



Service Bulletin No. 1050

MODEL	: T900 Series ; T2100 Series
TYPE	: Service information
MANUAL & SECTION	: Operator's Guide Book : Section 2 - Operating Instructions (emergency conditions) Maintenance Manual : Chapter 2 - Cooling system
DATE	: August 31 st , 2000
SUBJECT	: Cooling fan clutch mechanical locking device
CONDITIONS	: Service information only. Note that no claims will be accepted with reference to this Bulletin.

DESCRIPTION:

The purpose of this Bulletin is to warn operators and service technicians against the prolonged use of the cooling fan clutch lockup bolting feature, which may result in fan clutch damage. Although the T900 and T2100 Series cooling system has ample cooling capacity, engine overheating remains possible. The causes can be many and should be considered also before suspecting the clutch from being faulty and locking it up to improve cooling. To check the fan clutch operation and troubleshoot its wiring, refer to the service procedures further in this Bulletin.

SERVICE PROCEDURE:

CAUTION
OBSERVE SAFE SHOP PRACTICES AT ALL TIMES. READ ENTIRE PROCEDURE BEFORE BEGINNING TO WORK.

Service procedure continued on next page.

Service Bulletins are issued to supplement or supersede information in the Van Hool manuals. Note Service Bulletin number, date and subject on the register at the end of the relevant chapter(s). File Service Bulletin separately for future reference.

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1. Overheating :

Overheating may be brought about by :

- An internally clogged radiator, due to the use of an incorrect coolant mixture.
- A low coolant level, due to external or internal leakage.
- Air trapped in the cooling system.
- Slipping fan drive belts.
- Charge air cooler fins and radiator fins being obstructed with debris, insects, dirt...
- An obstructed radiator compartment door wire-mesh screen.
- A low engine oil level^(*).
- Faulty thermostats.
- A faulty water pump.
- Collapsed coolant hoses.
- A faulty coolant sensor.
- A faulty coolant temperature indicator.
- A leaking cylinder head gasket.
- Clogged engine and transmission oil coolers.
- An incorrect or malfunctioning radiator cap (cap rated pressure too low).
- A damaged or missing cooling fan shroud.
- Damaged or missing fan blades.
- Missing radiator sealing strips.
- Overconcentration of antifreeze and/or supplemental coolant additives.
- A faulty temperature controlled fan (fan clutch, wiring, or switch).
- Improper fuel combustion.
- A faulty retarder protection device (retarder capacity not reduced at high coolant temperatures).

(*) Not applicable to engines with electronic fuel management system.

These deficiencies should be corrected first : emergency locking the fan clutch will only temporarily postpone possible damage to the engine and its accessories.

2. To check fan clutch operation :

NOTE
<i>This check is not applicable to coaches equipped with a Cummins ISM engine featuring a CM570 type Electronic Control Module and #3681405 software (Engine Serial Number 34969616 on).</i>

1. Shut down the engine. Leave the master switch and the ignition "ON".
2. Open the engine compartment door. Check that the starter cut-out switch (see 2, Figure 1) on the control box (see Figure 2) is in the "disabled" position.

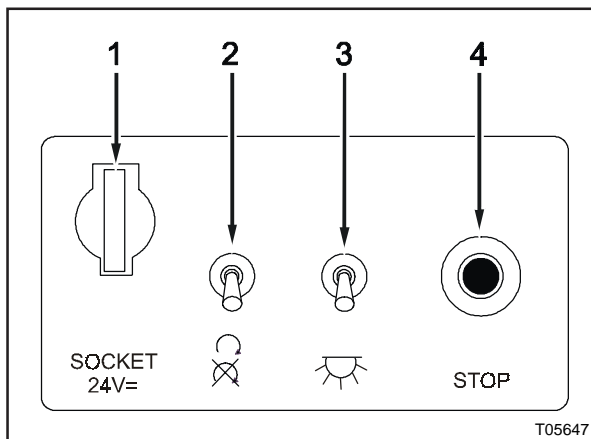


Figure 1 : Control box switches :

1. Socket for 24 volt utility light
2. Starter cut-out switch (in starter disabled position)
3. Engine compartment light switch
4. Engine shut down button

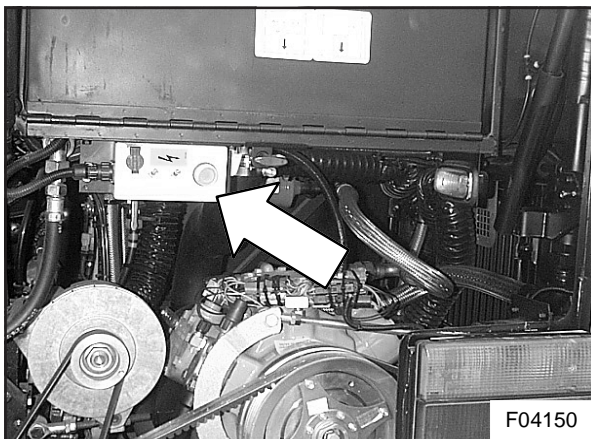


Figure 2 : Location of control box in engine compartment

3. Push and hold down the engine shut down button (see 4, Figure 1) for about 5 seconds. When the fan clutch works properly, a clicking sound must be heard, mechanical lock-up should occur, and it should take a considerable effort to turn the fan blades by hand.

