



FORD 4F27E/MAZDA FN4A-EL

PRINCIPLES OF OPERATIONS

The 4F27E transmission uses (2) ON/OFF solenoids and (3) PWM solenoids to produce each of the shifts and converter clutch apply as the chart in figure 6 reveals. The EPC solenoid is used to control line pressure relative to engine torque. So far this sounds easy but from a strategy standpoint, it progressively moves towards a “different way of doing things” when compared to what we are accustomed to. Lets start off on familiar ground. Shift Solenoids A & B are the ON/OFF solenoids which when they are OFF, block fluid from stroking valves while the Pulse Width Modulated Solenoids, C, D & E are the opposite. When they are OFF they allow fluid to pass through the solenoid and stroke valves. OK, so far not so bad. Sounds a little like the 41TE/42LE transmission with their Normally Applied and Normally Vented PWM - ON/OFF solenoids.

The first departure from the “norm” if you will, is that shift solenoid B could be better understood as a Lock Up/TCC solenoid. To call this shift solenoid B made it difficult for me when I first looked at a solenoid application chart like the one in figure 1. I kept thinking it was a gear shift solenoid not a TCC shift solenoid. But now, having clarified the operation of shift solenoid B, it would be good to do a “simple” overview of the function of each of the other “shift” solenoids and by doing so, the solenoid application chart will make considerably more sense.

SSA

When this solenoid is in the ON position, it strokes the 3-4 shift valve which exhausts Forward Clutch and servo release pressure.

SSB

When this solenoid is in the ON position, it strokes the TCC Control Valve which exhaust the converter release pressure allowing for TCC apply.

PWM SSC

When this solenoid is in the OFF position, it provides Forward Clutch Apply Pressure

PWM SSD

When this solenoid is in the OFF position, it provides Servo Apply Pressure

PWM SSE

When this solenoid is in the OFF position, it provides Servo Release Pressure

With this simple overview of the function of each of the shift solenoids, along with the hydraulics provided for each of the shifts while the manual valve is in the D4 position (figures 2-8), a closer look will provide a more detailed understanding of “a different way of doing things.”

Using the second gear TCC off hydraulic provided in figure 3, carefully look at the TCC Control Valve. Notice that forward clutch oil runs through the valve from the PWM SSC to the forward clutch. Also notice that line pressure is routed to and blocked by the TCC Control valve’s land next to the spring. When this TCC Control Valve is stroked by SSB for lock up, TCC release oil becomes connected to the PWM SSC solenoid for a controlled TCC apply. At the same time, the forward clutch apply oil switched from being fed by the PWM SSC solenoid to the line pressure that was being blocked by the land next to the spring (See figure 4).



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The PWM SSC not only controls forward clutch apply, it also controls converter clutch apply feel. Should this solenoid malfunction mechanically, we could have a harsh apply or delayed apply into forward and no TCC, or a slipping TCC concern. It is obvious that if SSB malfunctioned, we would experience TCC apply issues as well. And looking at the TCC Control Valve, in theory, should the valve or the valve bore develop excessive wear, combined with a lazy stroke of the valve, a forward clutch slip could occur at the time TCC is being applied in second or third gear.

OD POSITION	SHIFT & TCC SOLENOIDS					
GEAR SHIFTS	SSA	SSB	PWM SSC	PWM SSD	PWM SSE	VFS EPC
1st Gear	OFF	OFF	OFF	ON	ON	**
2nd Gear	OFF	OFF	OFF	OFF	ON	**
2nd Gear/TCC	OFF	ON	ON	OFF	ON	**
3rd Gear	OFF	OFF	OFF	OFF	OFF	**
3rd Gear/TCC	OFF	ON	ON	OFF	OFF	**
4th Gear	ON	OFF	ON	OFF	OFF	**
4th Gear/TCC	ON	ON	ON	OFF	OFF	**
**The Electronic Pressure Control Solenoid is in constant operation relative to throttle opening						

