

State of California
Office of Emergency Services
Fire and Rescue Branch

MAINTENANCE BULLETIN #24

Subject: Allison Automatic Transmission, Engines Beginning with OES-132

Beginning with OES 132, all fire apparatus purchased by this agency will be equipped with Allison torque converters and automatic transmission with a power takeoff to drive the auxiliary pump. The operation and maintenance of automatic transmissions is somewhat different from the conventional type. This bulletin briefly describes proper operation and maintenance practices in accordance with factory recommendations. In addition, the following manufacturer's handbooks are provided with each unit equipped with an automatic transmission. The bulletin and handbooks shall be considered as standard operating policy of this agency.

DRIVING TIPS with an Allison Fully Automatic Transmission
(SA 1214 20M 1066)

THE CARE AND HANDLING OF AN ALLISON FULLY AUTOMATIC TRANSMISSION
(SA 1215 10M 1066)

GENERAL DESCRIPTION

TORQUE CONVERTER:

Just what is a torque converter? First, a torque converter is not to be confused with a fluid coupling such as we found in use on Chrysler automobiles a number of years ago. It produced no advantage performance-wise since it did nothing more than take the place of a dry disc clutch. In fact, due to slippage, some power and performance loss was evident. A torque converter in truck transmissions does three things:

1. It acts as a hydraulic torque multiplier. In our fire engines, for example, where we use an engine delivering 480 lbs. feet of gross torque and a torque converter with a multiplication of 2.5:1, we are able to realize a gross torque output of 2.5 X 480 or 1200 lbs. feet. In addition, it provides an infinitely variable number of torque ratios and speeds. Combined with gearing, it gives perfect engine speed control over the operating range. This enables it to provide high "breakaway" torque ratios to get a load underway smoothly and quickly. Most important, it permits the engine to deliver peak performance free from lugging and stalling. At vehicle stall, such as starting on steep grades, it provides maximum torque at 0 miles per hour.
2. It provides an automatic converter lockup for direct mechanical drive from the engine through the transmission to the driving wheels. Thus, when we are traveling at a predetermined speed, there is no slippage through the converter and we are driving direct the same as with a dry disc clutch fully engaged.
3. The converter automatically operates as a fluid coupling for a brief interval of every gear change. Thus, shock loads are cushioned and absorbed by hydraulic fluid instead of driveline members.

AUTOMATIC TRANSMISSION:

The unit is basically a planetary three-speed transmission with a two-speed planetary high-low range, giving six forward speeds. This is exactly the same combination we would have using a three-speed transmission and a two-speed axle. The combination of the constant mesh planetary gear train and the torque converter eliminates the need for an engine disconnect clutch. With the fully automatic transmission, the engine is never disconnected from the load in any drive range. The planetary gear train, being in constant mesh, provides shockless, full torque shifts. We many times refer to this as a power shift transmission; that is, the transmission is shifted from one gear to another while delivering full power to the drive train. The holding members of the planetary system are held by hydraulic-actuated disc clutches which are oil cooled. No adjustment is needed.

HYDRAULIC RETARDER:

The hydraulic retarder is a most simple device, and has only one moving part -- a rotor or "paddle wheel." The truck wheels turn the rotor through the transmission. The rotor throws the oil in the rotor cavity against the fixed stator vanes, which resist the oil flow. This makes it harder for the rotor to turn and correspondingly makes it harder for the truck wheels to turn, thus slowing the vehicle. The oil does all the "braking" work, absorbing the heat generated by the braking action. The oil is circulated to the heat exchanger. When retarder action is not called for, the valve is closed, the oil is evacuated from the cavity, and there is no power absorption in the retarder. Bear in mind the hydraulic retarder is what the name implies -- a retarder, and will not bring the vehicle to a complete stop, but only retard its forward motion. Since the capacity of the retarder or its retarding action is directly related to its RPM, it will be most effective at higher engine and vehicle speeds.