NOTE

An alternative method to make sure the fan clutch operates properly is to connect an 8 Amp fused 24 V DC source directly to the clutch terminals.

3. To check Van Hool fan clutch wiring :

NOTE

Actual clutch failures are unusual. Control and supply circuit problems are more likely.

a. General :

1. Loose or corroded terminals ; frayed, bare or broken wires ; and cracked, oil soaked or porous insulation are frequent causes of malfunctioning equipment. Before troubleshooting a problem, check wires, fuses and connections. Remember that wires can separate internally with no break in the insulation. A terminal may be tight and still be corroded. Also check the condition of the batteries. Make sure the charging system is operating properly.

2. Check the warning indicator lights on the instrument panel for messages. Refer to the Operator's Guide Book for detailed information.
3. Question the fault storing feature of the engine computer memory by pressing the diagnostic request switch(es) on the instrument panel to determine if :
 - the engine coolant and/or manifold air temperature sensors work properly (Cummins) ;
 - the engine coolant and/or manifold air temperature sensors function as they should (Detroit Diesel).

Section 2 of the Operator's Guide Book explains the diagnostic procedure in detail.

NOTE
<i>Technicians may use diagnostic tools to check stored fault codes.</i>

Sensor fault codes are :

Cummins : FC 144 : Engine coolant temperature-voltage above normal or shorted high
 FC 145 : Engine coolant temperature-voltage below normal or shorted low
 FC 153 : Intake manifold air temperature-voltage above normal or shorted high
 FC 154 : Intake manifold air temperature-voltage below normal or shorted low.

Detroit Diesel : FC 14 : Oil or coolant temperature sensor input voltage high
 FC 15 : Oil or coolant temperature sensor input voltage low
 FC 27 : Air inlet or intake air, temperature sensor input voltage high
 FC 28 : Air inlet or intake air, temperature sensor input voltage low.

4. If the engine computer reveals one or more sensor related defaults, go to a Cummins/Detroit Diesel Service Center to have the problem taken care of.

b. T-900 and T2100 Series Quick Check :

NOTE
<i>This check should be performed by an experienced automotive electrician.</i>

If no sensor or engine wiring fault codes are registered, the fan clutch and/or its wiring may be faulty. Proceed as follows :

1. Check that the batteries are fully charged. Recharge, if necessary.
2. Turn master switch and ignition "on".
3. On T900 coaches check manual reset circuit breaker no. Z024 in the front junction box. On T2100 units check manual reset circuit breaker no. Z060 in the main junction box. If necessary, reset. If resetting is impossible, refer to "c. T-900 and T2100 Series Comprehensive Check".

CAUTION

**CONNECTING RELAY HOLDER TERMINALS, OTHER THAN THE
ONES INDICATED BELOW, WILL DAMAGE THE ENGINE ECU.**

4. On T900 coaches remove relay no. RL909 from the rear junction box. On T2100 units remove relay no. RL505 from the main junction box. Install a jumper wire between terminals no. 30 and no. 87a of the relay holder (see Figure 3).

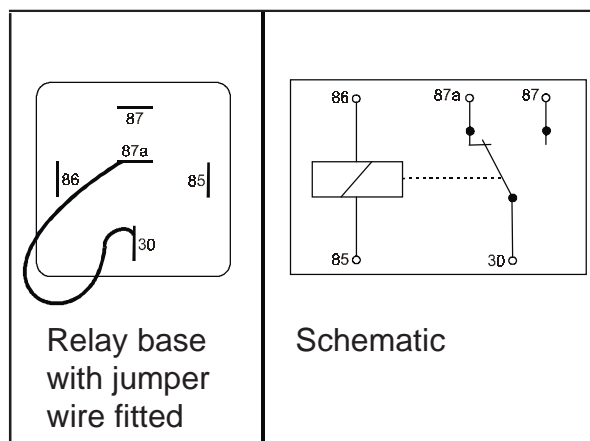


Figure 3 : Base and schematic of relay no. RL909/RL505

5. Check fan clutch operation. If the clutch works, relay no. RL909/RL505 needs replacing. If the clutch does not work, go to item 6 or 7.

NOTE

On coaches equipped with Cummins engine and B500R, relay no. RL909/RL505 is replaced by coolant temperature switch (K512). To check whether this switch is operating properly, disconnect the plug in the engine compartment (see Figure 4) and install a jumper wire between its terminals. If the fan clutch does operate with the jumper wire installed, and does not work with the switch connected, the switch is faulty and needs to be replaced. If the fan clutch does not work with the jumper wire in place, go to item 6 or 7.

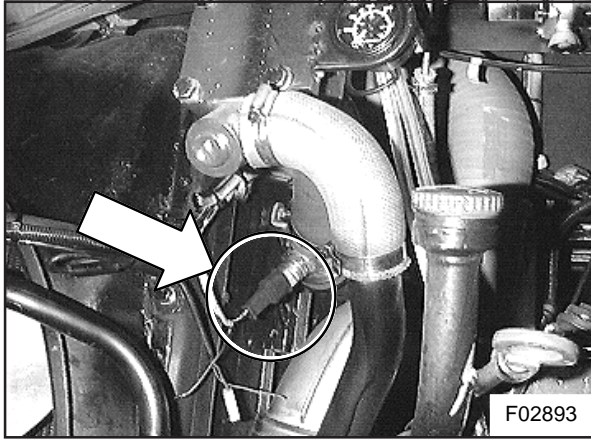


Figure 4 : Coolant temperature switch on coaches with Cummins engine and retarder (B500R)

6. On coaches equipped with the early style fan clutch (see Figure 5), cut loose the fan clutch connector, which is tied to the radiator shroud (see Figure 6).