Figure 1

FORD 4F27E/MAZDA FN4A-EL

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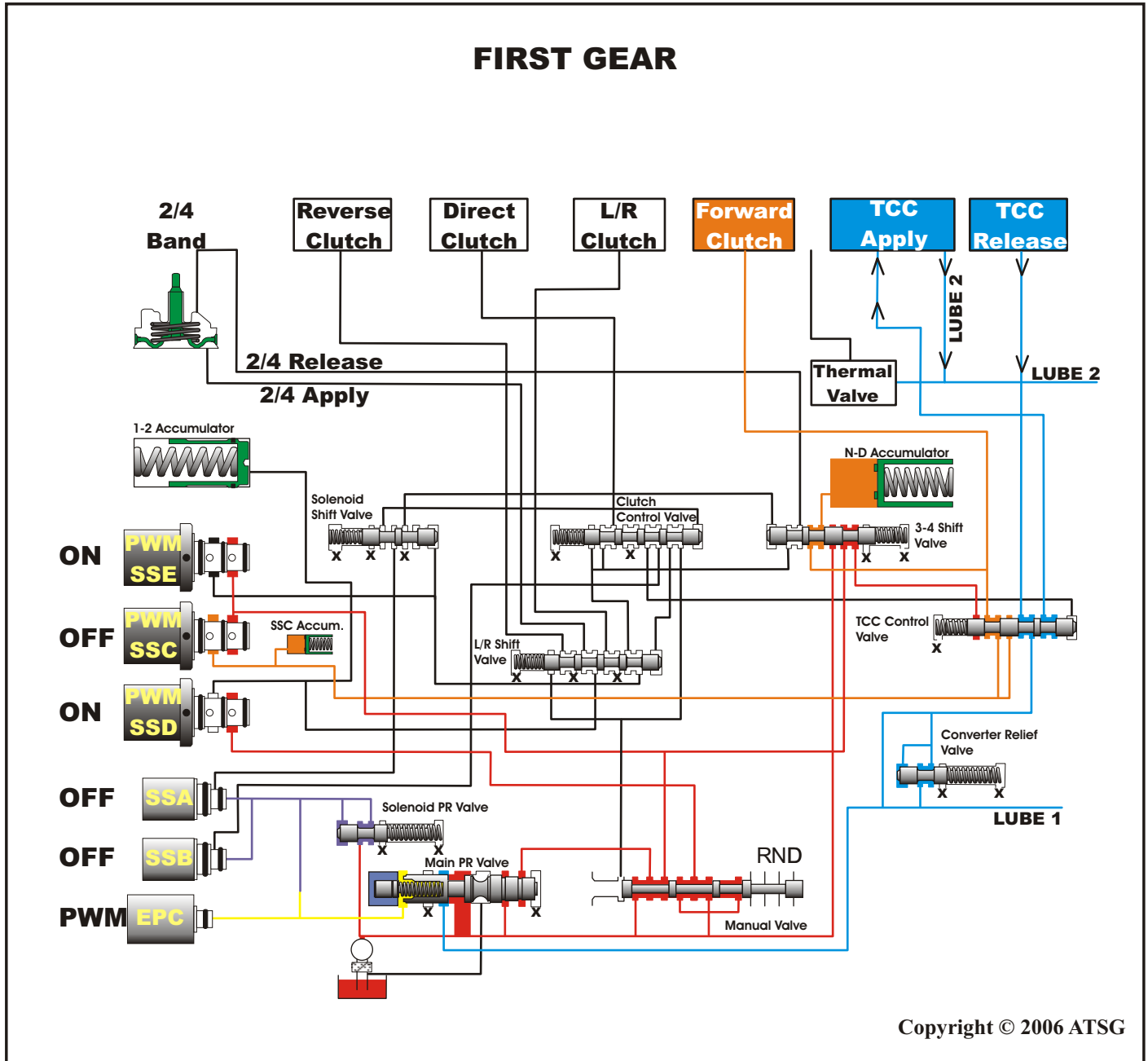


