



PRODUCT MARKETING BULLETIN

ALL DEALERS
BULLETIN FT06-01PMB
APRIL 19, 2006

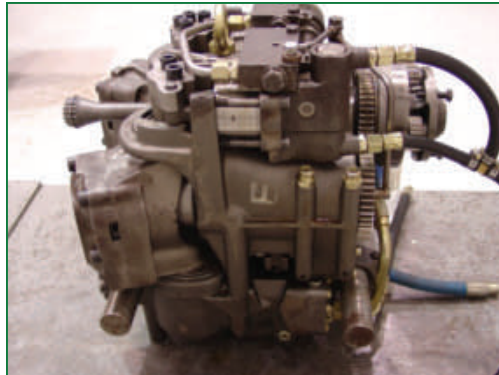
THE CVT

TRUTH VS. MYTH

NOTE: PLEASE REFER TO BULLETIN [F01-02](#) on **OneAGCO** FOR THE EXPLANATION OF HOW THE CVT WORKS.

INTRODUCTION::

Throughout the farming industry, the idea of the CVT (continuous variable transmission) has been received with skepticism due to misunderstandings of the CVT concept. The goal of this document is to explain the advantages of a continuously variable transmission over a powershift or geared transmission. Once again, please read bulletin F01-02 to understand how the transmission works.



THE IDEA.

The Fendt CVT transmission sits at the top of the technology curve when it comes to comparing transmissions in tractors. No other transmission can deliver functionality and reliability better than the CVT. Fendt is the pioneer of this technology and also the pioneer in providing features to make it operate at optimum efficiency at all times

During operation, the CVT allows the tractor to maximize field efficiency by being able to operate at optimum speed. Instead of separate speed ranges like in a powershift, the CVT gives the tractor infinite speeds. An operator can select the exact speed for the application whereas a powershift must operate within speed ranges. An example would be a powershift tractor that shifts from 6.5 mph to the next gear that's 8.0 mph. The tractor can pull the implement at 6.5 mph but, due to soil conditions, cannot shift up to go 8 mph. Now, with the CVT and its infinite speeds, the operator can pick a speed in between of 7.5mph. The 1 mph increase multiplied by the implement width results in more work done in the same amount of time.



The **IDEA** (continued)

**An example of the difference 1 mph can make on an implement width of 28 feet:
(5280 ft = 1 mile; 43560ft²=1 acre)**

$$\frac{28 \text{ Feet} \times 5280 \text{ Feet} \times 6.5 \text{ mph} \times 12 \text{ hours}}{43560 \text{ ft}^2/\text{acre}} = 264 \text{ acres/day at 6.5mph}$$

$$\frac{28 \text{ Feet} \times 5280 \text{ Feet} \times 7.5 \text{ mph} \times 12 \text{ hours}}{43560 \text{ ft}^2/\text{acre}} = 305 \text{ acres/day at 7.5mph}$$

= 41 acres/ day gained

The CVT tractor out performed the powershift tractor by 41 acres per each 12 hour day just because the powershift tractor cannot reach the optimum speed of 8 mph and has to settle for 6.5 mph. This example shows the Fendt CVT getting at least 16% more work done. That's almost savings one day a week in that application.

Going Further:

Different applications will vary how much more work will get done. Lets use 16% as an average.

Average North American farmer puts 800 Hours/year on a tractor.

800 hours x 84% = 672 hours. That's 16 days at 8 hours per day——SAVED!!!!.

Now Add Fuel Savings:

Previously, the result of 16% more work can be achieved with a CVT over a powershift. By getting more done, the owner discovers that 128 hours are saved at 14 gallons / hours. That comes out to approximately **\$5300** dollars saved with \$3.00 fuel.

