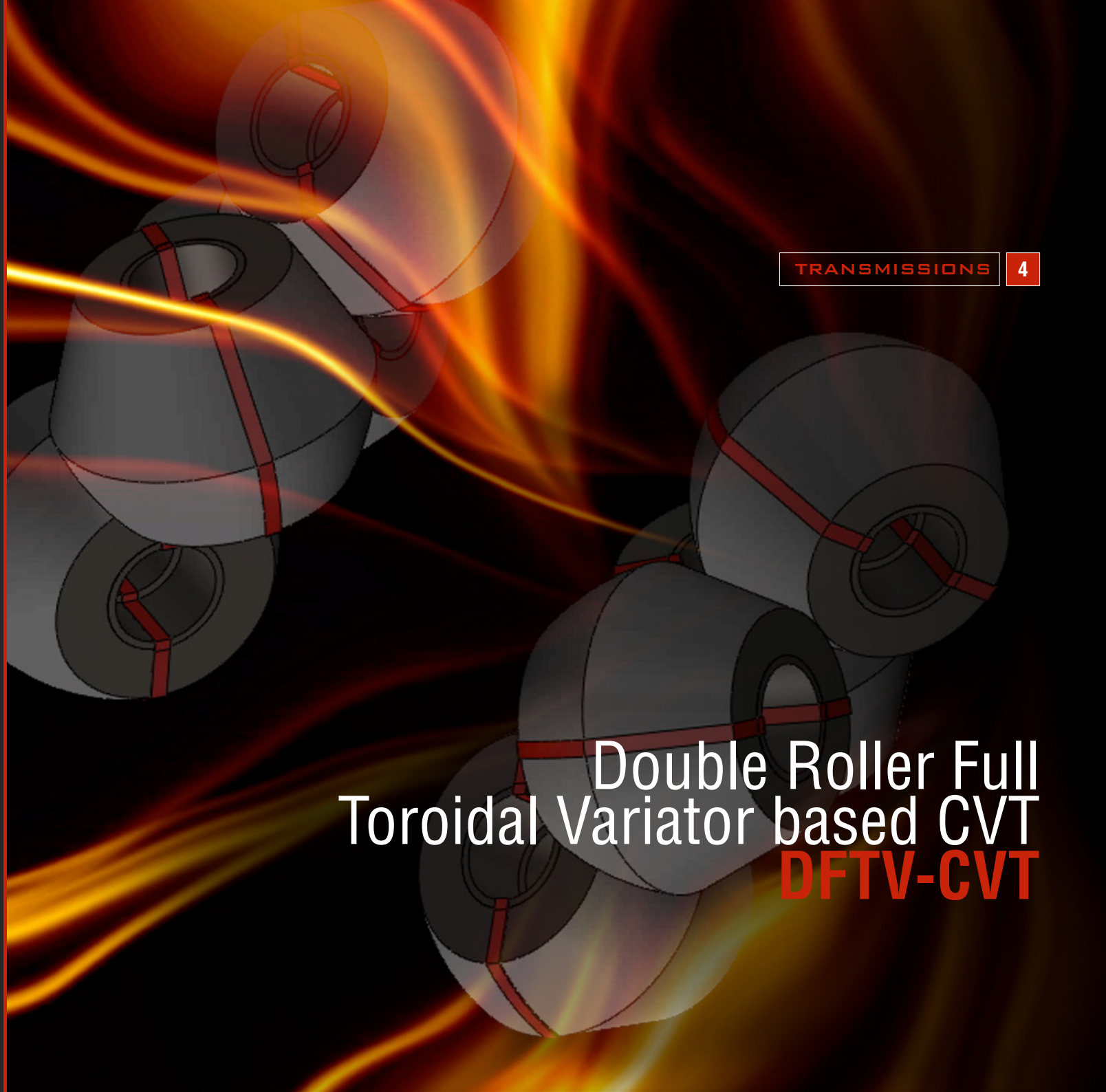
UTIMATE
TRANSMISSIONS

TRANSMISSIONS 4



Double Roller Full Toroidal Variator based CVT
DFTV-CVT

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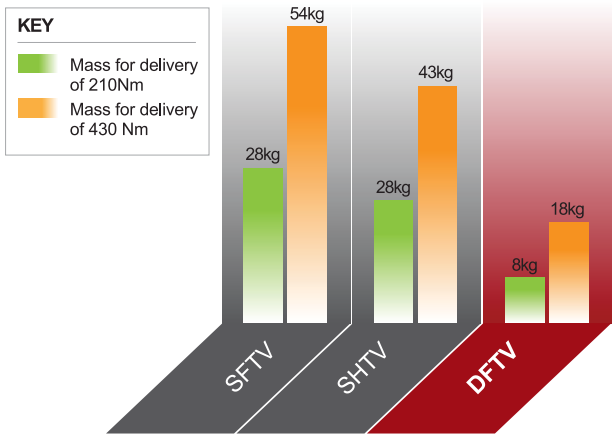
Overview

The Double Roller Full Toroidal CVT is more compact than the other single roller variants of SFTV (Torotrak) and SHTV (Nissan NSK).

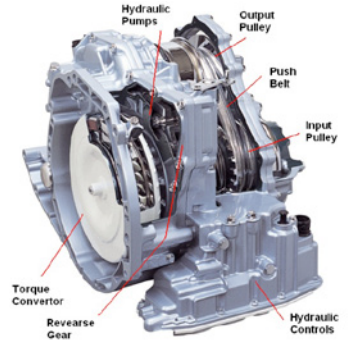


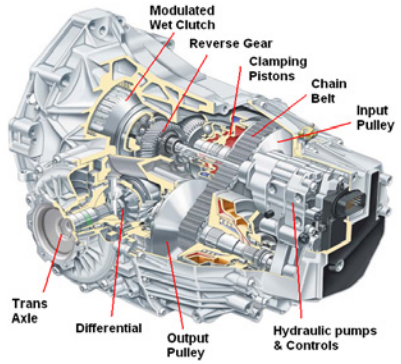
This chart is the result of studies carried out by Ultimate Transmissions which defines this advantage in terms of the relative mass of the three.

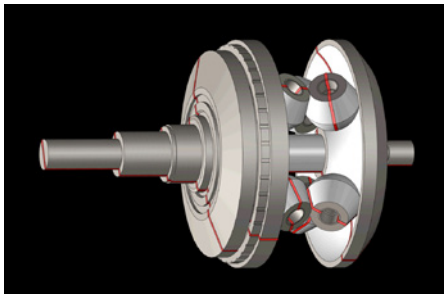
This makes a simple CVT application more compact than either a belt (Jatco) or chain type CVT (Audi).

The diagrams beside depicts a typical Push-Belt and Pull Chain type CVT and a DFTV. The Jatco is arranged for a typical East West engine front wheel drive while the Audi is arranged for a front wheel drive with a North south Engine and an AWD option.

