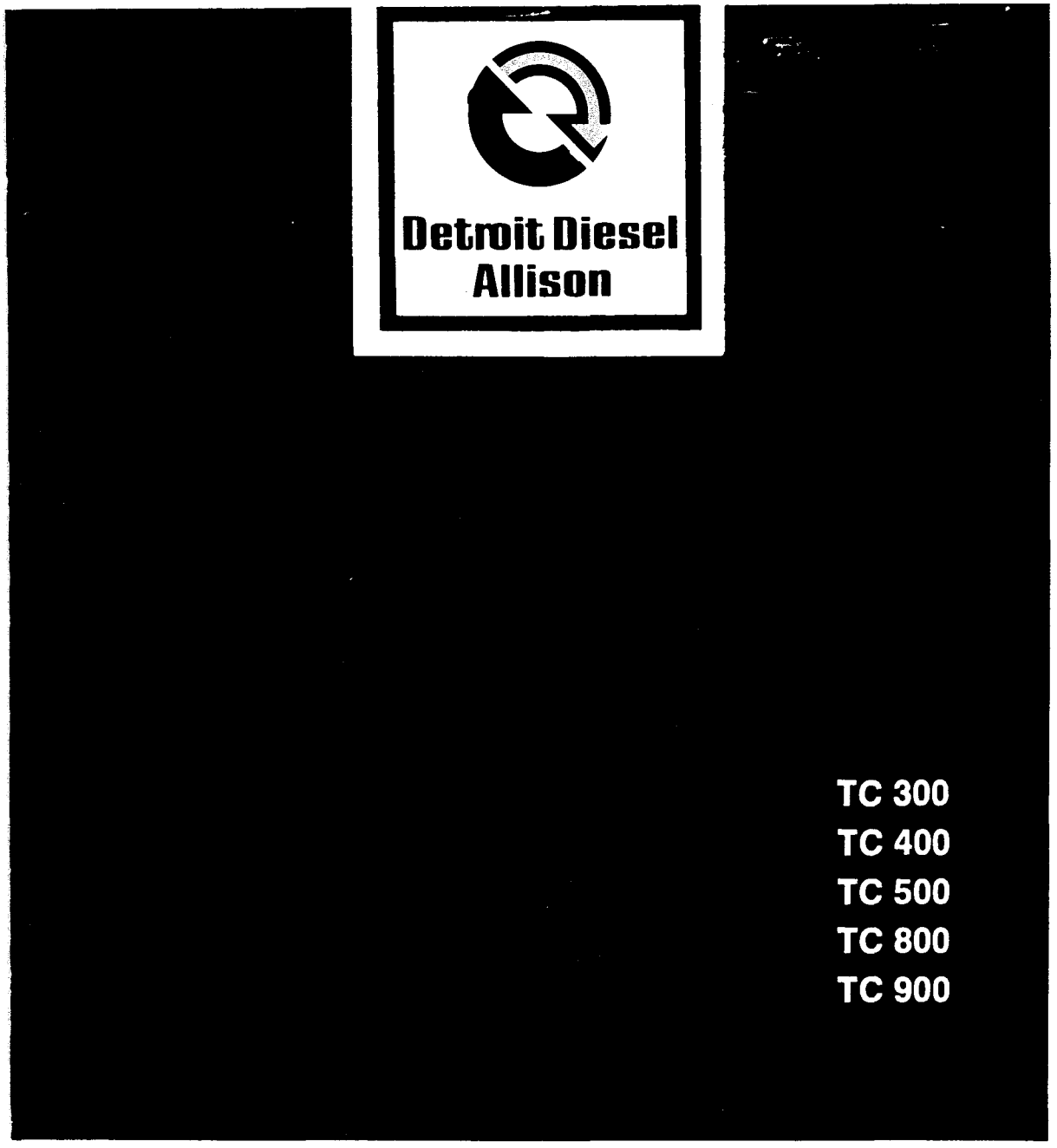
Allison Torque Converters

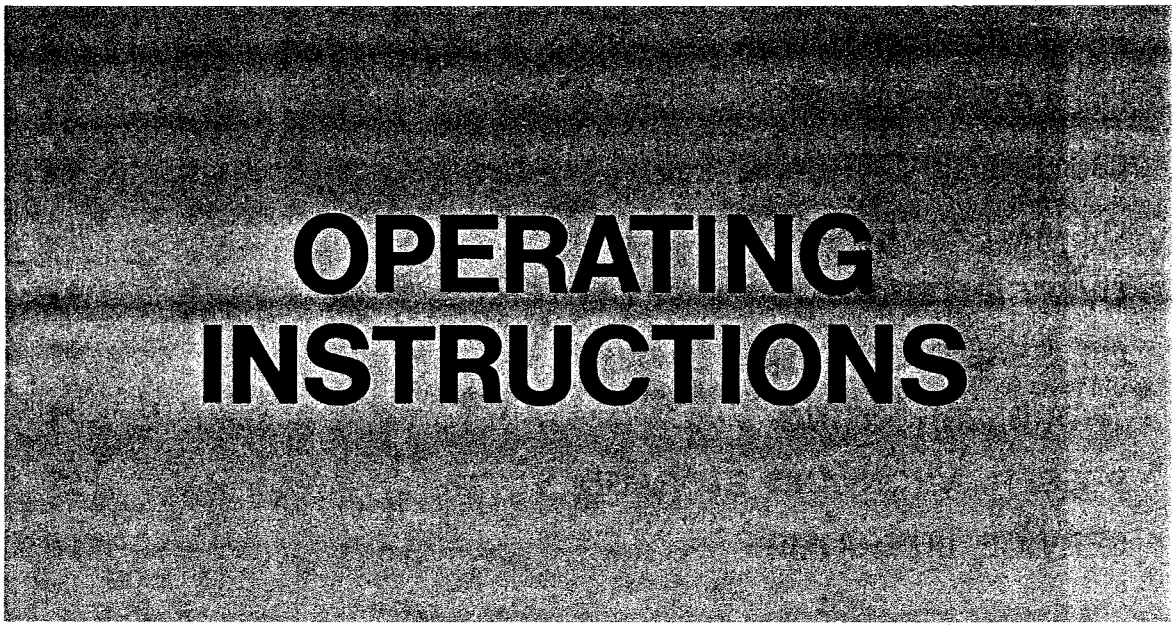
Operators Manual



TC 300
TC 400
TC 500
TC 800
TC 900

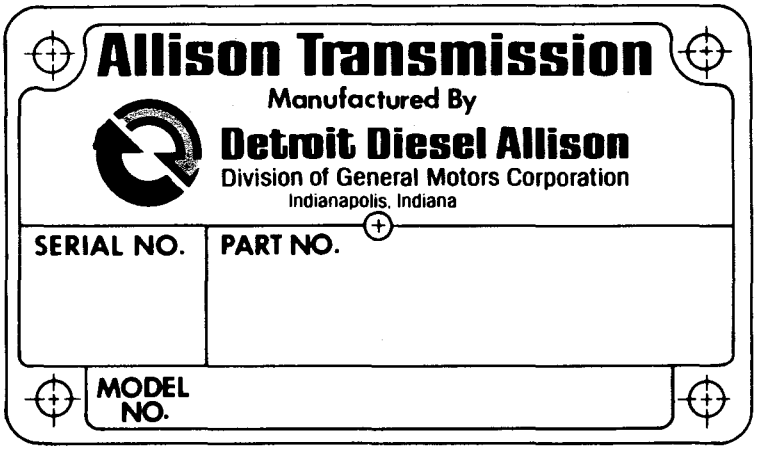
OPERATING INSTRUCTIONS

MAINTENANCE INSTRUCTIONS


OPERATING
INSTRUCTIONS

TORQUE CONVERTER NAMEPLATE

The nameplate is located on the converter main housing. The model number, part number, and serial number are stamped in the transmission nameplate. These three numbers define the torque converter configuration and all its components. Use *all three* numbers when you are seeking information or ordering replacement parts.



For handy reference, record the converter nameplate information onto the nameplate in the illustration.