SELECTOR QUADRANT:

All selector quadrants will have the following ranges: R (reverse), N (neutral), 3-6, 3-5, 3-4, and 1-2. Various vehicle manufacturers may choose to reverse the order in which they appear; that is, R on top and 1-2 bottom, or vice versa; or they may use slightly different terminology. Nevertheless, all ranges will appear on all makes of vehicles. These various ranges are available to allow the operator some control over the automatic transmission under varying operating conditions. For example, when traveling on truck trails or roads with varying grades and alternate curves and straight sections which requires the operator to alternately accelerate and decelerate, the transmission would constantly be upshifting or downshifting. By selecting the range, which will give the desired road speed, the transmission will no longer be upshifting or downshifting and maximum vehicle performance will be realized. Vehicle speed at governed engine RPM will be approximately 15 mph in 1-2 range, 28 mph in 3-4 range, 40 mph in 3-5 range and 70 mph in 3-6 range.

POWER TAKEOFF:

A power takeoff may be mounted on either or both sides of the transmission. It is converter driven and loads can be smoothly started, inched, held, raised or lowered by throttle action along. The power takeoff on OES fire engines is mounted on the right side of the transmission and is used to drive the auxiliary pump (Gorman-Rupp Centrifugal Single-Stage). See special instructions regarding use of this pump.

TRANSMISSION - BRAKE:

An electrically controlled friction brake applied to the driveline to slow transmission for PTO operation. (See power takeoff operating instructions.)

PUMP - MIDSHIP:

A 1000 GPM centrifugal pump has been installed midship in the main driveline, powered by vehicle engine and transmission.

OPERATION

TRANSMISSION:

1. Place selector in neutral before starting engine. a safety switch renders the starter inoperative in all ranges except neutral.
2. With the ignition key in the start position the red warning light on the dash and pump panel should light. This is merely a check on the operation of the light.
3. Place selector in the range, which will give the desired road speed and engine RPM. Refer to paragraph entitled SELECTOR QUADRANT. It is neither necessary nor desirable to start the vehicle in a lower range and then manually upshift the transmission. The Allison transmission automatically shifts in sequence, both up and down, through all gears in the range selection; i.e., 1-2 range, start in 1st shift to 2nd; 3-4 range, start in 3rd shift to 4th; 3-5 range, start in 3rd shift to 4th and 5th; 3-6 range, start in 3rd shift to 4th, 5th and 6th.

Examples of range selecting may be as follows: Off road or truck trails - use 1-2 or 3-4 range; mountainous highways or suburban traffic up to 45 mph - use 3-4 or 3-5 range; normal highway driving (where maximum speeds can be attained) - use 3-6 range. Hence, nothing can be gained by manually shifting in an attempt to compensate for slight changes in driving conditions. As with any automatic transmission, smoothest upshifts are accomplished by steady accelerator pedal pressure.

The driver can override the automatic controls to a certain extent by pushing the accelerator pedal past the full throttle detent. This action raises the engine speed at which upshifts or downshifts occur. It prevents upshifts entirely by raising the upshift point above the governed speed of the engine. Also, it causes the gearbox to downshift at higher engine speeds -- very much like the "kickdown" on a passenger car automatic transmission for more efficient passing or hill climbing performance. Once familiar with this feature, the driver will use it to "hold" a gear in anticipation of road conditions ahead, which the automatic controls, of course, cannot see. The transmission thus can be locked in any gear except 1st gear in the through detent throttle position.

4. The hydraulic retarder can be used in any of the drive ranges. As stated previously, the oil absorbs heat, during retarder action. Should oil temperature in the transmission rise above 3750 F, the red warning light on the dash and pump panel will come on. Discontinue use of the retarder until the red light goes off.

Since the retarder is only effective at higher engine and vehicle speeds and the effectiveness drops rapidly with engine RPM decrease, it is recommended the retarder not be used when engine RPM has dropped to approximately 2200 RPM. Continued use below this RPM will do no more than generate heat. Thus, for effective retarder action, keep engine speed as close to governed RPM as possible by selecting the range, which will accomplish this without over-speeding the engine above governed RPM.

POWER TAKEOFF:

1. To engage or disengage a side-mounted PTO:
 - a. Stop vehicle, idle the engine and set the brakes.
 - b. Make sure the selector lever is in anyone of the drive ranges.
 - c. Depress transmission brake button (on dash).

Caution: Because the PTO is converter driven, the PTO gear will always be revolving whenever the engine is running with the selector lever in Neutral (N). The gear can be stopped for engagement or disengagement only when you are in a drive range with the engine at idle.