Figure 2

FORD 4F27E/MAZDA FN4A-EL

PRINCIPLES OF OPERATIONS

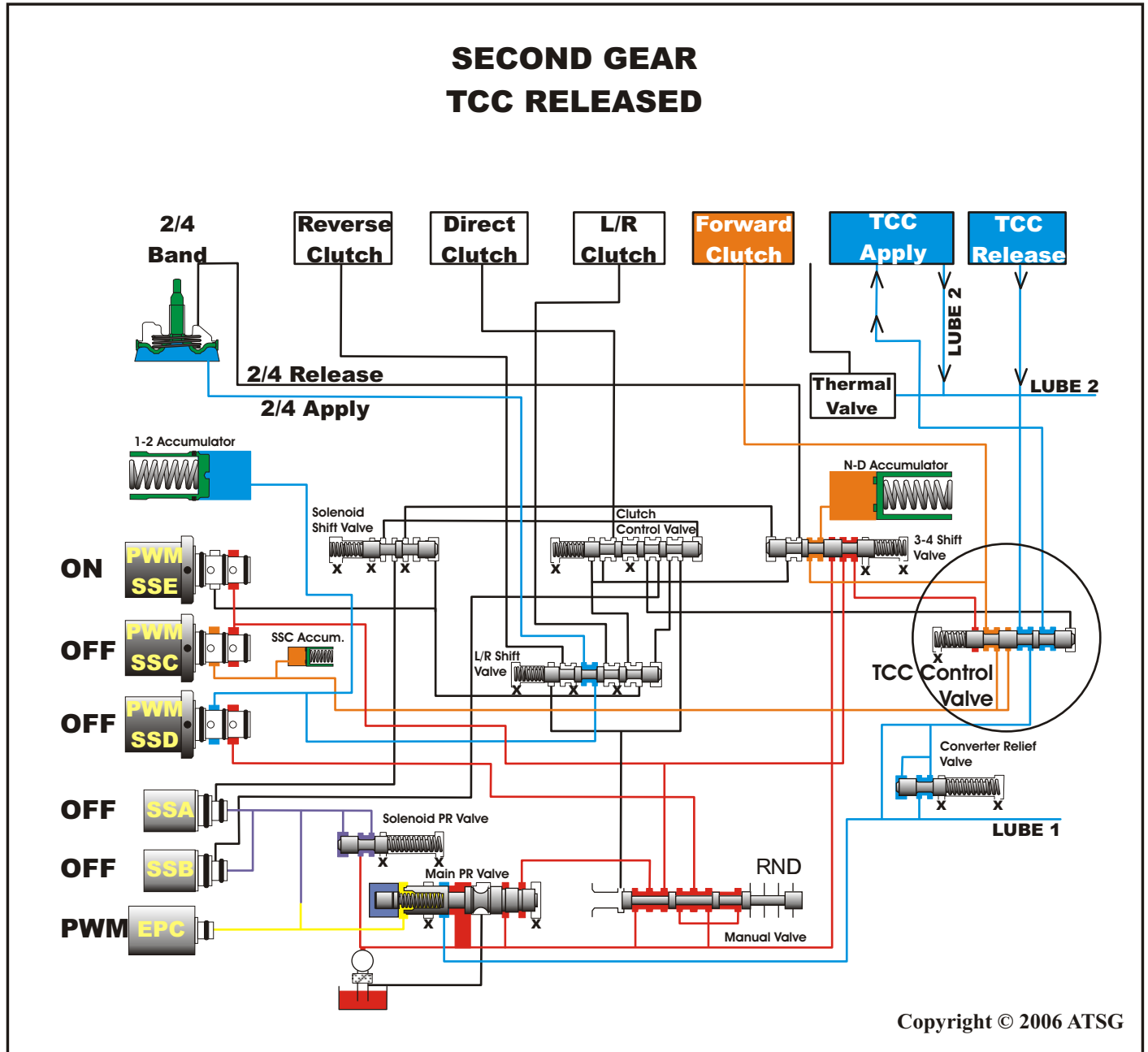