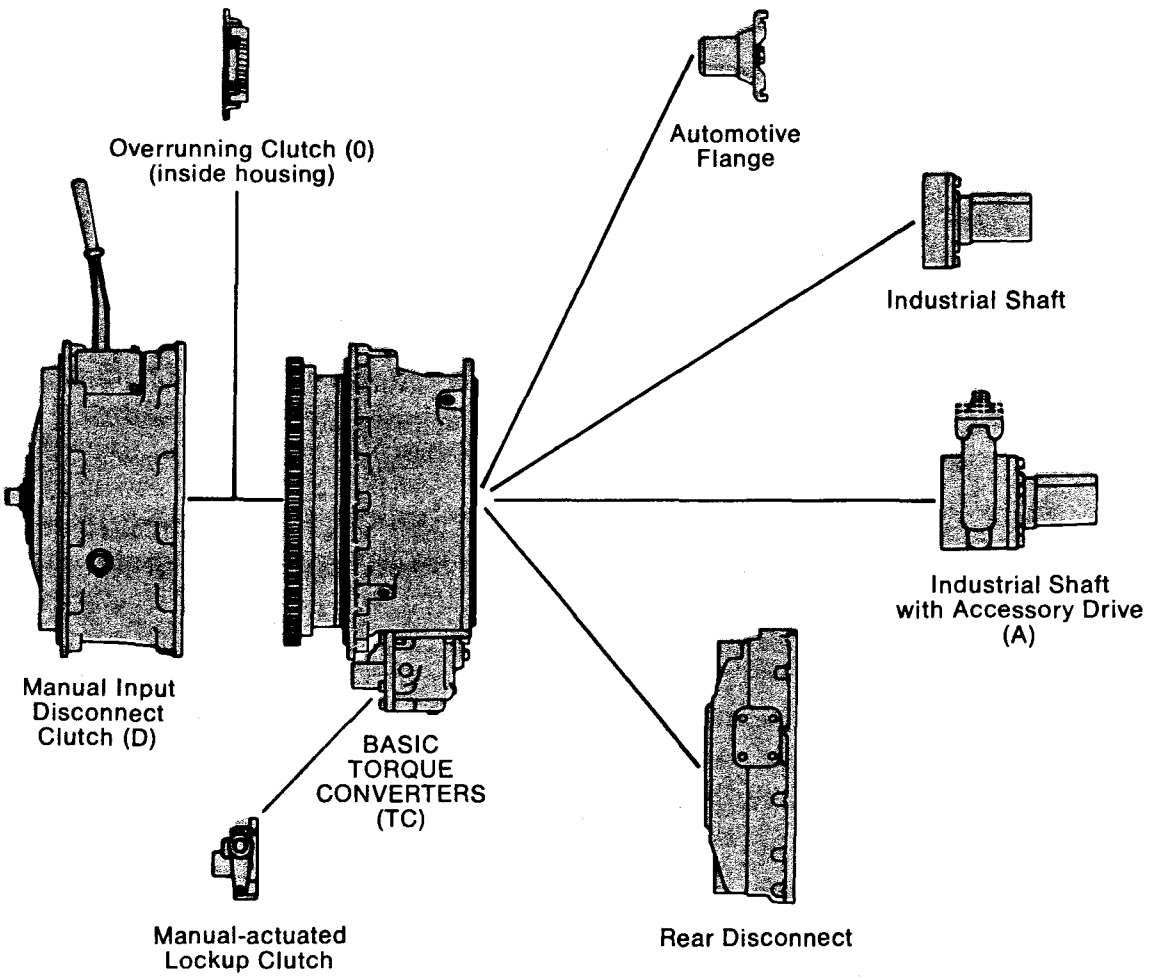
Model Designation Codes

The model number is an alpha-numeric code that defines the basic torque converter and its major features. The alpha segment of the number defines the major features as illustrated in the Basic Model Code Chart. The numeric segment consists of three significant digits. The first digit defines the torque converter series (size), the second defines the torque absorption capacity and ratio, and the third defines the type of output shaft. (For the TC 300 Series, an additional 3-digit group only further defines, paint color, diameter of input clutch or drive ring, etc.) The part number and serial number define the specific piece parts of the torque converter and any variations not covered by the model number.

Basic Model Code

Series 300	Series 400	Series 500	Series 800	Series 900
TC	TC	TC	TC	TC
TCA	TCA	TCA	TCA	TCA
—	—	TCB	—	—
—	TCD	TCD	TCD	—
	TCDA	TCDA	TCDA	—
—	TCDO	—	—	—
	TCDOA	TCDOA		
			TCL	TCL
—	—	—	TCLA	TCLA
TCO	—	—	—	—
TCOA	—	—	—	—
TCORD	—	—	—	—
TCRD	—		—	—

TC—Torque converter
A —Accessory drive
D —Manual input disconnect clutch
L —Lockup clutch
O —Overrunning clutch
RD—Rear Disconnect Housing



OPERATION

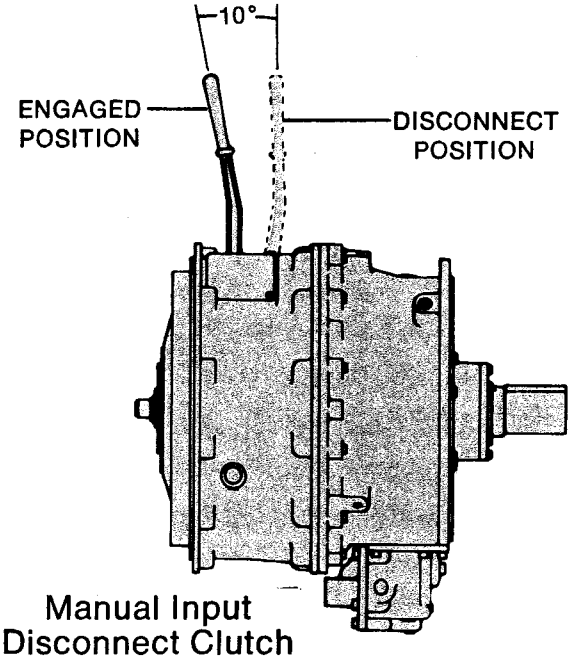
Starting