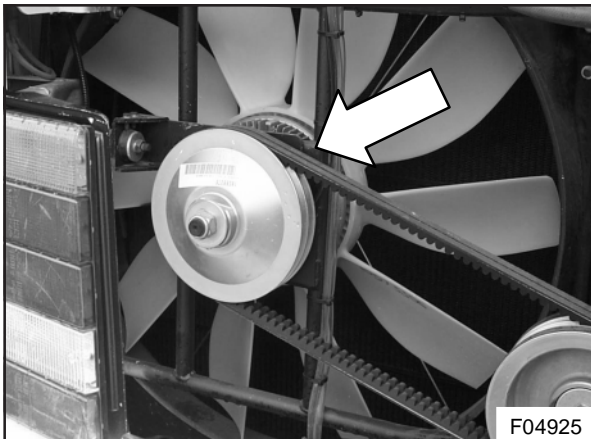


Figure 5 : Early style fan clutch as found on T900 and T2100 coaches

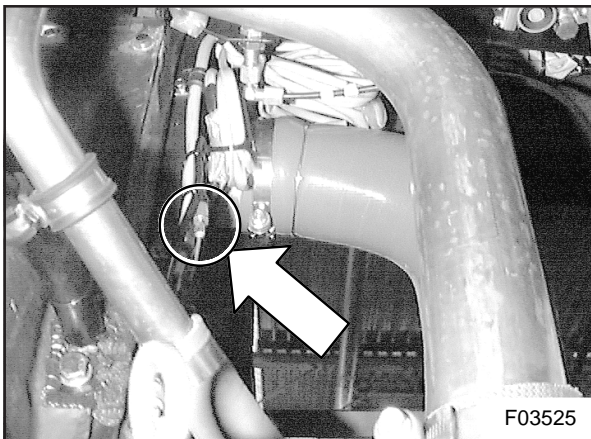


Figure 6 : Location of fan clutch connector

Separate the two connector halves. One half holds a brown and yellow wire. With a multimeter check whether 24 V is present between the terminals of these wires. If no voltage can be measured, go to "c. T900 and T2100 comprehensive check".

To check the service life of the clutch refer to item 6 of the procedures in this Bulletin.

7. On coaches equipped with the latest clutch type (see Figure 7), remove the clutch connector at the fan clutch (see Figure 8).

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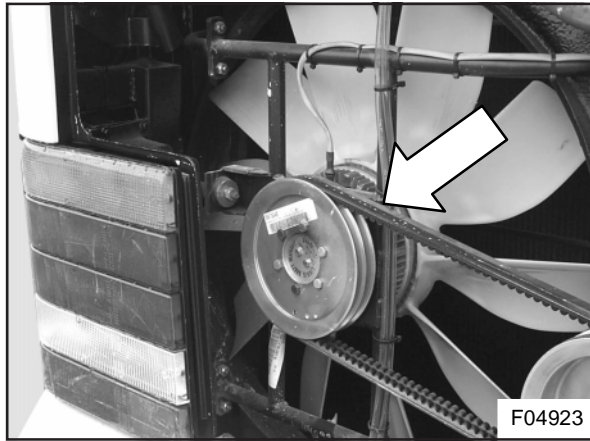


Figure 7 : Latest clutch type (on T2100 coaches only)

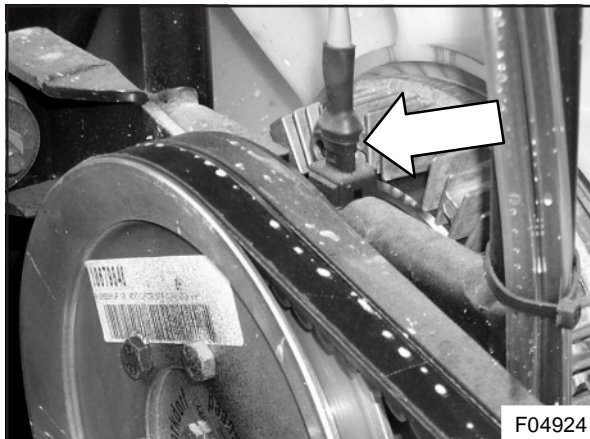


Figure 8 : Location of fan clutch connector

With a multimeter check that 24 V is present between the two terminals of this connector. If no voltage can be measured, go to "c. T900 and T2100 comprehensive check".

To check the service life of the clutch refer to item 6 of the procedures in this Bulletin.

c. T900 and T2100 Series Comprehensive Check :

NOTE

This check should be performed by an experienced automotive electrician.

When checking the wiring harness for this application, always refer to Section 19D of the Electrical Wiring Diagram Booklet that accompanies the coach.

Shortened or interrupted wires can be substituted by transparent spare wires provided in the junction boxes.