SUMMARY

**Reduced Fuel Consumption
Increased amount of work accomplished
More productive operators**

Fuel Savings + Labor Savings(\$18/ hour) = \$7500/year savings

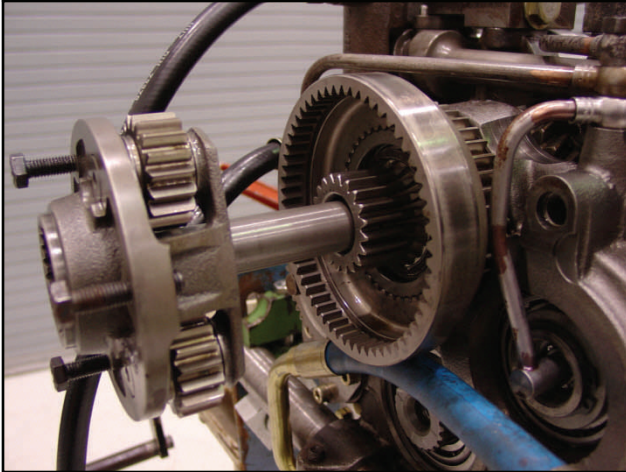
Owner/Operators of the CVT are discovering that by taking operation costs into account, the Fendt CVT tractors are less money in the long run than a powershift competitor.

OPERATION & PERFORMANCE MYTHS

MYTH: The Planetary Gear setting causes parasitic loss.

TRUTH:

It is claimed by some competitors that whenever planetaries are used, power loss is higher because of the meshing of the gears. Actually, a planetary gear set is one of the most reliable ways of transmitting power because there are many teeth in contact. This spreads the transmitted power over a larger area to bear the load with



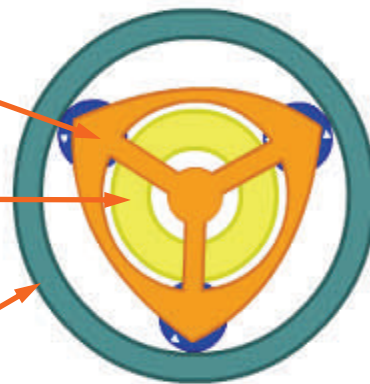
the teeth on the gears in constant contact. The gear setting basically splits and transfers power to the mechanical portion or the hydraulic portion of the transmission. That's why the size of the planetary is relatively small to the amount of power passing through it.

The Planetary

Carrier -Engine driven Power

Sun Gear—Mechanical Driven Power

Ring Gear—Hydraulically driven Power

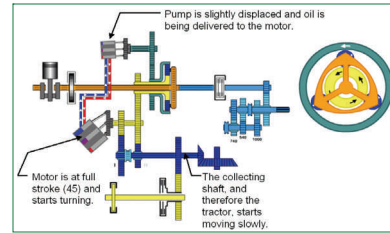


NOTE:

The difference between the application of this planetary compared to those in a final drive is that all portions of the planetary components are allowed to rotate whereas a final drive has one component fixed. By allowing all of the components to turn, the ratio of the speeds of the planetary components also change.

MYTH: The CVT is a Glorified Hydrostat.

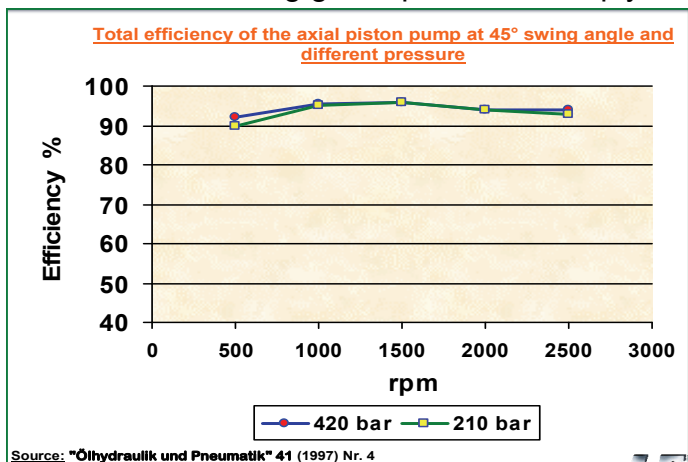
TRUTH: Hardly!! The CVT does use some of the same components that are found in a hydrostatic transmission. Yet, the hydrostatic transmission does not utilize a planetary gear set with the center sun gear directly driven to the rear tires. This means that a hydrostatic transmission does not, at any speed, directly transfer power to the ground using a mechanical drive. With both the pump and motors having the ability to displace oil up to 45 degrees, the CVT increases the pump angle (oil displacement) to increase ground speed. When the transmission reaches top speed, the motors, set at 45 degrees, begin to restrict oil flow by decreasing the angle to 0 degrees. This increases the resistance on the hydraulic system causing the planetary set to redirect the engine power through the sun gear.