Check the oil level. A cold check (before engine is started) is necessary to determine if there is sufficient oil in the unit to safely start the engine. This check is especially important if the equipment has not been in operation for a long period of time.

Input Disconnect Clutch

The manual input disconnect clutch is controlled by a single lever. When the lever is forward (toward the engine), the clutch is engaged and provides a positive drive from the engine to the converter. When the lever is rearward (away from the engine) the clutch is disengaged and allows a positive disconnect from the engine. The control lever may be actuated manually or by a hydraulic or pneumatic cylinder. The lever should not be actuated when the engine is above idle speed. Engagement or disengagement above idle speed will shorten the life of the clutch plate and possibly damage the engine.

The clutch should be disengaged for cold weather starts, extended periods of engine idling, engine servicing, or any other time it would be desirable to completely isolate the engine from the driveline.



Manual Input Disconnect Clutch

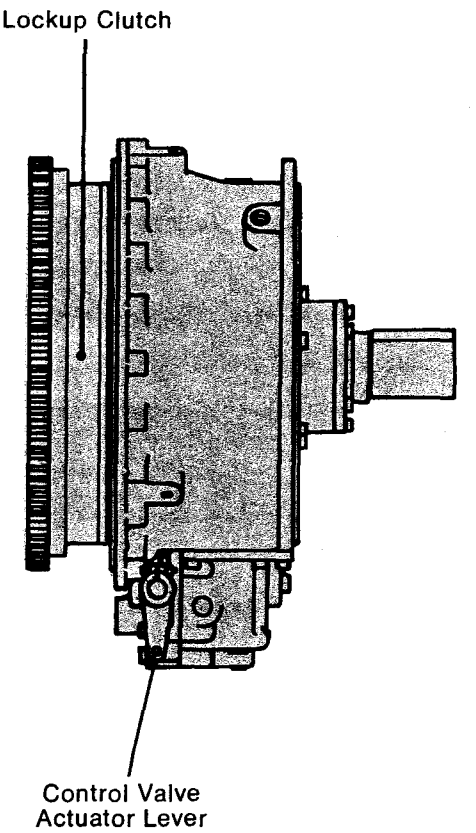
Lockup Clutch

The lockup clutch is controlled by a pneumatic —or manual-operated valve. When the valve is actuated clockwise, a clutch, within the flywheel housing, locks the converter pump to the turbine—that is, the input is locked to the converter output. When the valve is actuated counterclockwise the lockup clutch releases.

