UTIMATE
TRANSMISSIONS

Ultimate Transmissions Design and Construct Development Offer

250DFTV–IVT Transmission Performance Specifications

Ultimate Transmissions Design and Construct Development Offer

General Description

The Transmission proposed is configured for a Front wheel drive application fitting within the envelope required for a Jatco push belt transmission with a maximum input torque of 200Nm. It is generally referred to as a “Two regime IVT transmission with geared neutral”

A DFT based CVT is connected directly to the output shaft of the IC engine. A secondary fixed ratio gear connection from the input shaft drives the planet carrier of a planetary gear-set. Another fixed ratio geared connection from the output of the CVT drives the sun while the ring-gear drives the output to the differential, via a low-range clutch. The low-range clutch can disconnect the ring-gear from the differential and a second high-range clutch can connect the output from the CVT directly to the differential.

When the CVT is configured to output its high speed ratio with the low-range clutch connected the output, the transmission is in reverse, when in an intermediate ratio (between high and low) the output is zero. When the CVT reaches its low gear position, the output RPM is synchronous with the output RPM with the CVT connected directly to the output (without passing through the planetary gear-set). This synchronous rotation allows the low-range clutch to be disconnected simultaneously with the high-range clutch being engaged.

When the CVT ratio is moved to near the geared neutral state the low range clutch is relaxed to an extent that creates a small forward or reverse creep (dependant on gear selection), similar to the creep expected of a transmission fitted with a torque convertor. The modulation of this clutch controls the maximum output torque of the transmission.

At all times the low-range clutch protects the transmission from any torque spikes while in low range. The high range clutch can perform a similar function when in high-range.

The maximum differential slip RPM that can occur in the low range clutch is 40. This slip can run continuously at the maximum output torque for around 120 seconds without overheating. The maximum creep torque and creep RPM (while there is no depression of the accelerator or the vehicle is stationary) is limited to 3,000Nm. and 2,000RPM.

The transmission is fitted with a conventional parking gear and output to a speedometer cable.

Maximum Input Torque

The maximum input torque is 250Nm for the physical size specified here. Larger and smaller torques are possible with proportional increases and decreases in size and weight, up to 800Nm and down to 80Nm. Outside these limits it may become necessary to modify the transmission concept.

Maximum Output Torque

With an input of 250Nm. the maximum output torque is limited to 5,000Nm., (to the wheels) within this frame size

The maximum torque can be increased to around four times this provided the size of the secondary gears and clutches are increased to accept it, with a necessary increase in overall, transmission size. The output torque of an IVT is theoretically infinite.

Maximum Input RPM

The input RPM is limited to 7,000 for the proposed frame size. This can be increased without any fundamental affect on the transmission concept. With decreasing transmission input torque the increase can be very significant with 20,000RPM possible. Similarly there will be lower upper limits for very high torque inputs.

Size of Transmission

The volume of this transmission within this framework will be no greater than 16 litres with a maximum wet weight of 40 kg. No special materials are used to reduce weight other than simple aluminium alloys.

The overall dimensions will remain inside the envelope created by a similar output DCT or Push-belt CVT.

All components including the electronic ratio control, hydraulic clamping pump, hydraulic valves solenoids, differential and transmission casing are included. The cockpit controls and linkage mechanisms to the CVT are not included.

The Efficiency of the Transmission

The efficiency of the transmission will be above 97% in some circumstances and never perform below 90% provided the input RPM remains above 1,000RPM and the input torque above 50 Nm.

These efficiency expectations can be further refined once the detailed duty cycles of the transmission are defined in greater detail.

The overall average mechanical efficiency of the transmission when operating as a transmission for a normal automobile will be above 92%.

Efficiency includes all losses associated with the CVT planetary gearsets, clutches, differential, electronic ratio control, and hydraulic clamping hardware.

The Durability of the Transmission

The design life of the transmission will be based on 400,000kms. operating within a duty cycle expected of a “normal” automobile.

Transmission Ratios and Vehicle Speeds.