Refer to Bulletin MF06-23PMB.

**MYTH: The Hydraulic System of the CVT robs horsepower
-Power doesn't get to the ground**

TRUTH: Power comes from the engine to the planetary. At the planetary, it is divided, then transferred through the ring gear (hydraulic system) and through the sun gear (mechanical drive to the ground). This separation at the planetary gear setting is referred to as power splitting. Power will take the path of least resistance. As the tractor starts off, most of the power will pass through the ring gear (where there's little resistance) with only a small amount of power passing through the sun gear (which is locked to the ground). As the tractor increases in speed, the sun gear resistance will loosen up allowing more power to transfer through the mechanical drive. As the speed ratio increases, the hydraulic motors will start to cut off flow thus increasing resistance on the ring gear. Now, with the heavy resistance on the ring gear, power will simply take the path of least resistance out the sun gear. The variable change of this power splitting ratio is where the CVT is most efficient.



NOTE :

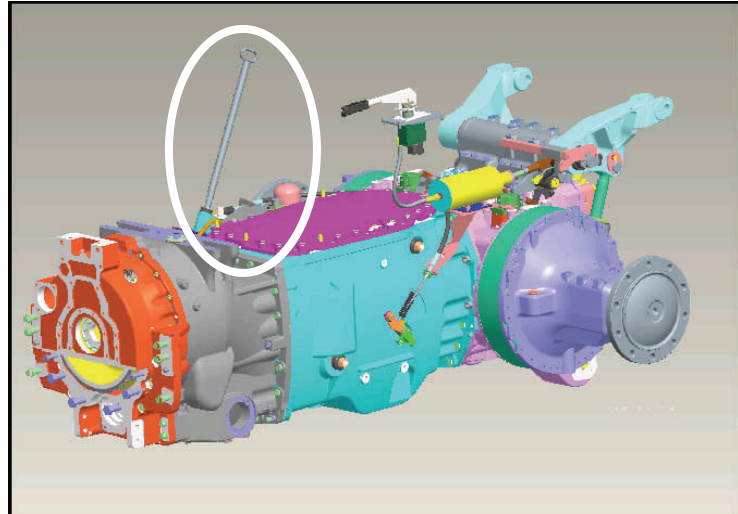
In summary, the advantage of power splitting is allowing power to take two paths through the transmission. When one path (either the hydraulic or mechanical) is inefficient, the other path picks it up. The result is as much as a **93.1% efficiency**.



MYTH: The actual CVT transmission is an electrical nightmare.

TRUTH:

The CVT Transmission does use an electric actuator to control the angle of the hydraulic motors which in turn controls the speed of the tractor. However, after that it is purely under its own operation. Components, such as the planetary, pump, and motors, all are operated without the use of electronics. In fact, if all electric was shut off from the tractor, the operator can utilize “limp home mode” to control the actuator themselves and still operate the tractor.