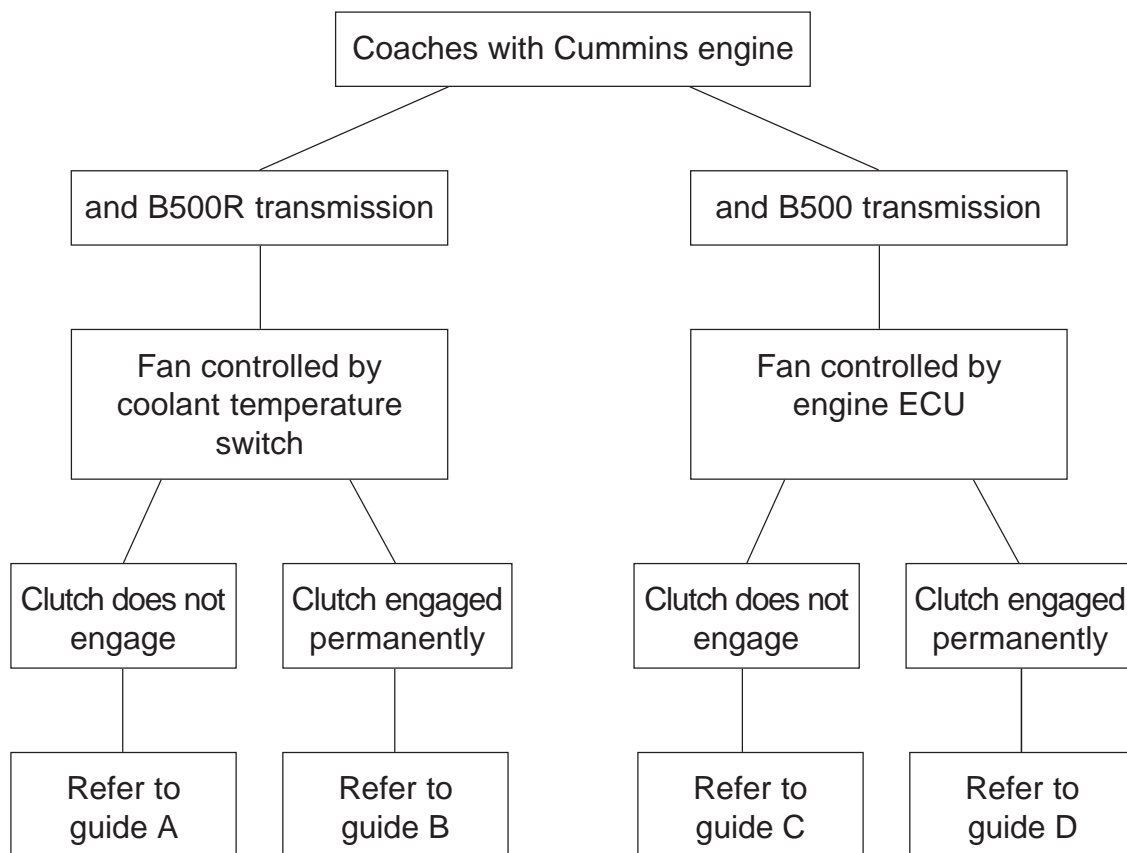
Check the wiring using a suitable multimeter.

ECM output wire no. 034 provides 24 V at low temperature (Cummins). ECM output wire no. 499 provides 0 V at low temperature (Detroit Diesel).

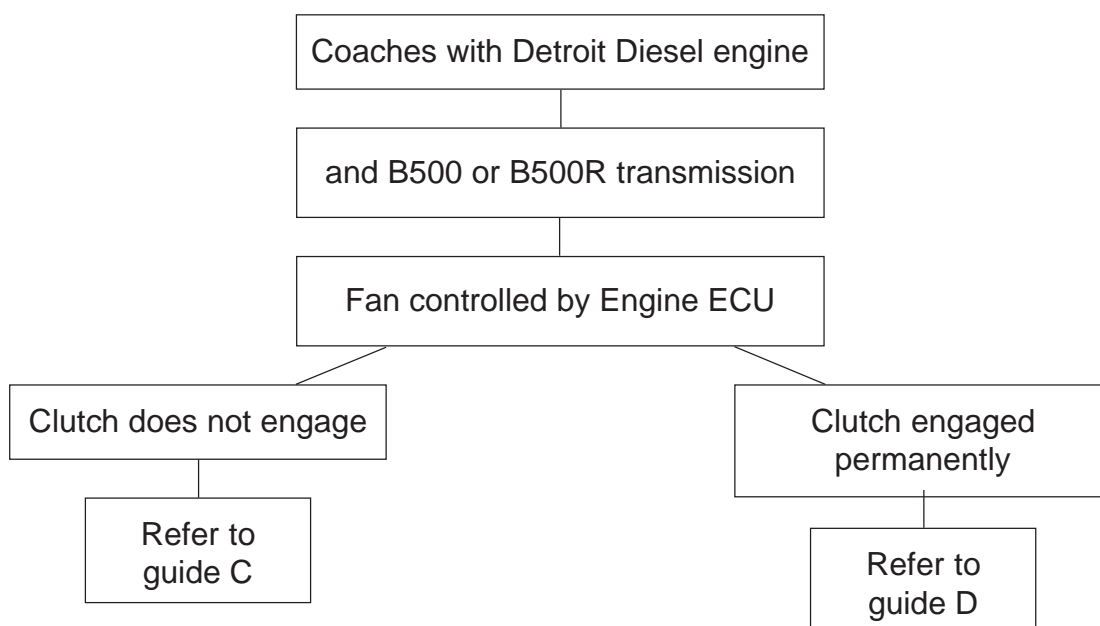
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Mentioned below are the guides that will help troubleshooting the cooling fan wiring on T900 and T2100 coaches.