These types of arrangement are typical of most CVT's. A Torque convertor or modulating wet clutch is used as the launching device with the CVT belt or chain providing the variable ratio. The necessary hydraulic supply for belt clamping and ratio control is typically integrated into the design. A set of clutches and planetary gear set allows selection of reverse and forward gear. In a front wheel drive application the Differential is integrally mounted with the CVT to drive the front wheels.







Double Roller Full Toroidal Variator based CVT (DFTV-CVT)

In a typical Jatco CVT a torque convertor is used as the launching device with the belt and pulleys providing the variable ratio.

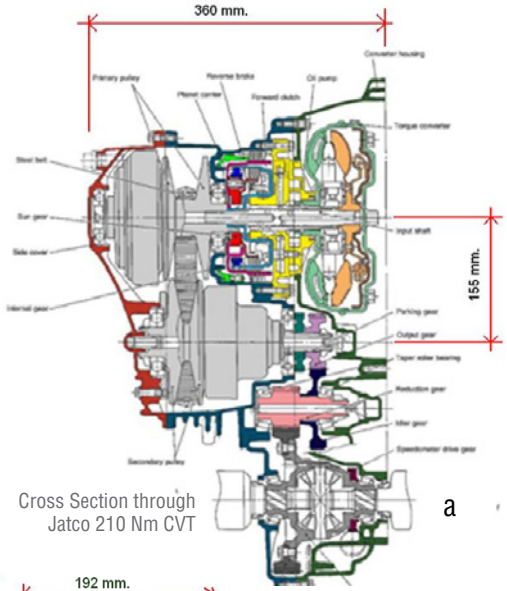
The necessary hydraulic supply for belt clamping and ratio control is mounted between the torque convertor and the CVT. A set of clutches and planetary gear set allows selection of reverse and forward gear. The differential is internally mounted to drive the front wheels.