Figure 3

FORD 4F27E/MAZDA FN4A-EL

PRINCIPLES OF OPERATIONS

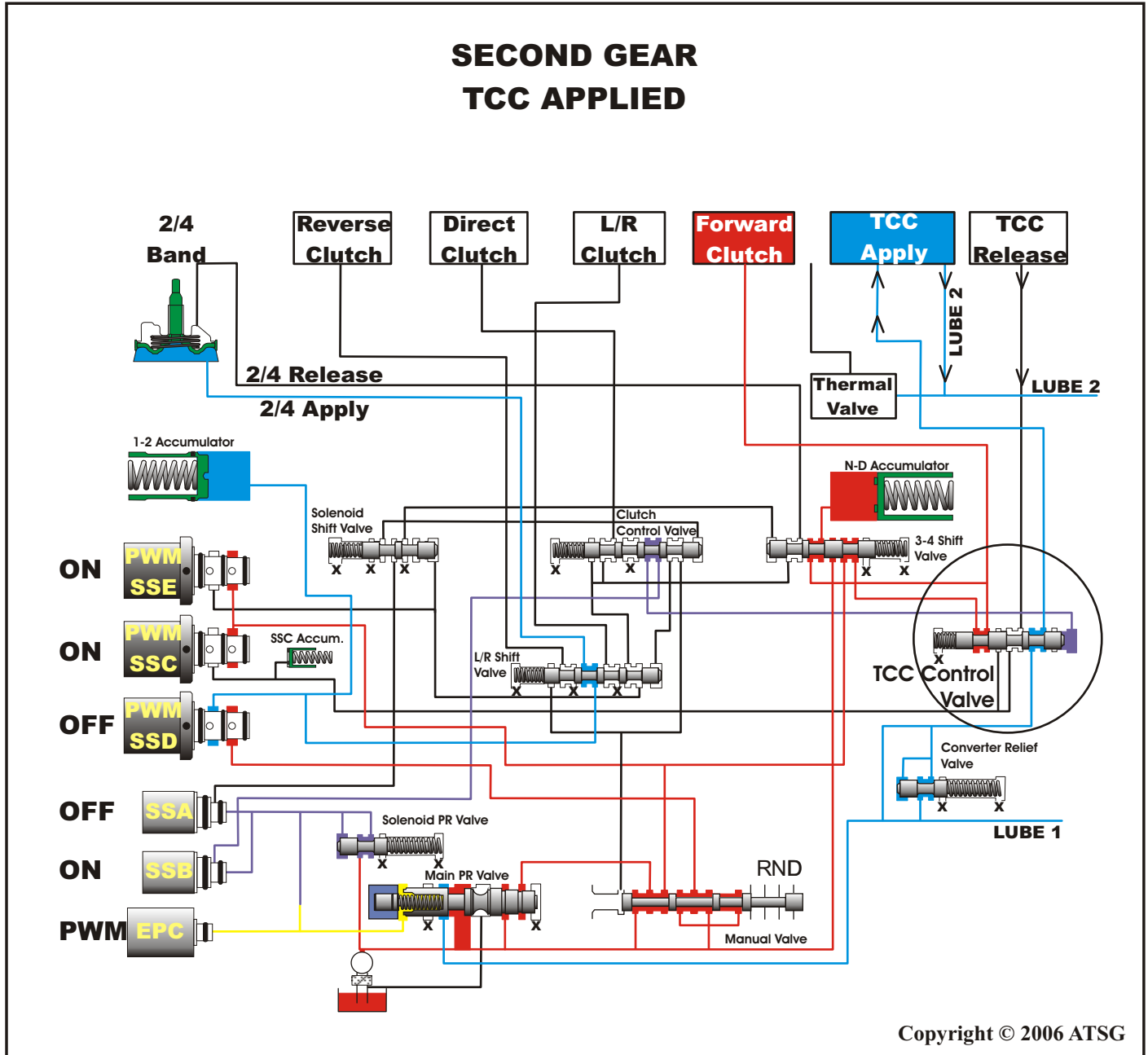


Figure 4

FORD 4F27E/MAZDA FN4A-EL

PRINCIPLES OF OPERATIONS