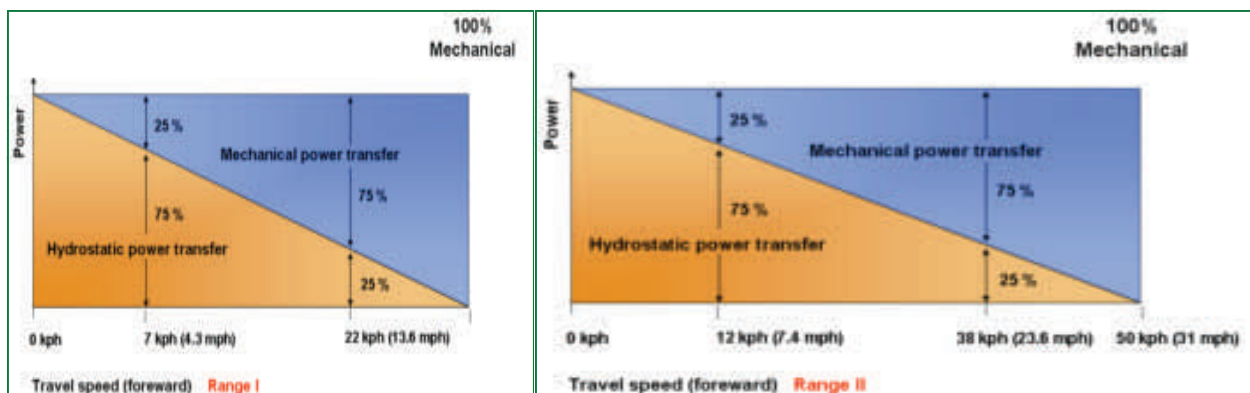
Obtain the limp home wrench from behind the cab and insert it on the actuator shaft through the door in the cab floor. Twist one to accelerate and the other way to decelerate

NOTE:

Competitive tractors cannot compete with this feature.

MYTH: Since the CVT has a high/low range, it is a two speed powershift

TRUTH: This is a very interesting point, even if it is not correct. High/low toggles between two different ratios making low range set-up for field work and high range for transport. The switching back and forth is controlled by an electro-hydraulic synchronized sliding collar. No clutches or powershifts to increase the heat level in the transmission. Field range operates from 0-18mph while transport range travels from 0-32(50kph option). The difference is, once again, the power splitting proportion of hydraulic and mechanical power. Field range operates with a higher ratio of mechanical power than the same speed in transport range.

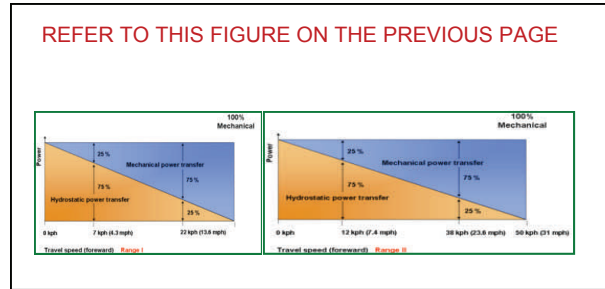


Remember, the higher percentage of power being transferred through the sun gear (mechanically), the more efficient the operation is. Field work should always be done in field (low) range.



MYTH: The CVT operates at high pressure which robs horsepower

TRUTH: Like any transmission, there are cooling lines to keep the oil temperature down. When operated correctly, high pressure and heat are at proper levels. This can be done by keeping the engine rpm down to the point that maintains desired speed. This reduces high pressure and heat from operating the transmission in the highest mechanical ratio possible.



NOTE:

Contaminants also create heat and high pressure. The CVT transmission separates the auxiliary hydraulics from the transmission. This means that when the tractor is hooked up to the neighbors old disk, the contaminated oil in the lines of the disk will not effect the CVT transmission thus increasing the reliability.

MYTH: Reliability of the CVT is questionable

TRUTH: There is a question of the reliability of this transmission. The question is how many have been produced up to today.

THE ANSWER

50,000

A PROVEN TRANSMISSION.