Jatco do not make a CVT for rear wheel drive cars, other than their involvement with Nissan and the NSK Extroid.

The diagram (a) below is a diagrammatic section of one of these types of transmission suitable for a maximum input torque of 210Nm.

It can be seen that an idler gear is needed between the differential and the CVT output in addition to a parking gear and speedometer takeoff.

NOTE that the transmission is shown "folded" for clarity.



Cross Section through Jatco 210 Nm CVT a

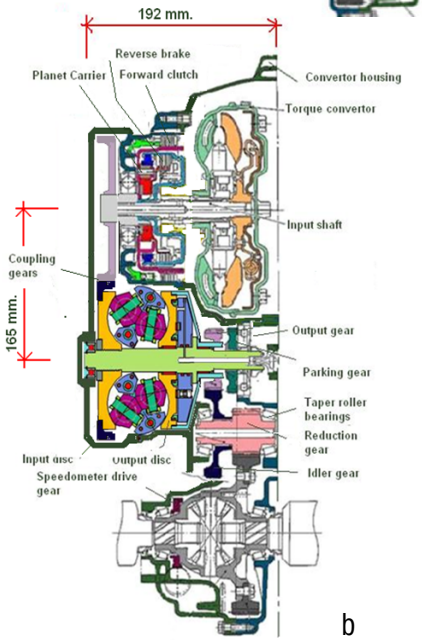
A DFTV – CVT based on a maximum input torque of 250 Nm is depicted in this diagrammatic section (b).

The Torque Convertor is maintained as for a Jatco transmission

The hydraulics are much smaller and are driven by an electric motor outside the body of the transmission

The section is shown "folded" out as for the other transmissions .

The same basic architecture adopted by the Jatco CVT is uses with the torque convertor and forward reverse gears and clutches located between the Variator and the IC engine. The same idler gear and and differential are used.



b

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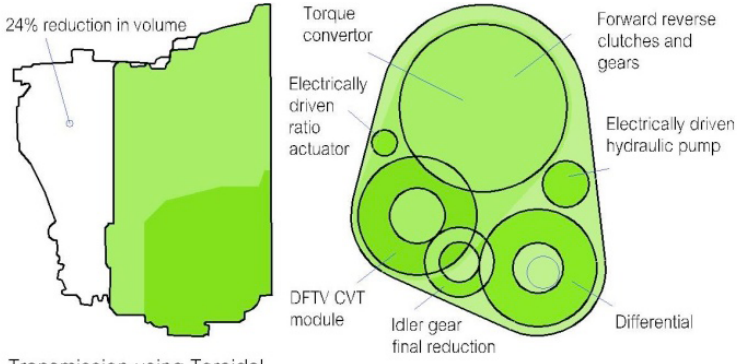
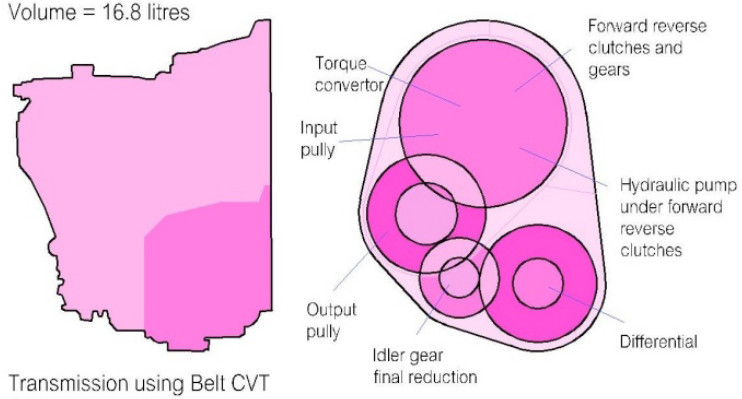
Double Roller Full Toroidal Variator based CVT (DFTV-CVT)

The diagram demonstrates the much smaller mechanical volume of the DFTV based CVT.



