

a question of balance

BALANCE
DRIVETRAIN SPECS
FOR FUEL ECONOMY AND
PERFORMANCE.

By **JOHN BAXTER**

Some marine diesel engines turn at less than 100 rpm and drive the propeller directly, and they give the best fuel economy of any diesel. That's an important lesson for a modern-day trucker. Even though the original truck diesels were made light enough to be practical by increasing the operating rpm, the trend for the past decade has been to turn them slower and slower. Especially since the 2002 introduction of new emissions control technology (exhaust gas recirculation or, in Caterpillar's case, ACERT), proper spec'ing of drivetrain gearing means turning the engine slower at cruise than ever before.

Before getting into what has changed, let's review the basics. There are five steps to getting the right gearing:

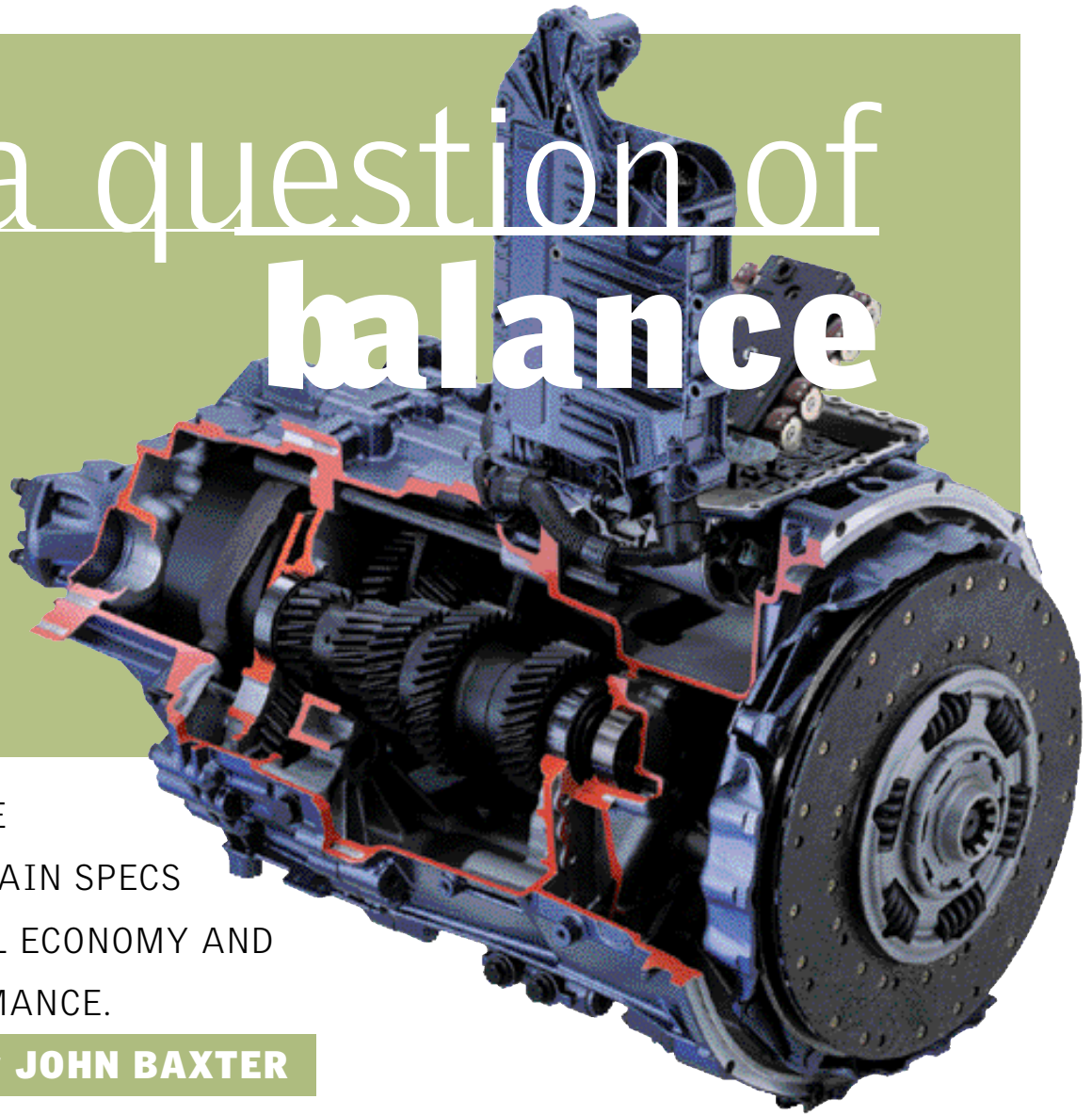
- Match the components' torque ratings to one another.
- Match the gear steps to the engine's torque charac-

When spec'ing a transmission, make sure the torque ratings of your components match.

teristics by choosing the right number of gears in the transmission.