Guide 1 :

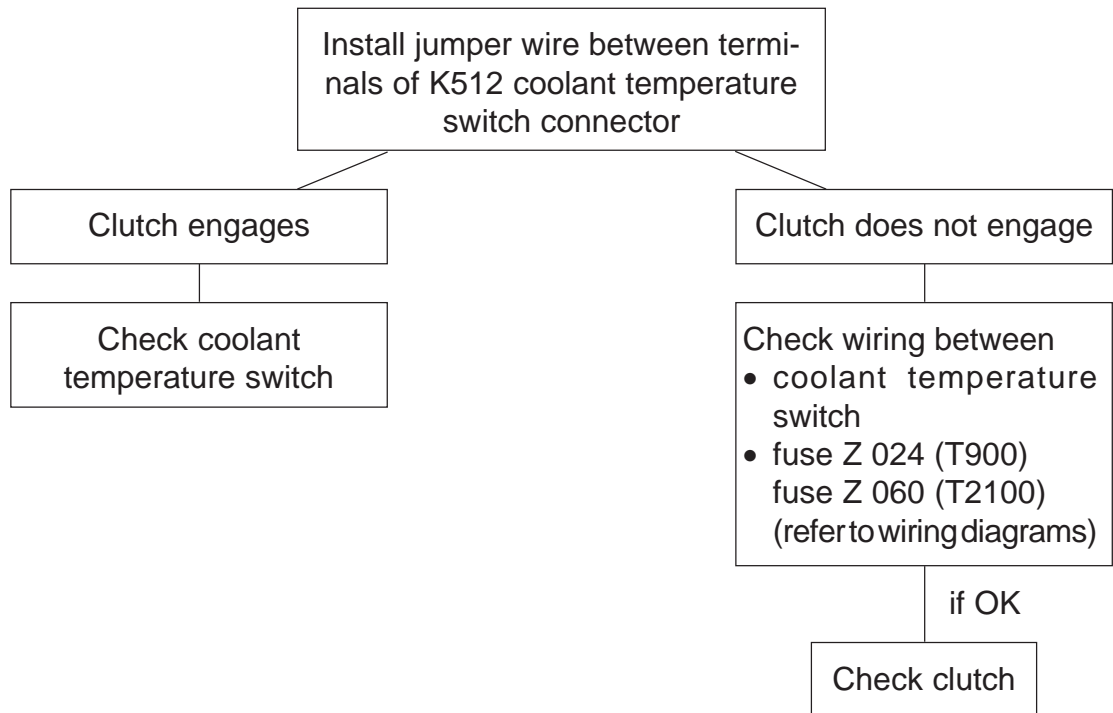


Guide 2 :