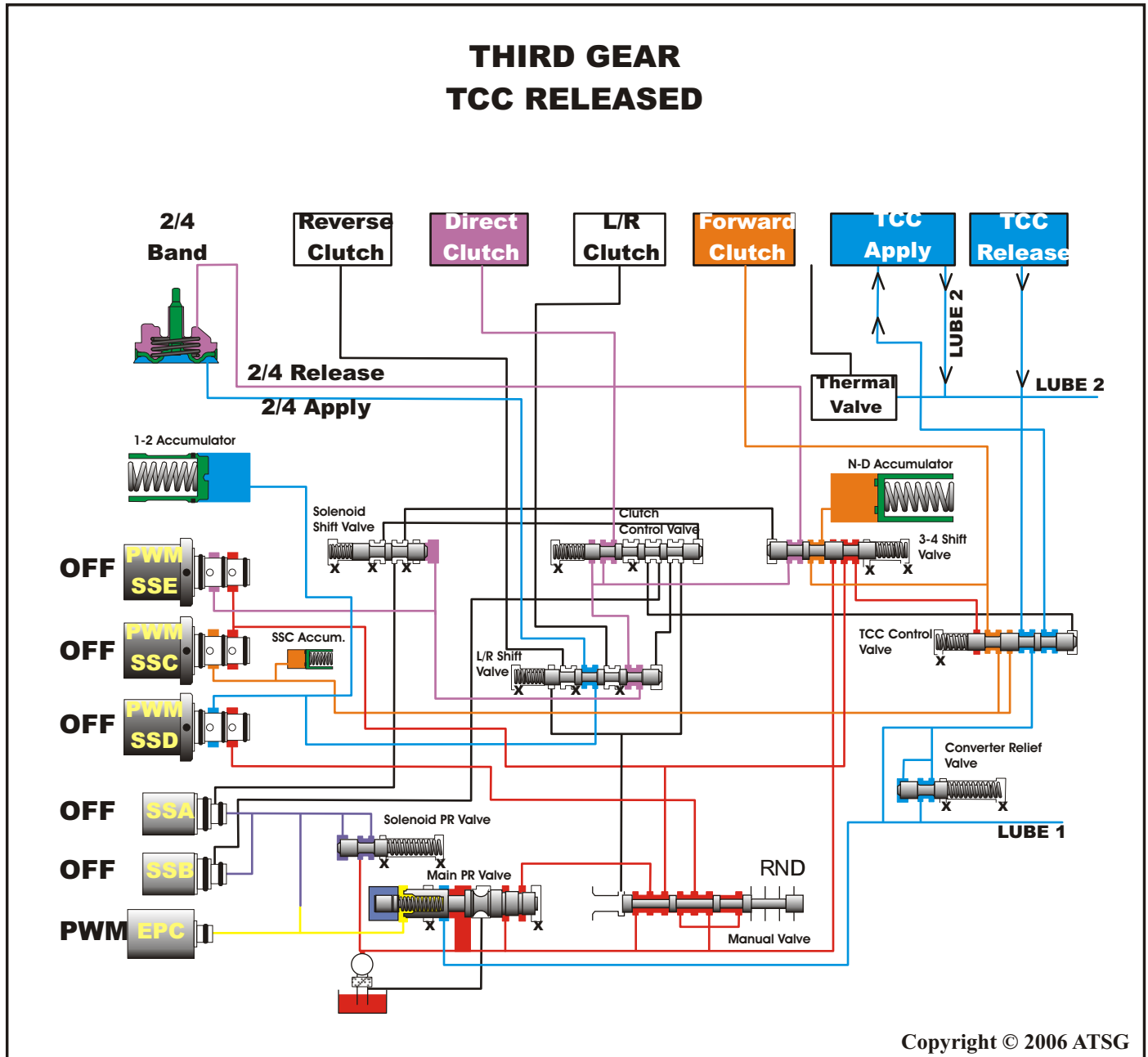
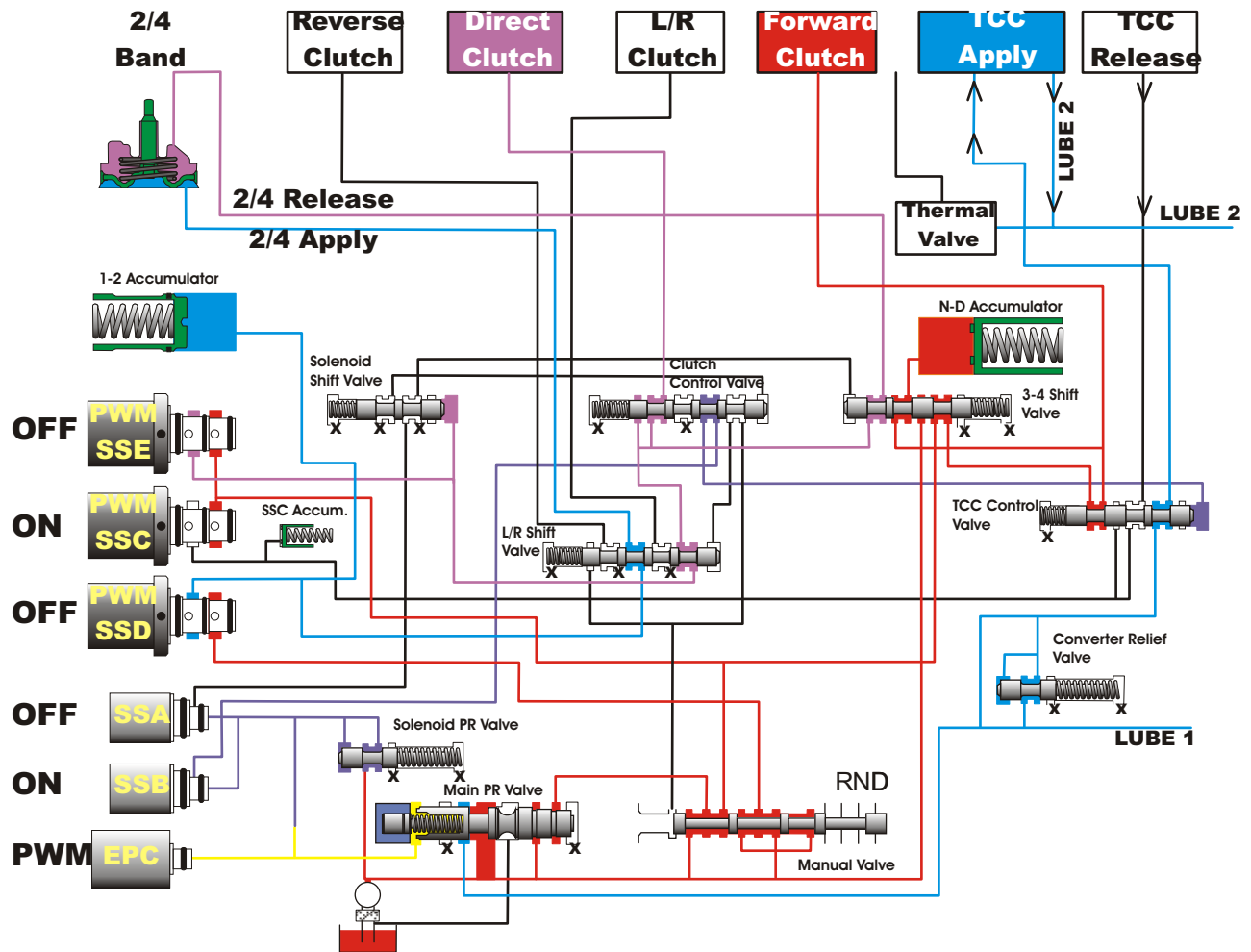


