

# Swamp's Diesel Performance

## *Competition Parts For Your Diesel*

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## **POSSIBLE GEAR RATIOS WITH DUAL TRANSMISSIONS AND A 2-SPEED TRANSFER CASE:**

It took over 3 months of daily usage to really figure out how to best use and shift the two transmissions to full advantage. Even after 5 months, I still refer to chart 2, which I keep on the visor, very regularly. As a general rule, it has worked out to 6 different shifting modes, based on driving conditions:

1. Serious, hard core, mountain four wheeling, transfer case goes in low range, the Spicer in 2, and 1-4 with the ZF\*
2. Off-road, rough going, the Spicer stays in 2, and I use 1-4 of the ZF for general shifting; this gearing is equivalent to normal low-range.
3. On-road, but rough dirt roads, the Spicer stays in 3, and I use 1-5 of the ZF.
4. Paved roads or around town, the Spicer stays in 4, and I use 1-5 of the ZF.
5. Two lane and interstates, I start out with the Spicer in 4, shift from 1-5 with the ZF, and then move the Spicer into 5 and leave it there; if down shifting is needed on hills, I down shift the ZF to 4.
6. Pulling my 33' 13,000 lb. fifth-wheel RV: start with the Spicer in 3 and shift 1-4 with the ZF, then shift the Spicer to 4, ZF to 5, Spicer to 5.

\*We did some work at the Sugarloaf/USA ski area near Kingfield, Maine in the summer of 1999, clearing single- and double-

diamond (difficult and extremely difficult) ski slopes. I gave 14 employees a ride in the truck down one of the trails, which was a constant 20-degree slope of loose gravel and rocks for almost 2 miles. With this gearing combo (2 x 2 x Low Range), I had to keep my foot on the accelerator just to keep moving even while going downhill!

Useful Formulas:

|  |
|--|
| $\text{Tire Diameter} = (\text{mph} * \text{gear ratio} * 336) / \text{rpm}$ |
| $\text{Gear ratio} = (\text{rpm} * \text{tire dia}) / (\text{mph} * 336)$    |
| $\text{MPH} = (\text{rpm} * \text{tire dia}) / (\text{gear ratio} * 336)$    |
| $\text{RPM} = (\text{mph} * \text{gear ratio} * 336) / \text{tire dia}$      |

Chart 1: Gear ratios based on which transmission is in what gear...

| Gear Ratio by Transmission Gear |    |      |      |      |      |      |
|---------------------------------|----|------|------|------|------|------|
| Trans Gear Ratios               | ZF | 4.14 | 2.37 | 1.42 | 1.00 | 0.77 |
| SPI CE Gear                     |    | 1    | 2    | 3    | 4    | 5    |

|      |   |       |       |      |      |      |
|------|---|-------|-------|------|------|------|
| R    |   |       |       |      |      |      |
| 5.00 | 1 | 20.70 | 11.85 | 7.10 | 5.00 | 3.85 |
| 2.79 | 2 | 11.55 | 6.61  | 3.96 | 2.79 | 2.15 |
| 1.65 | 3 | 6.83  | 3.91  | 2.34 | 1.65 | 1.27 |
| 1.00 | 4 | 4.14  | 2.37  | 1.42 | 1.00 | 0.77 |
| 0.80 | 5 | 3.31  | 1.90  | 1.14 | 0.80 | 0.62 |

Chart 2: Gear ratios based on transmission gear, multiplied by axle gear ratio...

|  |      |      |      |      |      |      |
|--|------|------|------|------|------|------|
| Gear Ratio by Transmission Gear Times Axle Ratio |      |      |      |      |      |      |
| Axle Ratio =                                     | 6.17 |      |      |      |      |      |
| Tra  | ZF   | 4.14 | 2.37 | 1.42 | 1.00 | 0.77 |

| ns<br>Gea<br>r<br>Rati<br>o |      |        |       |       |       |       |
|-----------------------------|------|--------|-------|-------|-------|-------|
| SPI<br>CE<br>R              | Gear | 1      | 2     | 3     | 4     | 5     |
| 5.0<br>0                    | 1    | 127.72 | 73.11 | 43.81 | 30.85 | 23.75 |
| 2.7<br>9                    | 2    | 71.27  | 40.80 | 24.44 | 17.21 | 13.26 |
| 1.6<br>5                    | 3    | 42.15  | 24.13 | 14.46 | 10.18 | 7.84  |
| 1.0<br>0                    | 4    | 25.54  | 14.62 | 8.76  | 6.17  | 4.75  |
| 0.8<br>0                    | 5    | 20.44  | 11.70 | 7.01  | 4.94  | 3.80  |