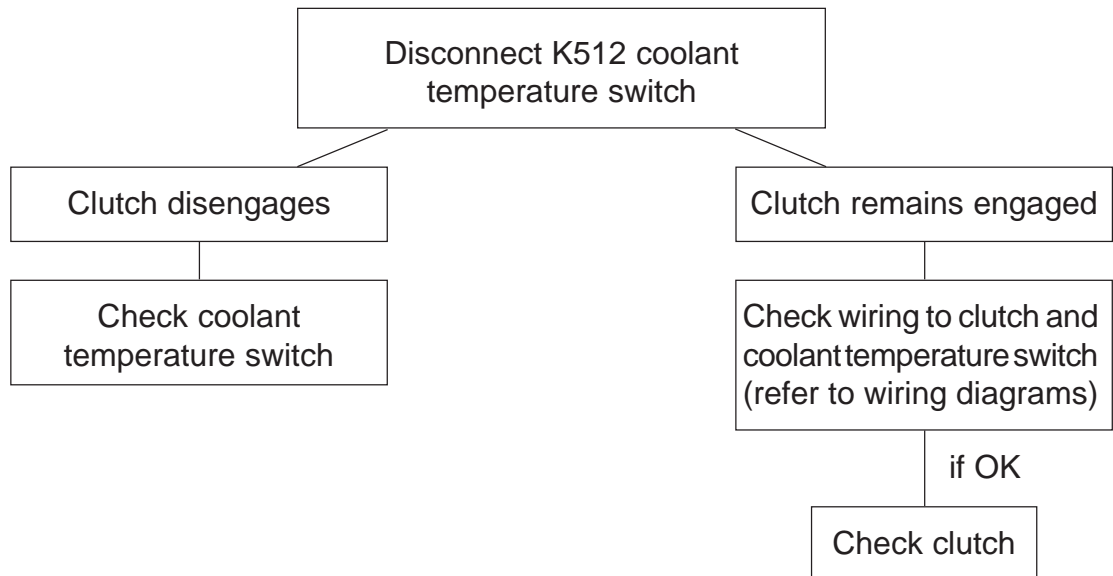


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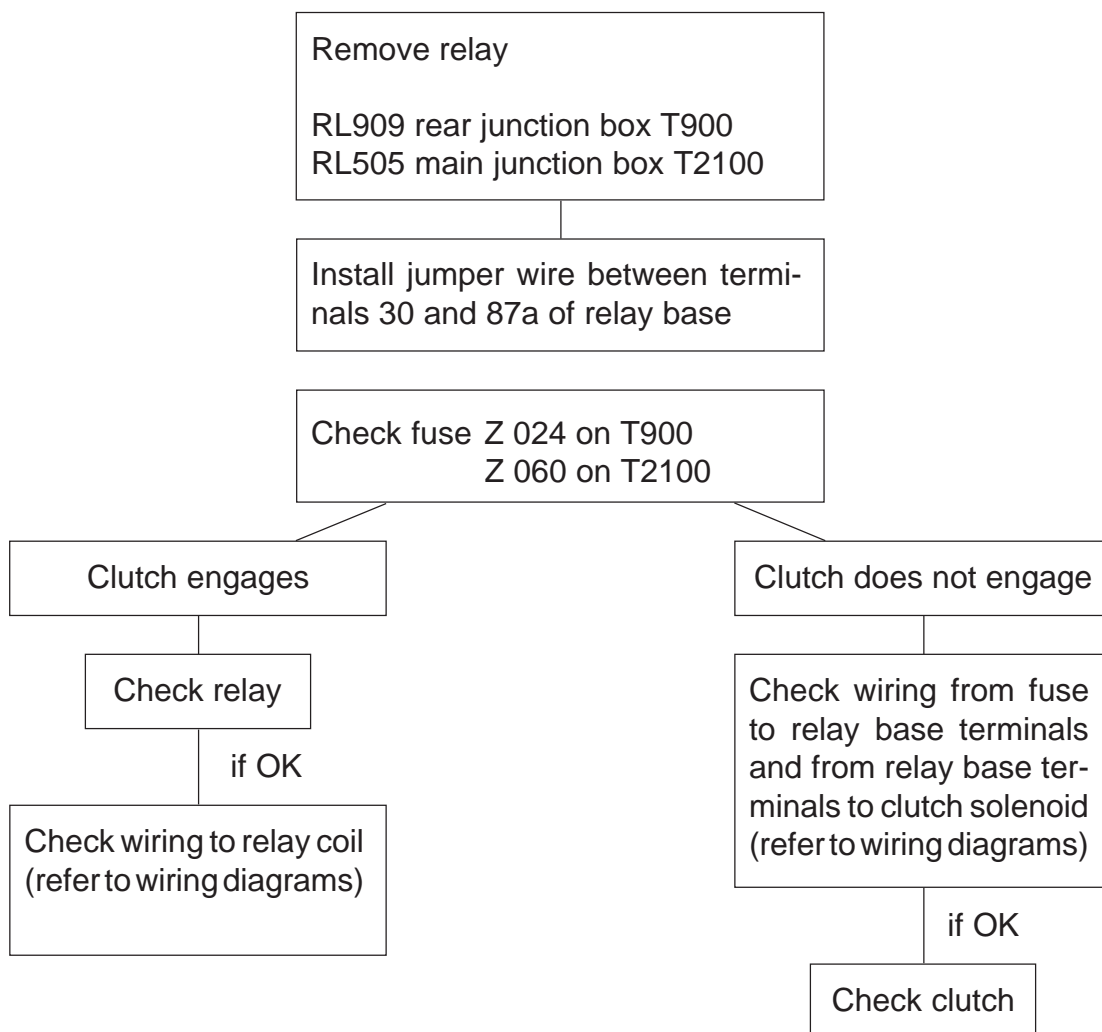
Guide A :



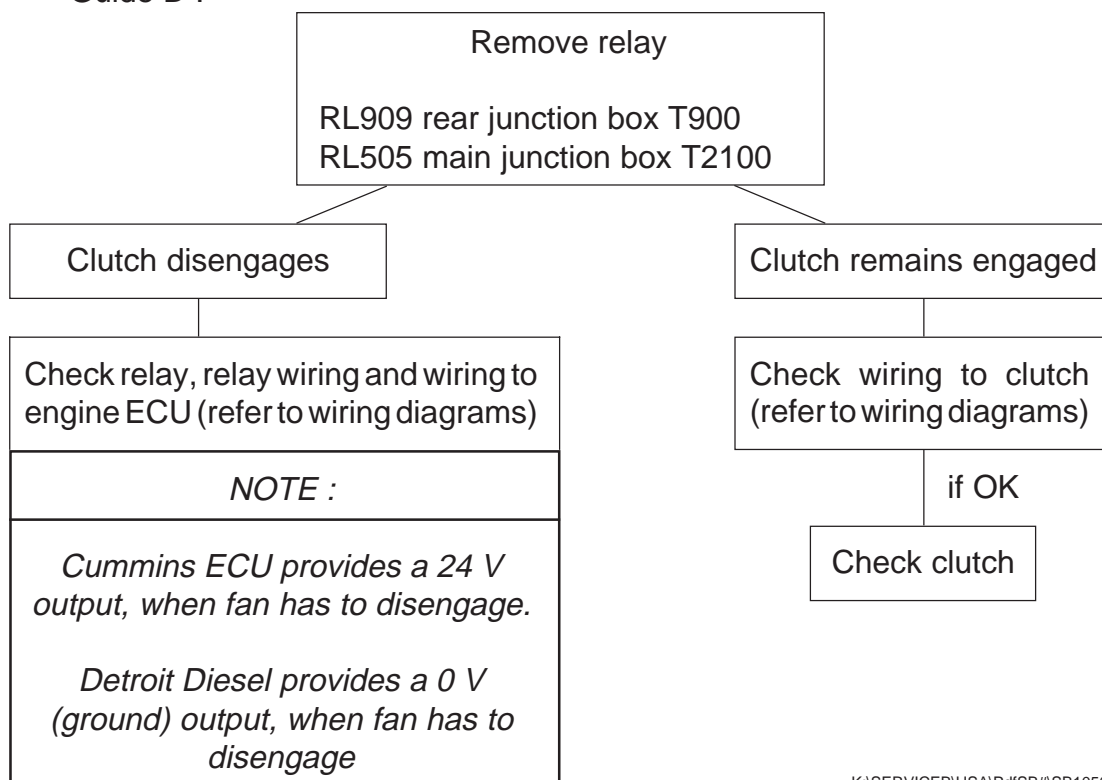
Guide B :