- Pick rear axle and top gear ratios that will give the right cruise rpm.
- Make sure you have a low-enough starting gear. This depends both on factors such as gross combined weight and engine torque, and on your vocation.
- Make sure your top ratios are close enough together that you can keep the engine rpm in the sweet spot, unless you cruise consistently in a very narrow rpm range.

Because transmissions and other drivetrain components are strong, there's nothing to be gained by over-spec'ing, says Charlie Allen, director of sales engineering at ArvinMeritor. However, Allen says, "You



FUEL IS A BIG CONSIDERATION WHEN SPEC'ING A TRANSMISSION, ESPECIALLY WITH EGR AND ACERT ENGINES.

may want to turn the engine power up at resale.”

Bill Batten, a product line manager at the Fuller Transmission Division of Eaton Corp., says this assumes “the engine has the iron for uprating. A fleet may want its drivers to have 475-hp engines with 1650 lb.-ft. of torque, and then uprate the engine for 500 hp and 1850 lb.-ft. of torque for resale into the performance market.” If you uprate the engine at resale without properly matched drivetrain components, the warranty automatically becomes invalid, reducing the vehicle’s market value.



Manufacturers also offer transmissions capable of handling an extra amount of torque in just the top two gears, which handles all highway cruise situations. The ArvinMeritor Torque 2 10-speed, for example, works with Cummins Smart Torque to produce an engine torque output rating of 1650 lb.-ft. in gears 1-8, and then ups it to 1850 in the top two gears.

The Eaton Fuller Lightning and FR-Series add 100 lb.-ft. in their top two gears. The engine and transmission communicate electronically to ensure the torque shows up only in the gears that can handle it. This produces a strong highway performance from a much less expensive drivetrain. Since the expense of producing the transmission goes to make the parts strong enough for starts in the lowest gear, you can spec a drivetrain with a 10-speed transmission that gives highway performance

AUTOMATIC CHOICE?

Spec'ing an automated or automatic transmission may make your life easier, but it may not be right for your application.

Ten years ago, an owner-operator's selection of heavy-duty transmissions was limited to manuals. An electronic revolution, however, has made self-shifting transmissions a viable option for major fleets and some owner-operators. Does that mean an automatic or automated transmission is right for your next truck?

Automatic and automated units use a micro-processor and tiny electric motors or electrically activated pneumatic cylinders to manage shifting. There are two main designs:

- Traditional three-pedal transmissions, which incorporate a clutch, brake and accelerator, and take over shifting once the driver has used the clutch to start the vehicle moving.
- Two-pedal designs operate the clutch for the driver.

Two major factors have made this technology welcome. Urban congestion has reduced traffic to a crawl on some interstates, making shifting and clutching a much greater challenge. Secondly, a driver shortage has brought in many inexperienced operators, most of them nurtured on automatic car transmissions and many carrying no emotional baggage about having to shift to be a real truck driver.

Safety is considered one of the main benefits of automatics. Large fleets like U.S. Xpress say accident rates have declined with the introduction of automatics because drivers are less fatigued from manually shifting and are less distracted.

Fuel savings can also be a big plus, but the amount largely depends on the driver. Generally, an automated transmission shifts up every time you throttle back to cruise, even when a downshift may be needed soon. It also downshifts whenever the engine gets well below the torque peak and the driver hits the throttle. Pampering the diesel like this makes it more efficient, for a fuel savings of 3 percent to 5 percent. That fractional increase adds up to big money.

Automatics also reduce drivetrain wear. Even

the three-pedal units float-shift between gears, which saves clutch wear if drivers use the clutch when shifting. Power is always re-applied smoothly after a shift, minimizing shock loading. The clutch collars are never abused because the processor knows the exact rpm of engine and output shaft and matches them perfectly.



Two-pedal units have self-adjusting clutches. The engine and driveline speeds are synchronized after a shift, so there's no large adjustment of engine speed at the expense of the clutch. There's also no lurch with the accompanying driveline shock.

Automatics offer improvements in safety, productivity and comfort. For this, of course, you pay – and prices vary considerably. Whether the improvement is worth the cost depends on what you buy, which benefits are important to you and how the vehicle is used – where it runs and what the traffic is like.

These are important issues in determining whether an automatic fits your application. For example, if you run 48 states and frequently pull heavy loads over rough terrain, even the most robust automatic may not be your best choice. Plus, if your hauls are mostly open stretches of interstate, you are less able to enjoy some of the benefits of an automatic, such as less fatigue and better fuel efficiency.

But if your loads and geography are consistent and you deal with continual traffic, an automatic may be a choice of convenience and comfort. If you are specifying a manual transmission for a truck that someone else will ultimately drive, you may want to ask yourself the same question that fleets do: Will I be able to hire a driver who can operate a manual? Likewise, for husband and wife teams, an automatic may also be a logical choice.

Finally, for veteran drivers, the comfort offered by an automatic may be enough to persuade them to consider an automatic. The choice, at least, is worth looking into.