Figure 5

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PRINCIPLES OF OPERATIONS

THIRD GEAR TCC APPLIED



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Figure 6

FORD 4F27E/MAZDA FN4A-EL

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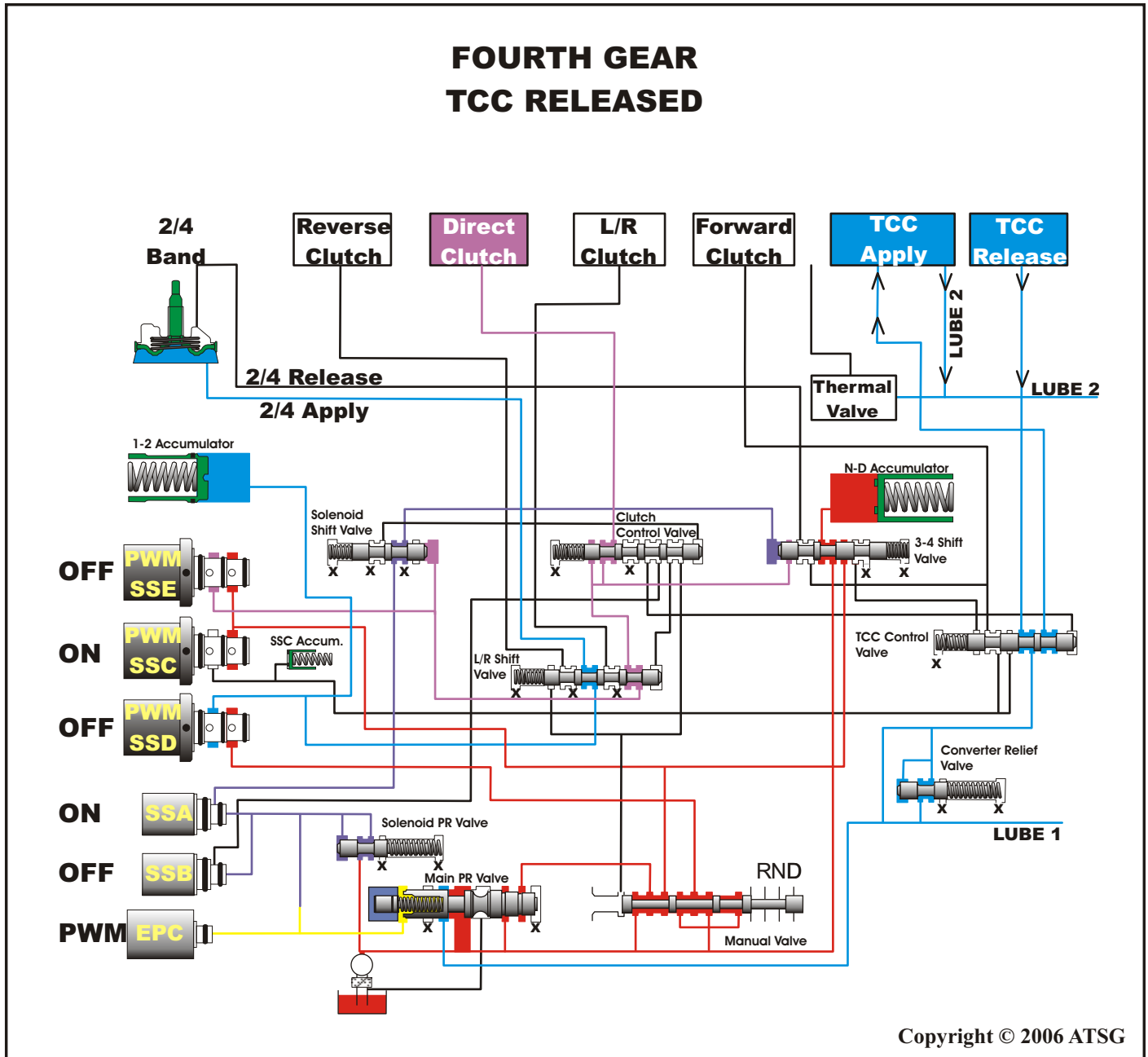