Guide C :



Guide D :



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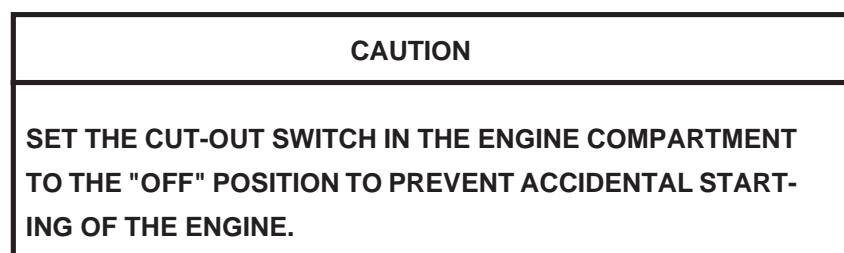
e. Quick fix for faulty fan clutch wiring :

1. Turn the battery master switch off.
2. On T900 coaches locate relay no. RL909 in the rear junction box. On T2100 units locate RL505 in the main junction box. Remove both the relay and the relay holder and cut-off all existing wires connected to them. Tape off the ground and +15 wire.
3. Install a new relay and relay holder at the same spot where the old ones used to be.
4. Referring to wiring diagram 19D, connect the wire coming straight from the engine ECU to the # 86 terminal of the new relay.
5. Connect terminal # 85 of the new relay with

ignition (+24 V) on coaches with Detroit Diesel engine ;
ground on coaches with Cummins engine.
6. Referring to wiring diagram 19D, connect the wire coming straight from the fan clutch solenoid to the # 87a terminal of the new relay.
7. Connect new terminal # 30 of the relay with : ignition (+ 24 V).

4. To lock early fan clutch type :

In the case of an electrical power or fan clutch failure, the fan clutch can be mechanically locked as follows :



1. Set the starter override switch in the engine compartment to the disabled position to prevent accidental starting of the engine (see 2-Figure 1).
2. Undo and remove the locking screws (wrench size : 10 mm) from the fan clutch support bracket (see Figure 9 for location of screws).

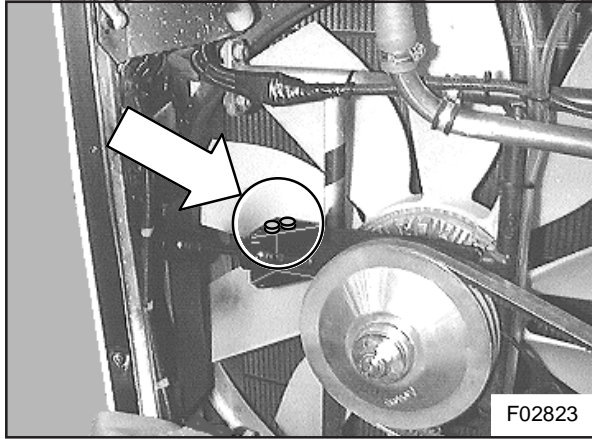


Figure 9 : Fan clutch lockup screws

3. Turn the fan by hand, until the holes of the catch plates (1, Figure 9) match the threaded holes (2, Figure 10). Slip the locking screws through the holes in the catch plates and screw into the threaded holes. Tightening torque : 7 ft.lbf.

CAUTION

THIS IS ONLY A ROADSIDE FIX. THE VEHICLE SHOULD BE SERVICED AT THE EARLIEST OPPORTUNITY.

KEEP CLUTCH LOCKED FOR 100 MILES MAXIMUM. EXTENDED USE MAY RESULT IN CLUTCH DAMAGE.

MECHANICAL LOCKING DEVICE MAY NOT BE USED TO AID COOLING. USE ONLY, WHEN CLUTCH IS SUSPECTED FAULTY.

ALWAYS USE AND FULLY TIGHTEN BOTH RETAINING BOLTS TO LOCK THE CLUTCH TO AVOID BREAKING OF THE CATCH PLATES.

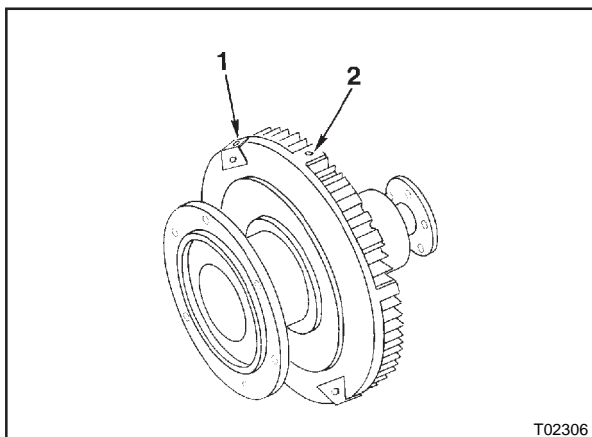


Figure 10 : Fan clutch with locking device

1. Catch plate
2. Threaded hole

5. To lock latest fan clutch type :

In the case of an electrical power or fan clutch failure the fan clutch can be mechanically locked as follows :