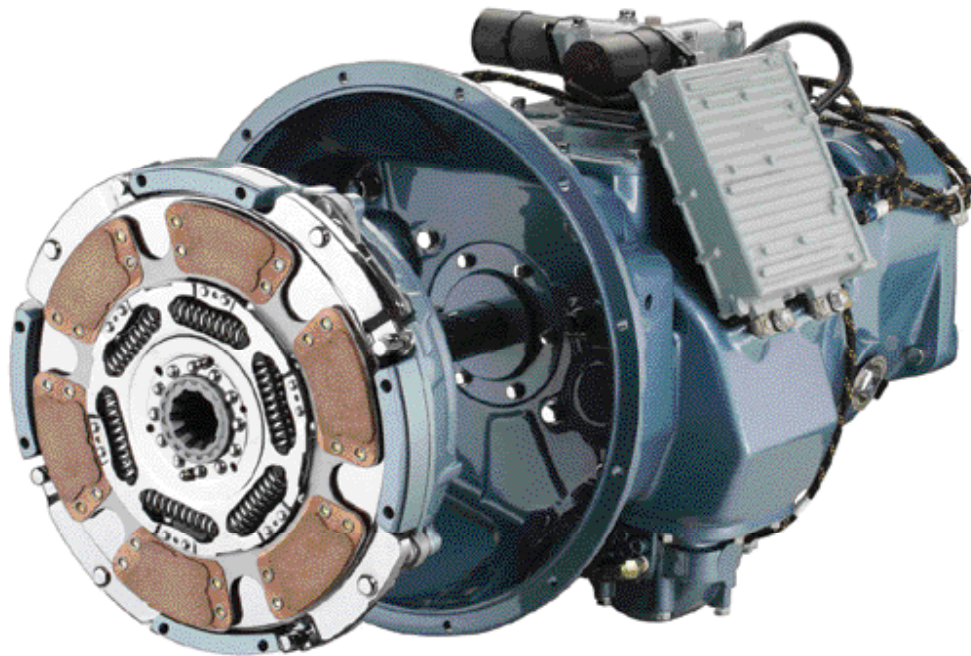
like trucks equipped with 13- and 18-speed gearboxes.

The torque ratings for the drive axles and driveshafts are also critical. This is a complex calculation based on the engine's torque output, the lowest gear ratio in the transmission, axle ratio, tire size and other factors. Let the truck factory do the difficult calculation, recommends Gerard DeVito, manager of global product planning for Roadranger, the joint initiative of Dana Corp., Eaton Corp. and other partners. But spec-

ify the traditional overdrive transmission, not direct drive, to get the right driveline balance.

Why? Direct drive typically reduces the rotating speed of the driveshafts nearly 25 percent, which increases the torque the shafts and axles must carry by the same percentage. When you specify this kind of drivetrain, says DeVito, the driveshaft yokes and crosses, which make up the U-joint, are really big. "Even then, they still may not do the job because there is

THE PROPER GEARING CAN OVERCOME FUEL EFFICIENCY LOSSES.



too little margin for driving errors that stress the drivetrain,” he says. “Drivers are not perfect.”

So, direct drive saves a little bit of fuel because of reduced transmission friction in top gear, but may not save you money in the end. Still, some owner-operators swear by direct drive. With less torque and properly spec’ed driveshafts, direct drive proponents say their trucks perform reliably past the million-mile mark and save fuel.

Fuel is a big consideration when spec’ing a transmission, especially with EGR and ACERT engines. Pre-2002-emission engines were more forgiving of improper gearing, but the proper gearing can overcome fuel efficiency losses, truck and engine makers say. “You don’t have to use more fuel,” says Larry Hess of Midway Truck Service. “The key is gearing the truck properly.”

Caterpillar recommends running at 1325 rpm at 65 and not much over 1400 at 70, according to Bob Keene. Operators should specify more torque – at least 1750 lb.-ft. – and drop a full axle ratio, except in the very heaviest hauling situations. Cat also recommends “close steps” in the top gears.

Other manufacturers have similar recommendations. Volvo’s Ed Saxman, for example, says the sweet spot for the Volvo VED12 465 hp engine has

dropped to 1400-1600 rpm from 1400-1650. However, the power curve is much flatter, meaning, “Owners who ran 3.73:1 rear axles can now run 3.58 axles because peak horsepower is available over a wider range.”

All this brings up another debate: Do you want a 10-speed or a 13- or 18-speed gearbox with a splitter? Hess encourages the simpler approach to reduce costs and keep the driver from gearing down when it’s not necessary. But experienced drivers who need to cruise at 70 mph one day and 55 mph the next can greatly benefit from being able to split down rather than shifting the main box down a full gear. The choice depends on the driver, the terrain, and the consistency of the cruise speed. ■

TRANSMISSION SPECS. The transmissions included in the spec listings represent the products from each manufacturer that are most popular with owner-operators for over-the-road and vocational uses. Consult a dealer for information on other models, including partly and fully automated transmissions; contact information is available on Page 6.