The lockup clutch should be engaged anytime the equipment will benefit from a direct drive operation. It is particularly beneficial when the clutch can remain engaged for a period of time in a preselected operating range of a transmission.

The lockup clutch should be disengaged before shifting the transmission. The lockup clutch is not designed to withstand the shock loading that accompanies high-load shifting. Failure to disengage the lockup clutch prior to shifts will result in reduced clutch life and possible damage.

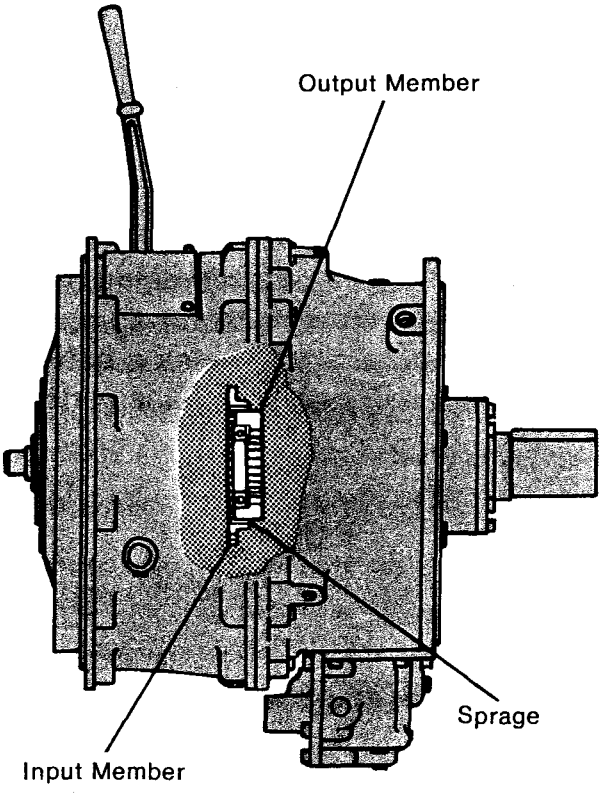
NOTE: Movement of the control valve actuator lever should be made rapidly. Slow movement can result in blown converter seals and reduced clutch life.



Overrunning Clutch

The overrunning clutch is a sprag-type clutch that is controlled by the relative speeds of the input and output shafts. Anytime the output shaft (converter turbine) attempts to overrun the input shaft (converter pump) the clutch engages. The engaged clutch provides full engine braking for the drive line. However, when the speed of the input is greater than the output, the clutch releases. The released clutch allows the converter to perform normally as a torque multiplier and fluid coupling.

Engagement of the overrunning clutch occurs anytime the output attempts to overrun the input. Thus the overrunning clutch provides engine braking for slowing vehicles during downhill runs, lowering loads during crane operations, or any other application where this advantage would be desired.

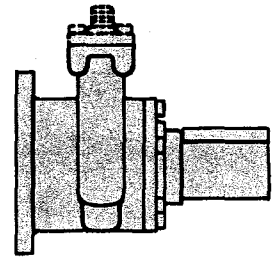


Overrunning Clutch

Accessory Drive

The accessory drive consists of two helical gears which are contained in the rear bearing housing. These gears are driven by the converter output shaft at a 1:25 ratio. Drive from this location can be used to drive a speedometer or serve as a governor drive for the converter output shaft.

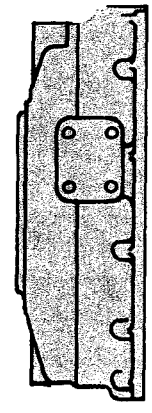
The governor drive provides the necessary constant output speed for equipment such as shovels and cranes. The governor drive also prevents harmful engine lugging and stalling.



Accessory Drive
(with industrial shaft)

Rear Disconnect Clutch Housing

The rear disconnect clutch housing encloses a V-belt hub which is integral with the converter turbine shaft. The shaft is supported by ball bearings within the housing bores. The drive hub of the shaft has six tapped holes to accommodate a clutch plate or other driven accessory. The V-groove in the drive hub provides a belt-type drive for a governor or other similar component.



Rear Disconnect Housing

Temperature

The normal operating temperature range is 180 to 200°F (82 to 93°C). This temperature is indicated by a transmission oil temperature gage on the instrument display panel. When a continuous over-temperature condition, above 250°F (121°C), is indicated, stop the equipment and determine the cause.

The most common and easily remedied cause of overheating is extended operation under severe loads. When this occurs, reduce the load or shift to neutral, and operate the engine at 1200-1500 rpm until temperature returns to normal. If the temperature does not return to normal, refer to the troubleshooting chart in this manual for other possible overheating causes and remedies.

Pushing Or Towing

If a disabled vehicle must be pushed or towed farther than ½ mile (0.8 km), it is imperative the drive line be disconnected. Failure to comply with the ½ mile (0.8 km) limit may result in serious damage. If the distance is less than ½ mile (0.8 km), the drive line can remain connected, but the vehicle must travel at a LOW speed.