The ratios can be varied within a wide range with some maximum limits on reverse gear. Typically the output RPM from the differential with the IC engine running at 2,000 RPM can be as follows. The table also calculates vehicle speed using 600mm. diameter wheels.

Transmission state	IC RPM	CVT ratio	CVT output RPM	Transmission Output RPM	Vehicle speed in Km/hr including creep speeds
Top Gear Reverse	2,000	2.0	4,000	-83	-9.44
Geared Neutral Reverse	2,000	1.81	3,620	-5	-0.63 (-175mm./sec)
Geared Neutral Forward	2,000	1.785	3,570	+5	+0.63 (+175mm./sec)
Synchronous Ratio	2,000	0.5	1,000	+538	+61
Top gear forwards	2,000	2.0	4,000	+2,154	+243

The actual (top-gear) speed of 243km/hr may not be possible at 2,000RPM and will depend on vehicle power plant performance, vehicle aerodynamics and wind speeds.

The actual vehicle speed in the geared neutral position will be zero controlled by application of the brake or road inclination, or both. The creep speed will only exist when the vehicle is on a level surface with no accelerator depression and no application of the brake.

Operator Control

The simplest form of operator control is a gear lever with the following

- Park
- Reverse
- Neutral
- Forward

Other systems can be incorporated including dial up Creeper Speeds, Cruise Control, and different forms of drive such as Eco, Sports and Off-road.

System Integration

The transmission is fitted with all necessary outputs to allow integration with other vehicle systems. The control system provided contains only that hardware required to operate the transmission itself.

Parts Count

The parts count is based on counting each individual part (bolt, nut, “O”ring, gear, shaft, etc) as a single part with the following full assemblies treated as a single part.

- Bearings
- Seals when composed of more than one material.
- Transmission housing when made of several parts including seals and gasgets.
- Electric Motor actuating the ratio control gearbox including fasteners and electric harness.
- Gearbox actuating the ratio control screw including fasteners.
- Hydraulic block containing all valves and distribution galleries
- Electric Motor and gearbox driving high pressure hydraulic clamping pump and low pressure lubrication pump.
- Paired Hydraulic Pump providing high-pressure and low pressure fluid for clamping/clutches and lubrication.

The table below outlines the parts associated with the four key transmission segments.

SEGMENT	Number of part types	Total number of parts	Weight of parts
CVT traction parts	3	10	6.02
CVT non traction parts	39	206	8.17
IVT gears and clutch systems	46	192	10.87
Casing controls and hydraulics	22	22	8.86
Lubricants	2	2	5.52
TOTAL	112	432	39.44

Design and Construct Offer

Ultimate Transmissions will manage the design and development of a transmission based on these general specifications and other particular specifications according to the following stages with payments made according to successful completion of each stage and in accordance with an agreed payment scheme.

1. Mobilization payment
2. Concept development and design mathematics
3. Working drawings of prototype
4. Parts drawings of prototype
5. Manufacture and procurement of all internal prototype parts
6. Manufacture and procurement of prototype casing
7. Assembly and test run of prototype
8. Full Testing of prototype.
9. Test report and recommendations
10. Full concept design of production transmission.
11. Full design of production transmission.
12. Parts design for production transmission.
13. Supervision of production.

An ongoing royalty will apply to all transmissions made according to the design or using the Double roller CVT. The royalty fee and terms will be negotiated on a case by case basis.