This transmission, built and pioneered by Fendt, has been part of the tractor industry since 1996. The average life of the CVT is 9000hrs with many achieving as high as 14000 hrs flawlessly. All problem opportunities have been examined. If service is required, simply remove the cab and the plate on top of the transmission, unhook the hydraulic lines and shafts, and pull the insert. Splitting the tractor is not necessary. Replacement of the CVT transmission requires only a fraction of the time and money needed to rebuild a powershift transmission

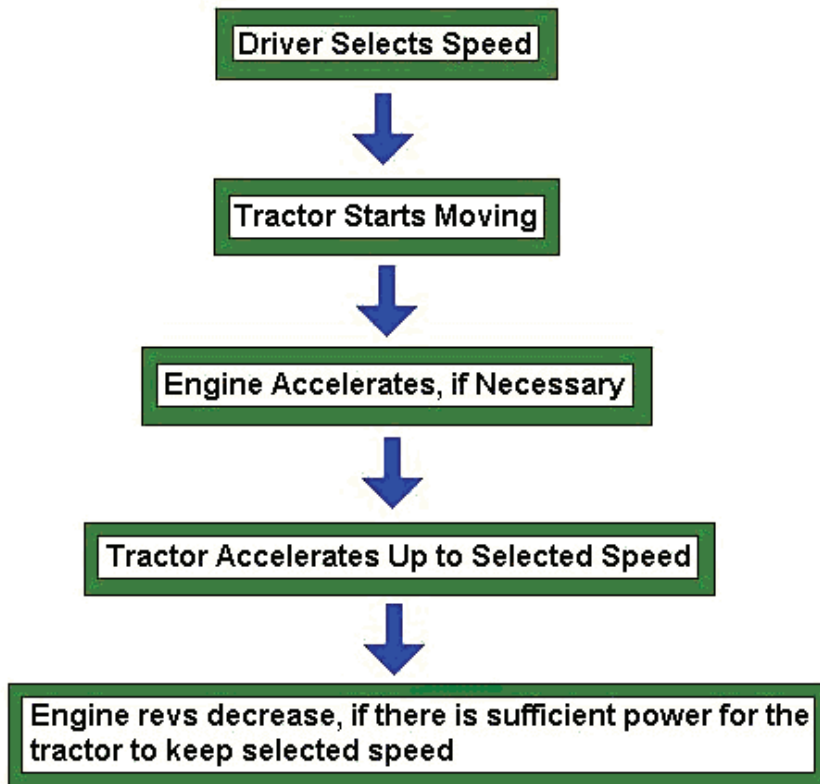
NOTE:

In summary, this reliable transmission is easier and cheaper work on.



MYTH: It's complicated to get the most efficiency out the transmission

TRUTH: Exclusively offered by Fendt, the Tractor Management System (TMS) is an electronic engine and transmission control that automatically matches engine speed and transmission ratio to ground speed setting and power demands. TMS can be operated in either joystick or foot pedal mode. It is known that the CVT delivers great fuel efficiency. Since the engine speed and the power requirements are continuously monitored and matched automatically, the TMS system achieves even better fuel efficiency