If the converter is connected to a transmission having an output-driven oil pump, the pump will supply oil to the transmission when the vehicle is being towed or push started.

MAINTENANCE INSTRUCTIONS

PERIODIC INSPECTION

The exterior of the converter should be cleaned and inspected at regular intervals. The severity of service and operating environment should determine the frequency of such inspections. Check the converter for loose bolts, oil leaks, and damaged or loose oil lines. Check the oil level in the reservoir daily. (Refer to paragraph about oil contamination.)

Occasionally check the oil cooling system for evidence of transmission oil which would indicate a faulty oil cooler. Report any abnormal conditions to the maintenance personnel—a faulty cooler requires immediate attention.

Oil Level Checks

The *correct* amount of oil in the reservoir, or transmission sump, is *important* to converter operation. Poor or erratic performance, overheating, and possible damage can occur when the oil level is not within the specified limits.

To ensure that the oil level is properly maintained, two check procedures are recommended—the cold check and hot check. Although different equipment installations have different means of checking—dipstick, level plugs, or petcocks—the procedures remain the same.

Cold Check.

Before starting the engine, check the oil level in the reservoir. If the level is at the Add line, the engine can be started safely. If it is necessary to add oil—DO NOT fill above the Add line.

Hot Check.

After the oil reaches operating temperature 180-200°F (82 to 93°C), idle the engine, and check the oil level. Add or drain oil as necessary to bring the oil level to the Full line. If the converter is equipped with an input disconnect clutch, engage the clutch before making the hot check.

Converter-Transmission Oil Check

If the converter is operating in combination with a transmission, the oil level check will be made at the transmission sump. (Refer to the transmission manual for oil level check procedures.)

Oil Specification

Only Type C-2 hydraulic transmission fluid is recommended for use in these converters.

When the ambient temperature is below −10°F (−23C°), an auxiliary preheat is required to raise the temperature in the sump (reservoir) to at least −10°F (−23°C).

NOTE: Only certain C-2 fluids have been approved for use in Allison converters. Check with the Detroit Diesel Distributor in your area to make sure you are using an approved brand.

Oil and Filter Change

Frequency

Generally, the oil and filter should be changed every 1000 hours of operation. However, if the equipment operates under severe dust and dirt conditions, the oil and filter should be changed more frequently. Change the oil immediately if it has been subjected to severe overheating. Change the oil any time it shows evidence of contamination.

Oil Contamination

Water.

At each oil change examine the oil which is drained for evidence of dirt or water. A normal amount of condensation will emulsify in the oil during operation of the transmission. However, if there is evidence of water, check the cooler (heat exchanger) for leakage between the water and oil areas. Oil in the water side of the cooler (or vehicle radiator) is another sign of leakage. This, however, may indicate leakage from the engine oil system.

Metal Particles.

Metal particles in the Oil (except for the minute particles normally trapped in the oil filter) indicate damage has occurred in the converter. When these particles are found in the sump, the converter must be disassembled and closely inspected to find the source. Metal contamination will require complete disassembly of the converter and cleaning of all internal and external circuits, cooler, filter, and all other areas where the particles could lodge.

Ethylene Glycol.

If engine coolant containing ethylene glycol leaks into the converter oil system, immediate action must be taken to prevent malfunction and possible serious damage. The converter must be completely disassembled, inspected, and cleaned. All traces of the coolant, and varnish deposits resulting from coolant contamination, must be removed.

Draining Oil System

The equipment should be at operating temperature when the oil is drained. While the oil is draining, check for evidence of contamination.

TC 300.

Remove the reservoir (sump) drain plug from the front, lower right hand corner of the converter housing. Remove strainers and filters, if used.

TC 400, 500, 800, 900.

Remove the reservoir (sump) drain plug from the reservoir. To remove the remaining 3 to 4 gallons (11 to 15 liters) from within the converter, remove the converter-in line and start the engine. Run the engine 20 to 30 seconds at 1000 rpm. Remove strainers and filters, if used.

CAUTION: Due to lack of lubrication, do not run the converter more than 30 seconds.

All models.

Clean oil strainers and screens by agitating them in mineral spirits or solvent. Flush all residue and particles from the screen mesh. Dry the strainer or screen with compressed air—do not use linty shop towels.

Should it become necessary to use a different transmission fluid, thoroughly flush the SYSTEM with the fluid to be used before refilling.

Filling Oil System

All models.

Install reservoir (sump) drain plug and tighten if sufficiently to prevent leakage. Install or replace filters and strainers, if used.

TC 300

Remove the dipstick and pour enough oil into the sump to bring the level to the Add mark. Start the engine and bring the unit to operating temperature, 180-200°F (82-93°C). Check the oil level again and add or drain enough oil to bring the level to the Full mark.

TC 400, 500, 800, 900.

Check to ensure that all drain plugs, oil filters, and oil lines have been installed or replaced and secured sufficiently to prevent leakage. Fill the converter reservoirs with the following volumes of oil—9 gallons (34 liters) in the TC 400 and 500 Series; 8 gallons (30 liters) in the TC 800 and 900 Series. Start the engine and bring the unit to operating temperature, 180-200°F (82-93°C). Check the oil level again and add or drain enough oil to bring the level to the Full mark.

Overcenter Disconnect Clutch

Lubrication.

