings and breathers with moisture-proof tape.

*** Motorstor is a preservative additive manufactured by the Daubert Chemical Company, Chicago, Illinois. Motorstor (under the designation of "Nucle Oil") is covered by US Military Specifications MIL-L-46002 (ORD) and MIL-I-23310 (WEP).**

Restoring Units to Service

- (6) Coat all exposed, unpainted surfaces with a good grade of preservative grease.
- (7) If additional storage time is required, (3 through (6), above, should be repeated at yearly intervals, except it is not necessary to drain the transmission—just add the Motorstor, or equivalent.

- (1) If Motorstor, or equivalent, was used in preparing the transmission for storage, use the following procedures to restore the unit to service.
- (2) Remove the tape from openings and breather.
- (3) Wash off all the external grease with solvent.
- (4) Add hydraulic transmission fluid, type C-2 to proper level.

NOTE: It is not necessary to drain C-2 oil and Motorstor mixture from the transmission.

- (5) If Motorstor, or equivalent, was not used in preparing the transmission for storage, use the following procedures to restore the unit to service.
- (6) Remove the tape from openings and breathers.
- (7) Wash off all the external grease with solvent.
- (8) Drain the oil.
- (9) Install a new oil filter element(s).
- (10) Refill transmission with hydraulic transmission fluid, type C-2 to proper level.

SERVICE LITERATURE

The following Allison publications covering the operation, servicing and overhaul of your Allison transmission can be ordered from your dealer or distributor.

Service Manual CRT 3321, 3331 CRT 3531, 3630 CRT 5630, 3631	Publication No. SA 1073 SA 1104 SA 1083
Parts Catalog CRT 3321, 3331, 3531, 3630 CRT 5530, 5630, 5631	SA 1244 SA 1076