MYTH: The Vario CVT is complicated to operate

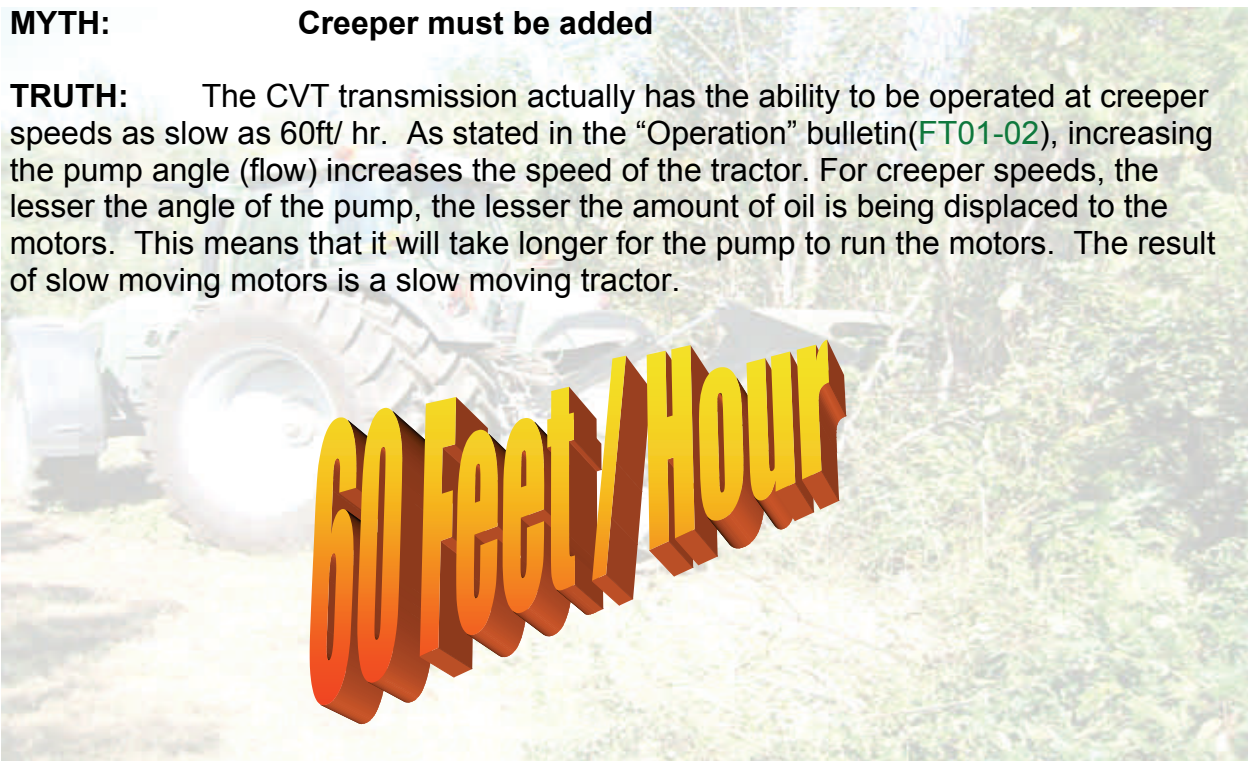
TRUTH: The Fendt Vario CVT transmission is the STANDARD for operational simplicity. The transmission can be activated, travel direction selected, shuttled forward and reverse, and cruise control engaged from one location, the joystick. If an uneducated operator sat in the tractor and ignored everything and concentrated only on the joystick, they would be up and running in little time.

For an operator to understand the rest of the features of the tractor such as preset engine speeds, cruise control settings, foot pedal, headland management, Vario terminal, etc., is a learning curve like with any other brand. To overcome this, the dealer must spend time explaining how to operate these features in the best way to maximize the tractor's efficiency.



MYTH: Creeper must be added

TRUTH: The CVT transmission actually has the ability to be operated at creeper speeds as slow as 60ft/ hr. As stated in the "Operation" bulletin(FT01-02), increasing the pump angle (flow) increases the speed of the tractor. For creeper speeds, the lesser the angle of the pump, the lesser the amount of oil is being displaced to the motors. This means that it will take longer for the pump to run the motors. The result of slow moving motors is a slow moving tractor.



Summary Advantages:

- **Infinite Speeds** allow smooth acceleration and optimum speed for every application.
- **No Clutch Packs in the CVT** reduce wear, extend life, and reduce power loss to the ground and increase reliability due to fewer moving parts.
- **Over 50,000 CVT transmissions** have been produced since 1996 making it proven technology compared to the competition who are only entering the market.
- Gain **Maximum Profitability** through optimal utilization of engine power, maximum fuel efficiency, and lowest fuel consumption.
- **Planetary Gear Setting** splits the power from the engine and directs it through the hydraulic and/or mechanical portion of the transmission maximizing power to the ground.
- **The CVT is Not an Electrical Nightmare** and can be operated manually. This is not true about the competition.
- **Creeper functionality** is included in the CVT. This feature is not field installed.
- Getting the **efficiency** out of the CVT is simple by lowering engine rpm.
TMS (Tractor Management System) controls the transmission and engine to operate at the highest efficiency possible.
- **Separate Hydraulic Reservoirs** keep auxiliary hydraulic remote oil away from the transmission
- **Foot Pedal Mode** allows increased functionality on the road, field, and many other applications.



TRUTH VS. MYTH