Lubricate the throw-out bearing and shaft bearing with high-temperature grease (300°F [150°C] minimum melting point) every 60 hours of operation. This time interval may vary due to specific operating conditions. Using a grease gun inject 1 "shot" into each grease fitting located on the top of the clutch housing.

CAUTION: Overlubrication of either bearing will cause grease to be thrown onto the clutch facing, causing the clutch to slip or grab.

Adjustment.

Occasionally, it will be necessary to adjust the clutch to compensate for normal wear. This check should be made every 500 hours of operation or more frequently, depending on frequency of operation and operating conditions.

The clutch requires adjustment if the force required to operate clutch control lever through the "overcenter" position is not within the limits shown in the adjustment chart.

Series	Engine horsepower, (kw) net	Force, lb (N)	Control lever distance, in. (mm)	Adjustment rotation to increase force
TC 300		40-45 (178-200)	16 (406.4)	CCW
TC 400, 500	below 240 (179)	55-75 (245-334)	21 (533.4)	CW
	240 to 350 (179 to 261)	75-115 (234-512)	21 (533.4)	CW
TC 800, 900		115-175 (512-778)	24 (609.6)	CW

If a pneumatic or hydraulic cylinder is used to operate the clutch control lever, be sure that the cylinder stroke does not overload the apply and release mechanism. Increasing the stroke for a "harder" apply will not affect engagement pressure.

Overloading at either end of the stroke will only result in excessive wear in the mechanism.

TC 300.

Remove the access cover and disconnect the clutch. Rotate clutch assembly until the lock screw is accessible. Remove the lock screw and lock from the adjusting nut. Using a spanner wrench (or drift and hammer) rotate the adjusting nut counterclockwise (facing engine flywheel) to increase the engagement force. Refer to adjustment chart for the force value. Replace the lock and lock screw, and replace the access cover.

TC 400.

Remove the access cover and disconnect the clutch. Rotate the clutch assembly until the collar lock pin is accessible. Remove the lock pin and rotate the adjustment collar and toggle assembly clockwise (facing engine flywheel) to increase the engagement force. Refer to adjustment chart for the force value. Replace the lock pin, making sure the pin has engaged one of the 24 holes in the hub plate. Failure to engage the pin securely will allow the clutch to lose adjustment.

TC 500, 800, 900.

Remove the access cover and disconnect the clutch. Rotate the clutch assembly until the adjustment collar lock is accessible. Press the lock with the thumb, and rotate the toggle assembly clockwise (facing engine flywheel) to increase the engagement force. Refer to adjustment chart for the force value. Release the lock, making sure it is engaged in one of the 24 slots in the clutch hub. Failure to engage a slot securely will allow the clutch to lose adjustment.

TC All models.

The means to lock or unlock the toggle mechanism may vary within the design of the disconnect clutch. It may, therefore, be necessary to adopt procedures other than those described.

Oil Seal Drain Line

Carbon Buildup.

On all Series, remove the oil seal drain line periodically and check for carbon buildup. If any carbon is evident, remove the deposit, and reinstall the fitting and drain line.

Excessively high converter operating temperatures will sometimes cause carbon deposits to occur in the hydraulic system. Accumulation of these particles in the drain line will restrict the flow sufficiently to cause a pressure buildup at the pump hub seal. This pressure will result in leakage and subsequent failure of the seal.

Periodically check the drain hole in the engine flywheel housing for an indication of leakage from the pump hub seal.

Correct Routing.

The drain line must be routed so that every point in the line is more than 3½ inches (89 mm) below the center line of the converter. The line must be kept free of kinks and tight bends. An incorrect routing will result in leakage at the pump hub seal or output shaft seal.

TROUBLESHOOTING

The operator must be alert to evidences of performance of the equipment. In some cases, the remedy may be beyond the on-site technical skills or tool inventory. When this occurs, report the condition to the appropriate maintenance personnel as soon as possible—don't let little problems become big ones.

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

Cause	Remedy
Ⓐ LOW CONVERTER CHARGING PRESSURE	
1. Low oil level	1. Add oil to correct level
2. Defective oil pump	2. Repair or replace
3. Excessive oil flow to transmission*	3. Check operation of selector valve, check valve, and transmission charging pump
4. Clogged inlet line or screen*	4. Clean or replace inlet line or screen
5. Suction screen uncovered*	5. Add oil to correct level or check for incorrect installation of screen
6. Leaking oil lines	6. Replace defective lines, gaskets; tighten fittings, gasket bolts
7. Aerated oil	7. Refer to ©

*Does not apply to the TC 300 Series Converters.

Cause	Remedy
Ⓑ HIGH OIL TEMPERATURE	
1. Incorrect oil level	1. Add or drain oil, as necessary
2. Engine coolant overheated	2. Correct engine overheating
3. Clogged or dirty heat exchanger	3. Clean or replace
4. Low converter charging pressure	4. Refer to Ⓐ
5. Operating too long in an inefficient converter range	5. Readjust work cycle
6. Stator(s) malfunctioning	6. Repair or replace stator(s)
Ⓒ AERATED (foaming) OIL	
1. Oil return line above oil level in sump	1. Place end of return line below oil level
2. Air entering suction side of charging pump	2. Check oil pump bolts, gasket, and sealing surfaces
3. Suction screen uncovered*	3. Check for correct installation of suction soreen; add oil to correct level
4. Low oil level	4. Add oil to correct level
Ⓓ LOSS OF POWER	
1. Low converter charging pressure	1. Refert to Ⓐ
2. Engine malfunctioning	2. Check engine; refer to engine service manual
Ⓔ LOCKUP CLUTCH SLIPPAGE	
1. Incorrect linkage adjustment to lockup selector valve	1. Adjust linkage
2. Lockup selector valve malfunctioning	2. Repair or replace selector valve
3. Failed or worn lockup piston sealrings	3. Replace sealrings
4. Stoppage in pump-to-piston apply passage	4. Clean passage and remove obstruction
5. Worn lockup clutch plate	5. Replace clutch plate
Ⓕ INPUT DISCONNECT CLUTCH SLIPPAGE	
1. Clutch facing worn	1. Adjust clutch; replace clutch facing
2. Grease on clutch facings	2. Disassemble and clean converter; replace clutch facings