Chart 3: Gear ratios based on 4WD low range, times transmission gear, times axle gear ratio...

| Gear<br>Ratio<br>by<br>Transm<br>ission<br>Times<br>Axle |  |  |  |  |  |  |
|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |

|                     |      |             |        |       |       |       |
|---------------------|------|-------------|--------|-------|-------|-------|
| Times Transfer case |      |             |        |       |       |       |
| Axle Ratio =        | 6.17 | Low Range = | 1.96   |       |       |       |
| Trans Gear Ratio    | ZF   | 4.14        | 2.37   | 1.42  | 1.00  | 0.77  |
| SPICER              | Gear | 1           | 2      | 3     | 4     | 5     |
| 5.00                | 1    | 250.33      | 143.30 | 85.86 | 60.47 | 46.56 |
| 2.79                | 2    | 139.68      | 79.96  | 47.91 | 33.74 | 25.98 |
| 1.65                | 3    | 82.61       | 47.29  | 28.33 | 19.95 | 15.36 |
| 1.00                | 4    | 50.07       | 28.66  | 17.17 | 12.09 | 9.31  |
| 0.80                | 5    | 40.05       | 22.93  | 13.74 | 9.67  | 7.45  |

Anything over 70:1 is getting v e r y s l o w.

All Possible Transmission Gear Combinations Sorted by Final Drive Ratio: Although 5x5 gives 25 possible gear combinations, some of the combinations are so close as to be the same for all intents and purposes, such as 3rd x 2nd = 3.96:1 and 2nd x 3rd = 3.91:1.

Chart 4:

Transmission Gear x Axle Ratio

|            |        |        |
|------------|--------|--------|
| Trans Gear |        |        |
| ZF         | SPICER |        |
| 1          | 1      | 127.72 |
| 2          | 1      | 73.11  |
| 1          | 2      | 71.26  |
| 3          | 1      | 43.81  |

|   |   |       |
|---|---|-------|
| 1 | 3 | 42.14 |
| 2 | 2 | 40.78 |
| 4 | 1 | 30.85 |
| 1 | 4 | 25.54 |
| 3 | 2 | 24.43 |
| 2 | 3 | 24.12 |
| 5 | 1 | 23.75 |
| 1 | 5 | 20.42 |
| 4 | 2 | 17.21 |
| 2 | 4 | 14.62 |
| 3 | 3 | 14.44 |
| 5 | 2 | 13.27 |
| 2 | 5 | 11.72 |
| 4 | 3 | 10.18 |
| 3 | 4 | 8.76  |
| 5 | 3 | 7.84  |
| 3 | 5 | 7.03  |
| 4 | 4 | 6.17  |
| 4 | 5 | 4.94  |
| 5 | 4 | 4.75  |
| 5 | 5 | 3.83  |

Chart 5:

Most useful gear combinations...

| Most Useful Gears       |      |
|-------------------------|------|
| Unloaded/Normal Driving |      |
| 1x4                     | 4.14 |
| 2x4                     | 2.37 |
| 3x4                     | 1.42 |
| 4x4                     | 1.00 |
| 5x4                     | 0.77 |
| 5x5                     | 0.62 |

|  |       |
|--|-------|
|  |       |
| These 8 cover 98% of my needs, on or off road. |       |
| Loaded/Off Road                                |       |
|  |       |
| 1x2  | 11.55 |
| 1x3  | 6.83  |
| 1x4  | 4.14  |
| 2x4  | 2.37  |
| 3x4  | 1.42  |
| 4x4  | 1.00  |
| 5x4  | 0.77  |
| 5x5  | 0.62  |

Chart 6: Engine RPM's at various speeds and gear combinations...

Note: Although the chart goes to 4,500 RPM, the engine redline is 3,300.

The closer the lines, the closer the gear ratios; 4x5 is the same as 5x4, so they overlap.