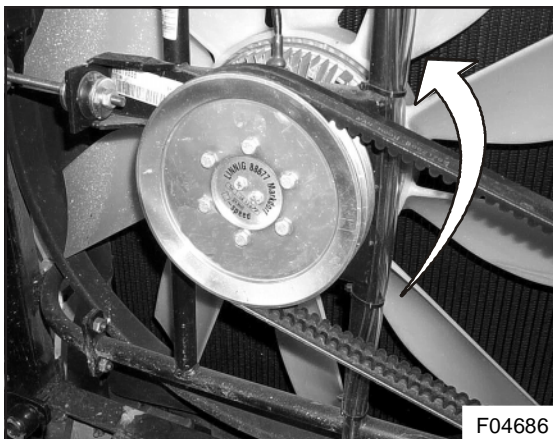
CAUTION

SET THE STARTER CUT-OUT SWITCH IN THE ENGINE COMPARTMENT TO THE "OFF" POSITION TO PREVENT ACCIDENTAL STARTING OF THE ENGINE.

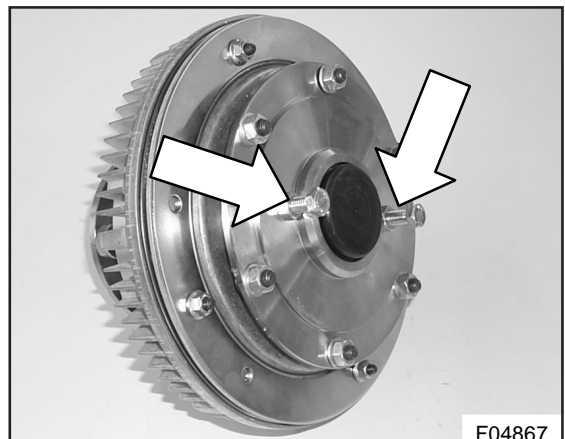
1. Set the starter cut-out switch in the engine compartment to the disabled position to prevent accidental starting of the engine.
2. Loosen the lock nuts of the two screws (wrench size : 13 mm) located at the front of the fan clutch (see Figures 11A and 11B).
3. Tighten both screws, until the fan cannot be turned by hand anymore (tightening torque screws : 18 ft.lbf).
4. Retighten the lock nuts.

CAUTION

**THIS IS ONLY A TEMPORARY REPAIR.
ALWAYS TIGHTEN BOTH LOCKING SCREWS.**



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Figures 11A and 11B : location of screws to mechanically lock the fan clutch

6. To check fan clutch service life (optional) :

a. Principle of operation :

The T900/T2100 two-stage fan clutch consists of a shaft with at one end a drive pulley, and in the middle a thrust assembly containing a copper ring. Both are firmly fixed to the shaft. At the other end of the shaft, next to the thrust assembly is a hub carrying the cooling fan. The hub can rotate freely on the shaft. The hub flange facing the thrust assembly contains permanent magnets

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and a flexing clutch plate. On the other side, between the thrust assembly and the drive pulley, the shaft rotates in a carrier containing an electromagnet. The carrier is fitted permanently to the cooling fan spider. When coolant temperatures are low and the engine is running, the permanent magnets of the fan hub create an eddy current in the copper ring of the rotating thrust assembly, forcing the fan to rotate with it (stage 1, 50 % engaged). It is important to know that at this stage the fan speed never equals the speed of the drive pulley.

When full fan speed is required due to high coolant temperatures, the electromagnet in the carrier cuts in and pulls the flexing clutch plate of the fan hub against the thrust assembly (stage 2). At this stage, the fan speed equals the speed of the drive pulley.

b. Test equipment :

To test the service life of the fan clutch, a DC adjustable electric power supply, with a voltage range of 10 to 30 V, and an amp rating of at least 3A, is required (see Figure 12).



Figure 12 : DC adjustable electric power supply (typical)

c. Test procedure :

The remaining service life of the fan clutch can be determined by measuring the voltage it takes to engage the clutch. The higher the voltage required to operate the clutch, the larger the air gap is between the flexing plate and the thrust assembly, hence the more the clutch is worn.

NOTE

It is not necessary to remove the fan clutch from the coach to perform this test.

Connect the fan clutch to the adjustable power supply. Starting at 10 V, slowly increase the voltage, until the clutch plate catches. There will be an audible clicking sound.

Note the voltage necessary to operate the clutch and refer to the chart below for the remaining life span.

d. To determine the clutch life span :

Coupling voltage	Remaining life at room temperature	Remaining life at operating temperature
10V	100%	
11V	88%	
12V	80%	100%
13V	72%	88%
14V	64%	80%
15V	56%	72%
16V	48%	64%
17V	40%	56%
18V	32%	48%
19V	24%	40%
20V	16%	32%
21V	8%	24%
22V	0%	16%
23V		8%
24V		0%

The chart shows the coupling voltages for cold clutches (room temperature) and for clutches which have been activated for about 20 minutes by a 24 V source.

e. Bearing wear :

With the fan belts removed it should be possible to spin the clutch and fan assembly without undue force. The fan should rotate freely in one plane, without any wobble. No catching should be felt, nor should any grinding noise be heard.

Service procedure complete.

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