PRESERVATION AND STORAGE

Preservative Method Selection

When the converters 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.

Storage

Four to Six Weeks

This procedure will preserve a converter for four to six weeks depending upon the environment.

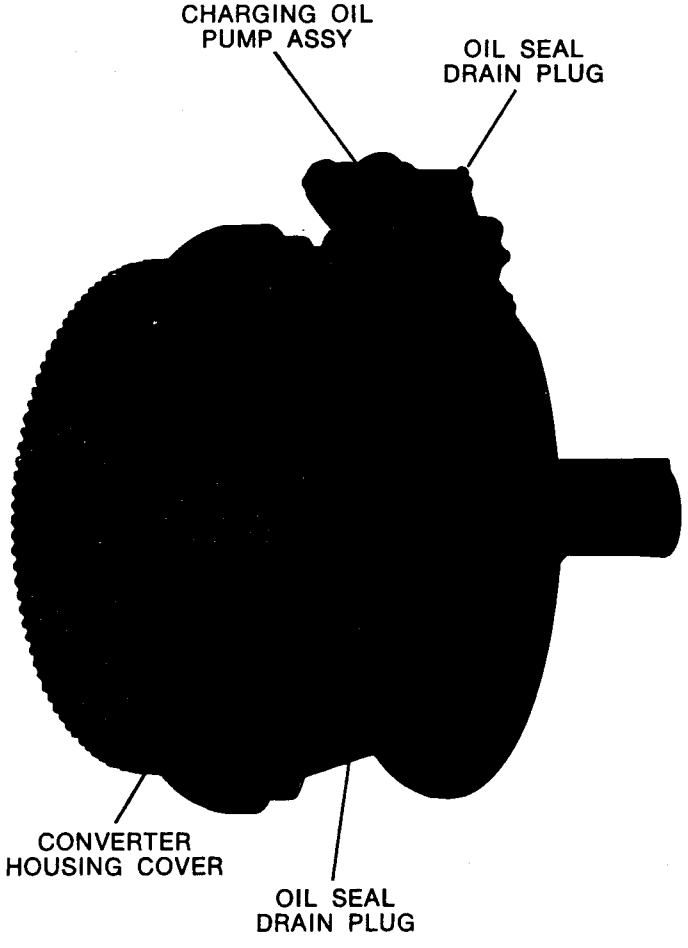
- Drain the oil and remove the oil filter(s). Install the drain plug and new oil filter(s).
- Fill the unit to operating level with any commercial preservative oil which meets US Military Specification MIL-L-21260, grade 1, to latest specifications.
- Operate the unit for at least 5 minutes at a minimum of 1000 rpm. If the unit is equipped with a lockup clutch, actuate the lockup selector valve. Then, stall the converter to raise the oil temperature to 225°F (107°C). (To stall the converter, prevent rotation of the output shaft.)

CAUTION: Do not allow the temperature to exceed 250°F (121°C). If the unit does not have a temperature gage, do not stall for more than 20 seconds.

- As soon as the unit is cool enough to touch, seal all openings and breather with moisture-proof tape. 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.
- For indefinite storage, at monthly intervals, repeat the operating procedure and reapply the preservative grease.

One Year Storage—Without Oil

- Drain the oil.
- Seal all openings and breather, except oil drain hole, with moisture-proof tape. Coat all exposed unpainted surfaces with a good grade of preservative grease.
- Atomize or spray 2 ounces (59 ml) of Motorstor*, or equivalent, into the converter. For the TC 300 Series converters, spray the preservative into the drain hole at the bottom of the sump. For the rest of the converters, spray the preservative into the unused oil seal drain hole, i.e., opposite the oil seal drain line fitting. Install the drain plug.



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- If additional storage time is required, reapply the preservative grease, and spray 2 ounces (59 ml) of Motorstor (or equivalent) into the specified opening. Repeat at yearly intervals.

One Year Storage—With Oil

- Drain the oil and remove the oil filter(s). Then, install the drain plug and new filter(s).
- Fill the converter reservoir (sump) with a mixture of 30 parts of transmission fluid, Type C-2, to 1 part Motorstor preservative, or equivalent.
- Operate the unit for at least 5 minutes at a minimum of 1000 rpm. If the unit is equipped with a lockup clutch, actuate the lockup selector valve. Then, stall the converter to raise the oil temperature to 225°F (107°C). (To stall the converter, prevent rotation of the output shaft.)

CAUTION: Do not allow the temperature to exceed 250°C). If the unit does not have a temperature gage, do not stall for more than 20 seconds.

- As soon as the unit is cool enough to touch, seal all openings and breather with moisture-proof tape. Coat all exposed, unpainted surfaces with a good grade of preservative grease.
- If additional storage time is required, replace any lost fluid, repeat the operating procedure, and reapply the preservative grease.