Transmission using Toroidal CVT and Torque convertor
Volume = 16.8 litres



Transmission using Belt CVT & torque convertor
Volume = 22.2 litres

COMPARISON OF BELT AND TOROIDAL CVT USING TORQUE CONVERTOR IN FRONTWHEEL DRIVE ARRANGEMENT

DFTV – CVT Compared to Pull Chain CVT

The DFTV based CVT can also be compared to the Audi pull chain CVT (a).

Audi uses a wet friction clutch as the launching device and mounts the hydraulics in a different position outside the CVT itself.

This transmission is capable of 350Nm of input torque.

(b) The overlay diagram below demonstrated very clearly the compactness of the DFTV arrangement.

A DFTV – CVT based on a maximum input torque of 250 Nm is depicted in the earlier diagrammatic section.

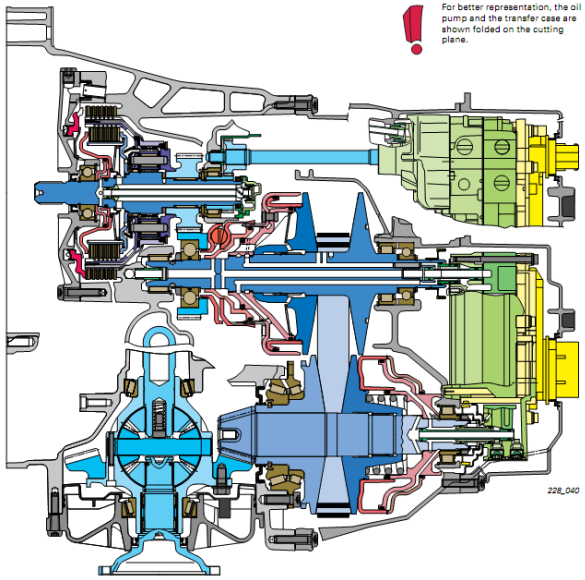
Efficiency

The efficiency of a DFTV Variator mechanism is much higher than a Push Belt or Pull Chain CVT. Its maximum efficiency (without control or clamping) is over 99% while the maximum efficiency of a Pull-chain CVT is 95%.

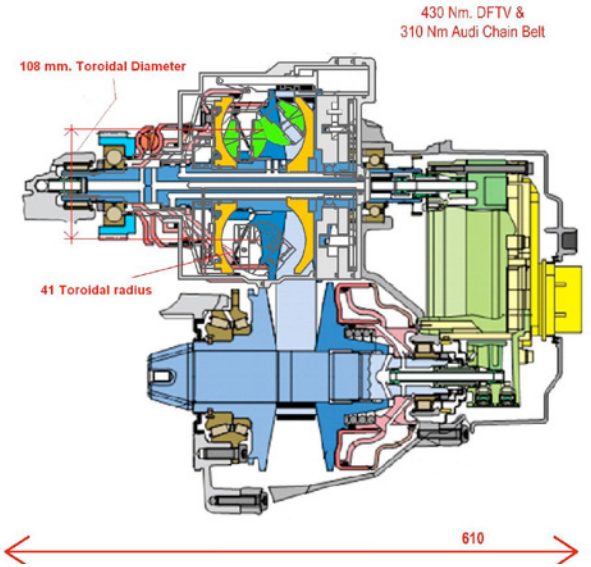
All three types types also require power to operate the CVT clamping and ratio controls.

The Pull-chain and Push Belt CVT uses a hydraulic pump to provide both of these. In these CVTs high pressure oil is needed in large quantities to move the pulleys against very high forces during a ratio change. This pump typically consumes 5% of the input energy when the CVT is operating at its most efficient state.

The DFTV uses an electric motor to drive the hydraulic pump for clamping. No oil other than makeup leakage is required which



a



b

DFTV – CVT Compared to Pull Chain CVT

gives rise to a very small pump. The ratio control is supplied by another very small electric motor. Very little force is needed to change ratio. The electric motors require less than 1% of the input power.

The DFTV operates across a working range of ratios and power settings at over 96%. The Pull-chain CVT operates similarly at less than 88%.

Fuel Savings

A CVT operating at around 88% will still outperform the fuel efficiency and CO2 emissions of a 6 speed automatic.

This is because it can hold the IC engine at its most efficient power delivery during acceleration.

Operating at above 95% a DFTV - CVT will deliver over 10% greater fuel economy than any automatic or DCT.

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