- d. Engage or disengage the PTO.
- e. If the PTO operation is stationary (no vehicle movement), shift to Neutral (N).
- f. If the vehicle is moving, shift to the desired position on the selector lever for normal requirements.

PUMP - MIDSHIP:

To engage pump place transmission selector in neutral position. Depress transmission brake button, shift pump lever to pump position. Place transmission selector in 3-6 position, lock in place with hinged locking device.

To disengage pump place transmission selector in neutral position. Depress transmission brake button, shift pump lever to road position.

DRIVER DO'S AND DON'TS

DO NOT: Do not at any time place transmission selector in reverse position with either pump in gear.

DO NOT: Do not manually downshift at speeds greater than:

3-5 -- 40 mph 3-4 -- 28 mph 1-2 -- 15 mph

If manual downshifts are made at speeds above those listed, severe damage can be done to the engine, the transmission or the vehicle drive train.

- DO NOT:** Do not manually shift transmission while the hydraulic retarder is in operation.
- DO NOT:** Do not shift PTO when transmission is in neutral.
- DO NOT:** Do not tamper with engine governor settings. Improperly adjusted governor will adversely affect transmission operation.
- DO NOT:** Do not tow or push vehicle without first removing drive line.
- DO NOT:** Do not attempt to push start vehicle. It is not possible to start an Allison-equipped vehicle by pushing.
- DO:** Do shift from neutral to drive range with engine at idle speed. Engine idle speed should not be set in excess of 700 RPM.
- DO:** Do stop vehicle before shifting from forward to reverse, reverse to forward.
- DO:** If red warning light comes on:
1. If using retarder, release retarder.
 2. If not using retarder, stop truck and determine cause of oil overheating condition.

MAINTENANCE

With exception of those items listed below, all problems, adjustments and repairs should be referred to an authorized Allison transmission service shop. This includes oil and oil filter changes. It should be noted there are relatively few authorized shops, and these may be limited to larger cities.

The following maintenance items may be performed by assignee or outside shops:

1. Check oil level and add oil if needed. Procedure for checking oil level is as follows:
 - a. Transmission at operating temperature.
 - b. Selector in neutral (N).
 - c. Engine must be at idle (approximately 450 RPM).
 - d. Allow minimum period of 10 minutes after using retarder before checking oil level.
 - e. Add Type C2 or Dextron automatic transmission fluid only. Do not overfill.

Be very careful that dirt or dust is not allowed to enter the transmission either through the dip stick filler opening or by using contaminated containers, funnels, etc. We strongly suggest that oil be stocked in one quart cans only; and even though only a portion of the one quart is needed, the balance be discarded to preclude adding contaminated oil at a later date. For all practical purposes, experience will show that we need not add oil in smaller quantities than one quart.

All dip sticks have a bayonet-type cap. Be sure bayonet is locked in place after checking oil level or slopover may occur. Some slopover may occur from the dip stick cap after use of the retarder.

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This is due to the fact that the oil has been temporarily aerated. This slopover will be at a minimum, however, if the bayonet cap is properly installed.

Again we repeat, DO NOT attempt to make adjustments to the linkage, engine governor or change oil or oil filter elements. Refer all problems to authorized Allison service shops.

With a little experience and driving practice, we are sure you will find a truck equipped with an Allison torque converter and automatic transmission will give performance superior to any engine or transmission combination we have used in the past.

SUPPLEMENT 1
POWER TAKEOFF LUBRICATION
OES Engines Beginning with OES-132

A Spicer Model PG6-12 power takeoff is used in conjunction with the Allison MT -42 automatic transmission.

Inasmuch as the transmission and the power takeoff are wide open to each other, the power takeoff is designed to be lubricated with automatic transmission fluid (see pages 4 and 5).

Oil level in power takeoff is determined by oil level in the automatic transmission. It is not necessary to check or fill the power takeoff separately.

**SUPPLEMENT NO.2
OIL LEVEL (May, 1972)
OES Engines Beginning with OES-132**

Fire apparatus beginning with OES-132 are equipped with Allison torque converter and automatic transmission - MT series.