Restoring Units to Service

If Motorstor, or equivalent, was used in preparing the converter for storage, use the following procedures to restore the unit to service.

- Remove the tape from the openings and breather. Wash off all external grease with solvent.
- Add Type C-2 hydraulic transmission fluid to the proper level.

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

If Motorstor, or equivalent, was not used in preparing the converter for storage, use the following procedures to restore the unit to service.

- Remove the tape from openings and breather. Wash off all external grease with solvent, and drain the oil.
- Install a new oil filter(s), and refill the reservoir (sump) with Type C-2 hydraulic transmission fluid to the correct level.

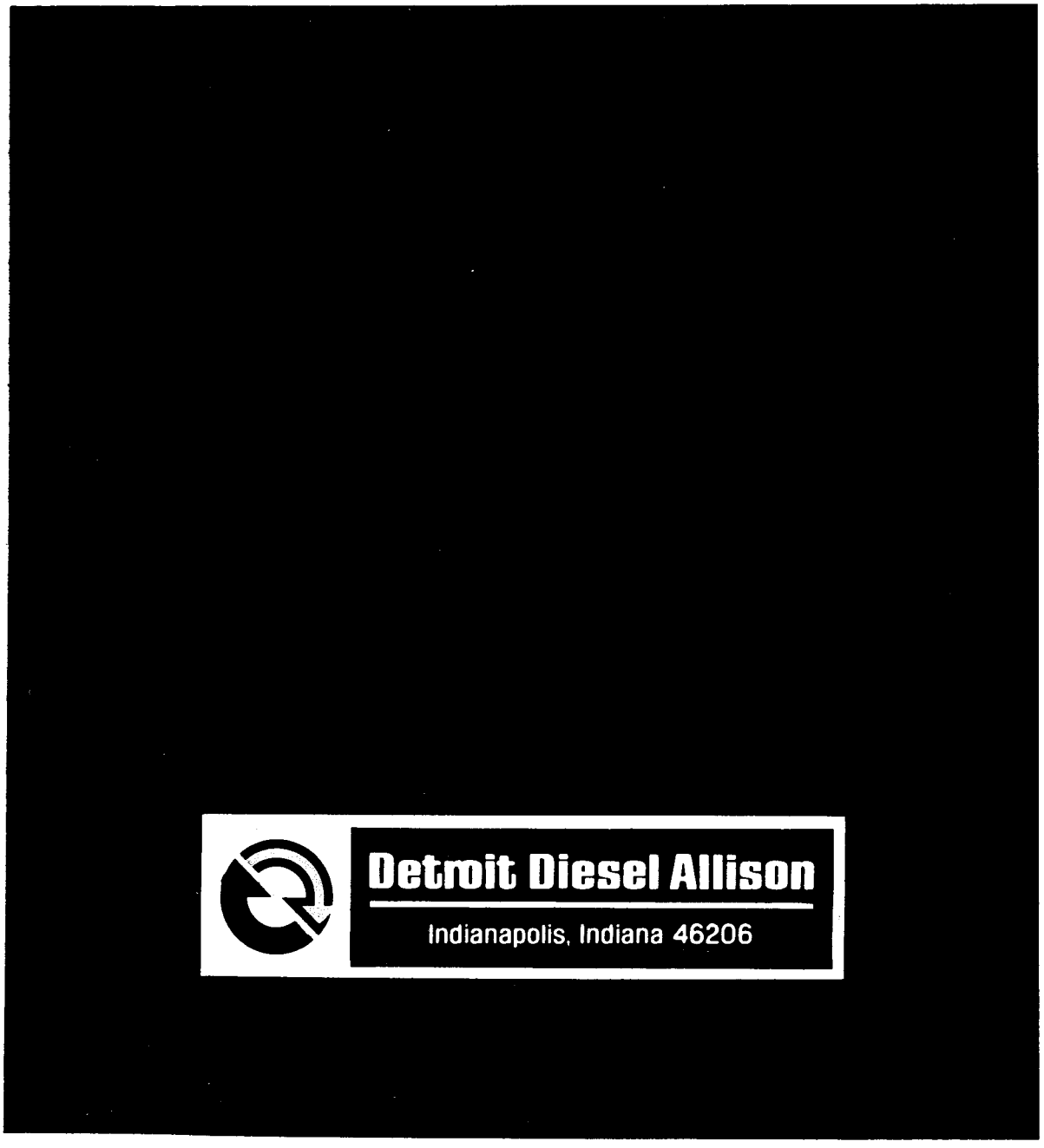
*Motorstor is a preservative additive manufactured by the Daubert Chemical Company, Chicago, Illinois. Motorstor (under the designation of "Nucle Oil") is covered by US Military Specifications MIL-L-46002 (ORD) and MIL-I-23310 (WEP).

SERVICE LITERATURE

The following publications describe the operation, servicing, overhaul, and replacement parts for your torque converter. These publications can be obtained from the dealer or distributor.

Service Manuals	**Publication No.**
TC 200, TC 300	SA 1099
TC 400	SA 1136
TC 500	SA 1058
TC 800, TC 900	SA 1054
Parts Catalog	**Publication No.**
TC 200, TC 300	SA 1039
TC 400	SA 1116
TC 500	SA 1057
TC 800, TC 900	SA 1038

The Allison Torque Converters



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