Figure 7

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PRINCIPLES OF OPERATIONS

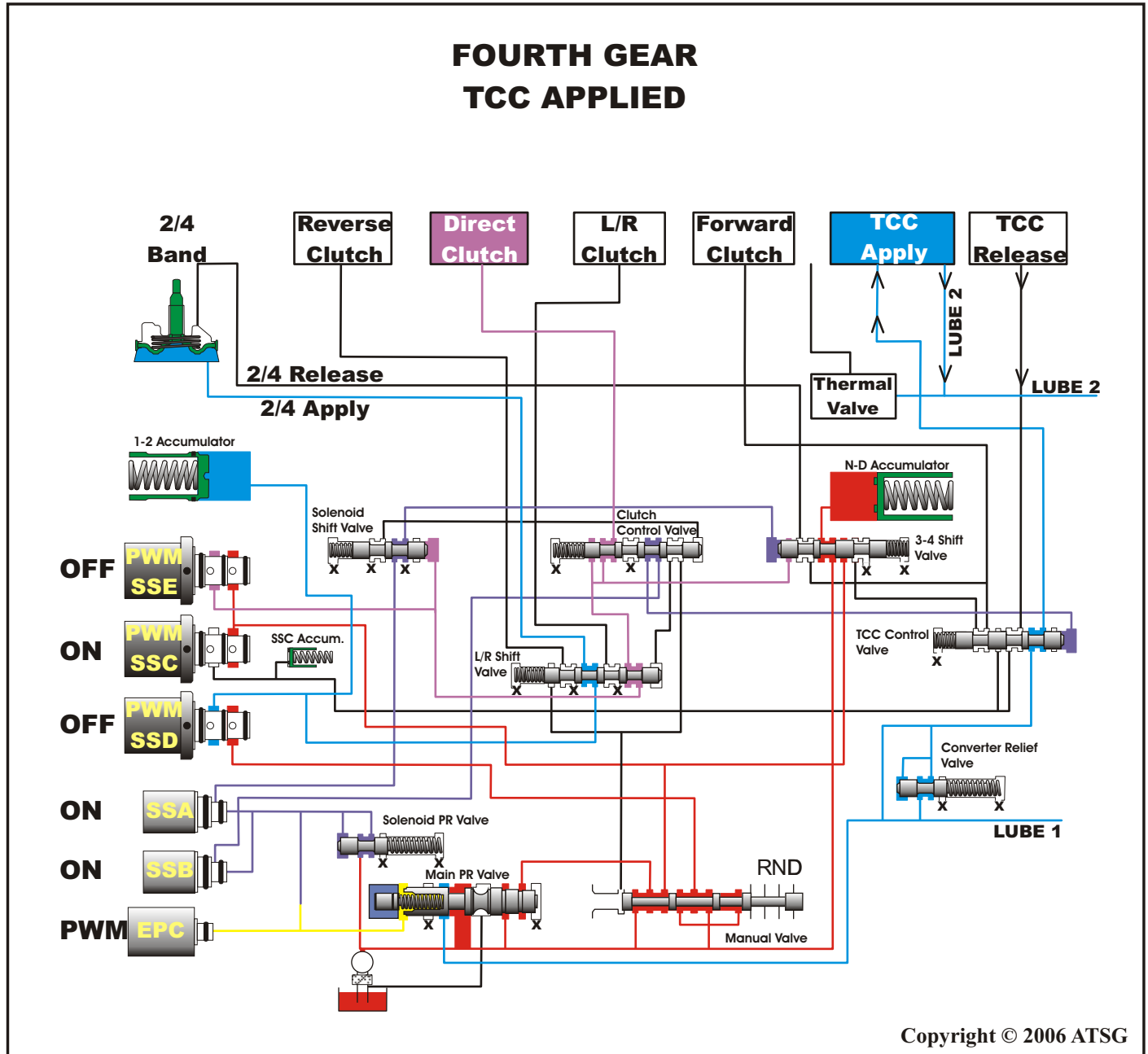


Figure 8