We have had several complaints from the field of the automatic transmission fluid turning dark brown and smelling scorched, indicating overheating of the transmission. A

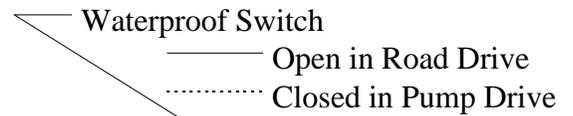
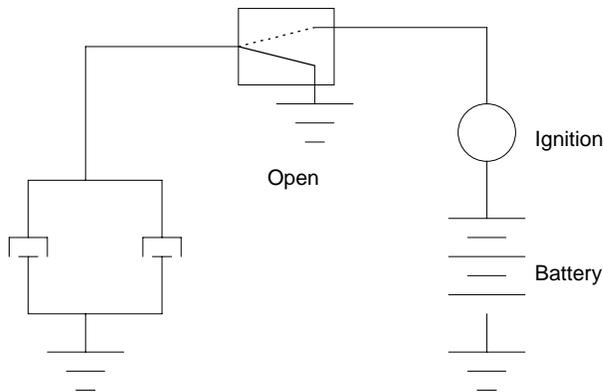
fter investigation we found that some engines have been equipped with the wrong dip stick, allowing the operator to assume the transmission was full when in reality it might be as much as three quarts low, thereby creating poor performance. Or, if the oil level is too high, overheating can occur and again create poor performance from the transmission.

All assignees of OES fire engines beginning with 132 should refer immediately to International Service Letter No. SLM68-9, dated 2/29/68, *Oil Level Checking Procedures Changes for MT Series Allison Transmission*, and take appropriate corrective measures if required.

**Supplement 3
OES Fire Apparatus 132 Through 165**

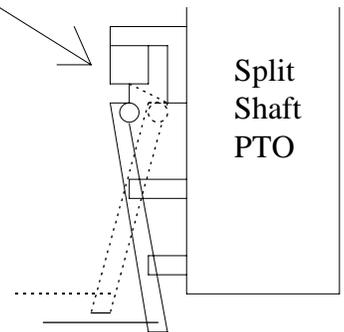
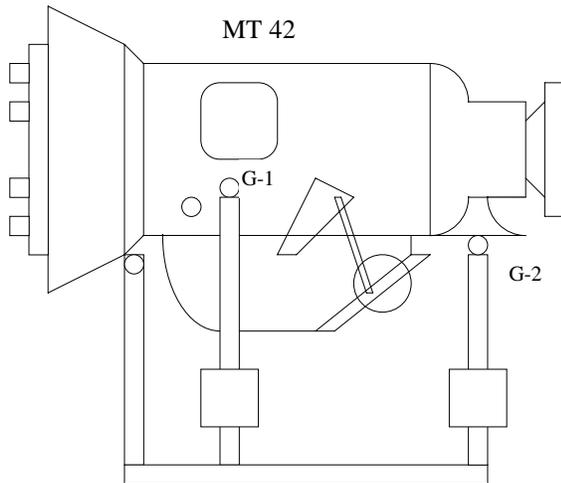
When using the midship pump, the pump transmission is driven with the Allison automatic transmission. The shift lever is in the 3-6 position. To prevent the automatic transmission from shifting while in pump gear, solenoid valves and a waterproof switch are used to lock the Allison direct to 6th gear, which is used for midship pumping.

The purpose of this bulletin is to provide qualified fire equipment maintenance personnel with a functional schematic of the system and solenoid valve numbers should a failure occur in the lockout system . Waterproof Switch



FUNCTIONAL
SCHEMATIC
ONLY

MT 42



**SUPPLEMENT 4
OES Engines Beginning with OES-166**

All fire apparatus beginning with unit number 166 are equipped with Allison MT650 (5-speed) automatic transmissions. When using the mid ship pump, the pump transmission is driven with the Allison automatic transmission. After the pump transmission is engaged, the automatic transmission shift lever is placed in the 2-5 position on the range selector. To prevent the automatic transmissions from shifting while in pump gear, a solenoid valve and a waterproof switch is used to lock the Allison direct to 5th gear, which is used for midshlp pumping.

The purpose of this bulletin is to provide qualified fire equipment maintenance personnel with a functional schematic of the system should a failure occur in the lockout system.

Departments assigned OES engines beginning with 166 are provided with Allison Automatic Transmission Driver's Handbook and MT600 Series Service Manual. Maintenance personnel should be familiar with both publications.

FUNCTIONAL SCHEMATIC ONLY - MT850