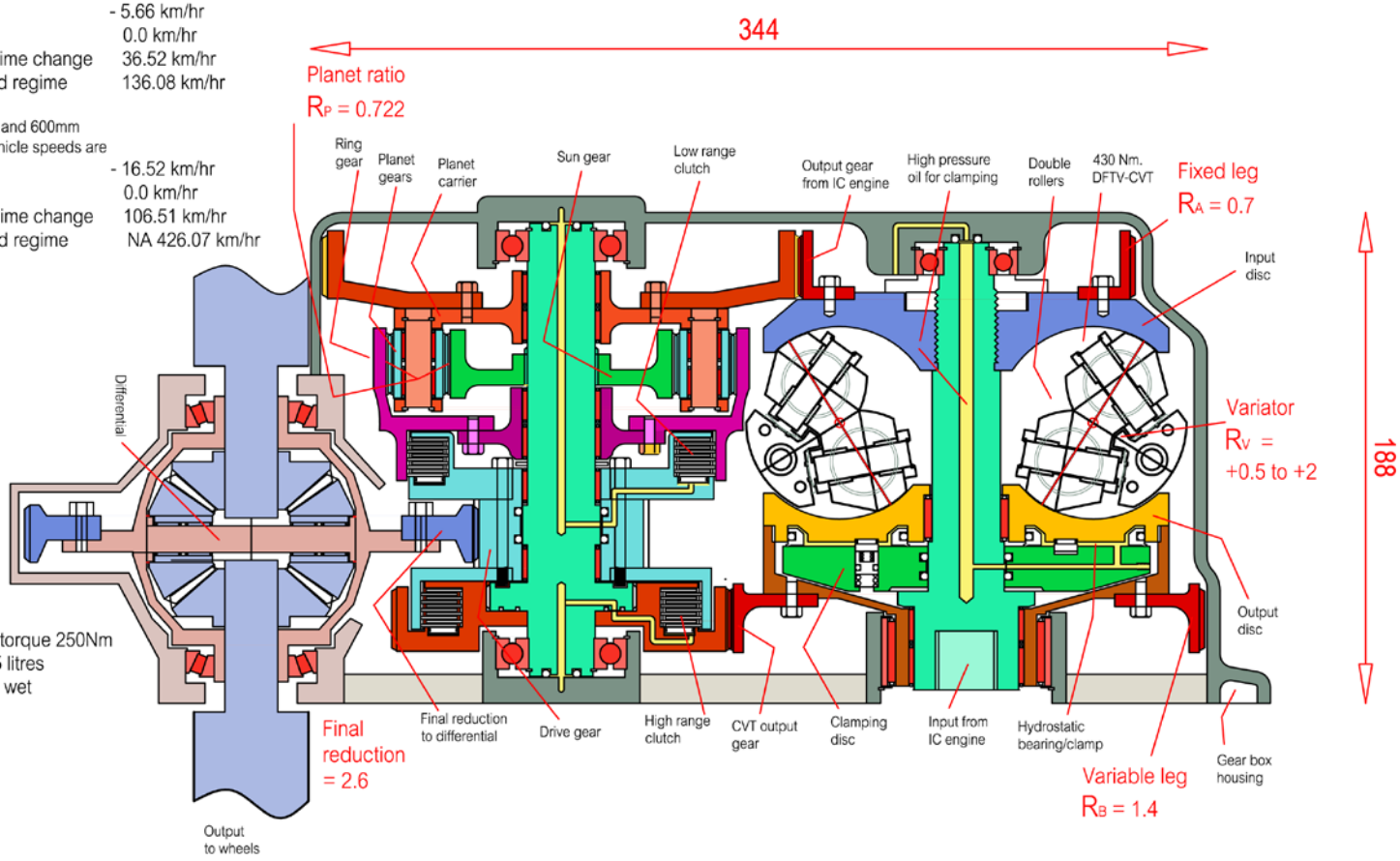
Ultimate Transmissions Design and Construct Development Offer

TWO REGIME IVT
At 1,200 RPM input and 600mm diameter wheels vehicle speeds are

Reverse	- 5.66 km/hr
Geared Neutral	0.0 km/hr
Syncronous Regime change	36.52 km/hr
Top Gear second regime	136.08 km/hr

At 3,500 RPM input and 600mm diameter wheels vehicle speeds are

Reverse	- 16.52 km/hr
Geared Neutral	0.0 km/hr
Syncronous Regime change	106.51 km/hr
Top Gear second regime	NA 426.07 km/hr



Maximum input torque 250Nm
Total Volume 15 litres
Weight 37.5 kg wet

www.ultimatetransmissions.com.au