CITGO Automatic Transmission Fluid

The webinar will begin in less than 10 minutes.

Abdul Maye

CITGO Automatic Transmission Fluid

The webinar will begin in less than 5 minutes.

Abdul Maye

CITGO Automatic Transmission Fluid

Abdul Maye

Abdul Maye

- CITGO Sr. Product Specialist
- BS, Chemistry
- 15 Years Experience in Lubricants
- STLE Certified
  - Oil Monitoring Analyst I

Automatic Transmission Fluid Agenda

Automatic Transmission Market Trend

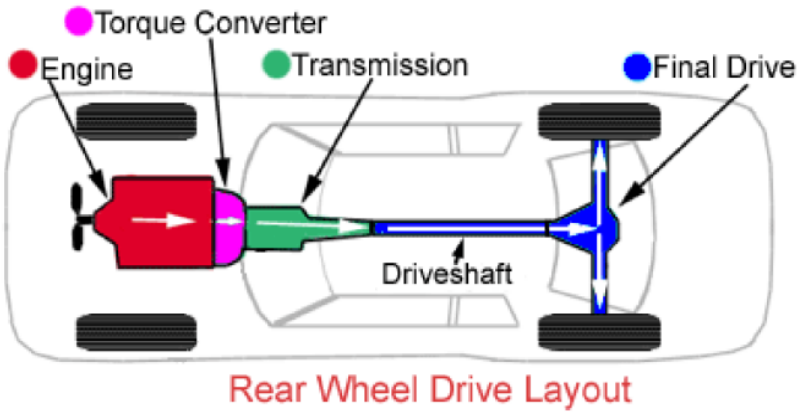
Automatic Transmission Hardware

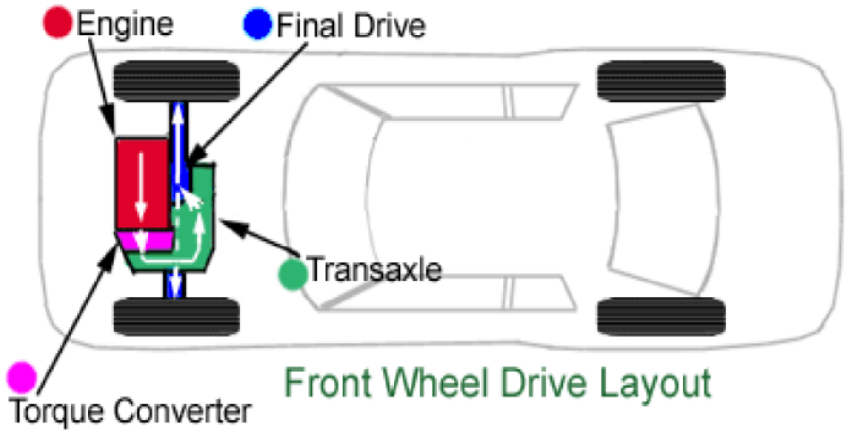
- Stepped Planetary Automatic Transmission
- Dual Clutch Transmission
- Continuously Variable Transmission (CVT)

Automatic Transmission Fluid Formulation

CITGO ATF Product Line

What does Transmission do?





Power Transmission Fluids (PTF)

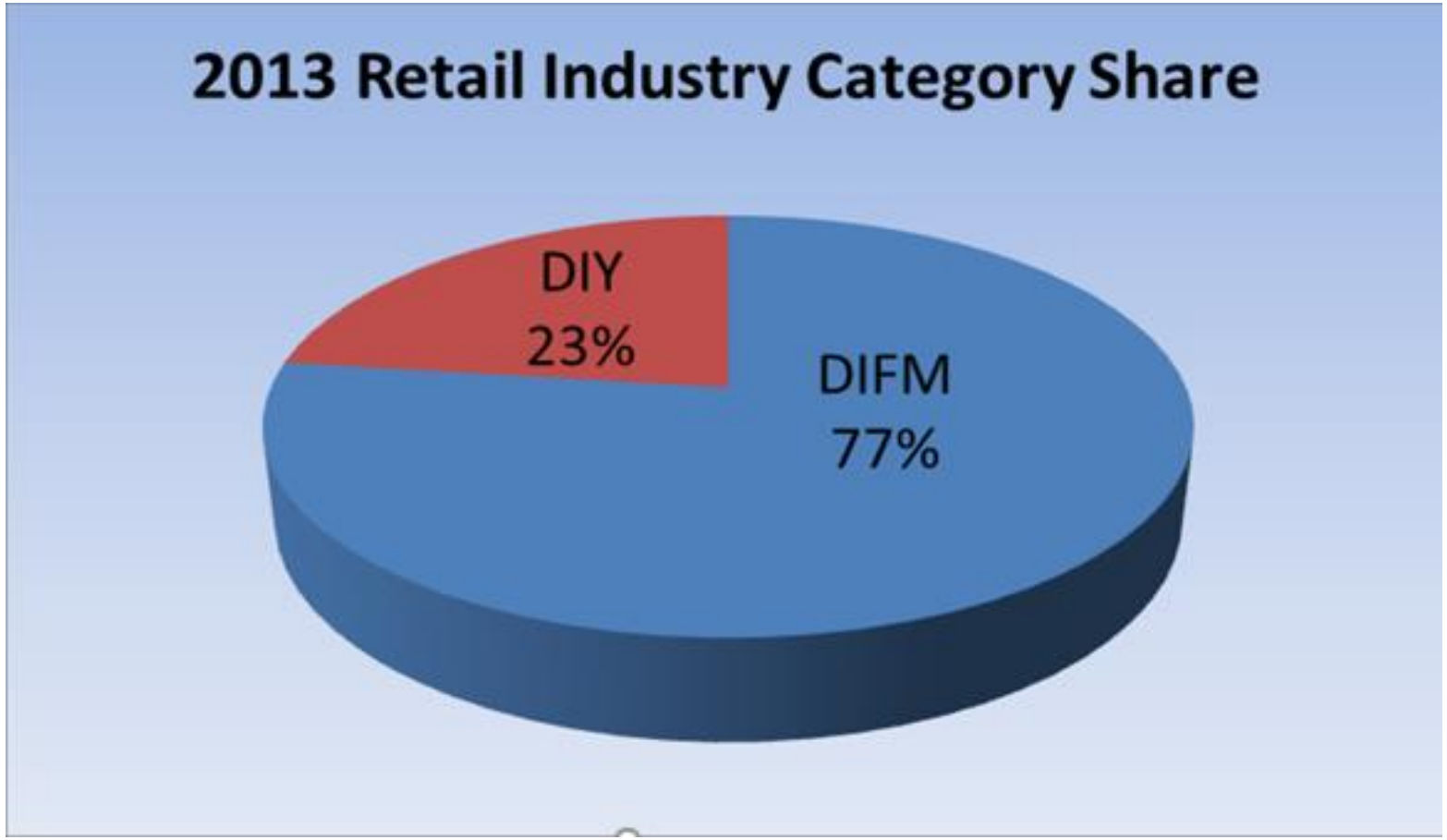
Describe fluids necessary for proper operation of automatic transmissions including: stepped automatic transmissions, dual clutch transmission, continuously variable transmission, etc.

Automatic Transmission Fluid (ATF)

Generally refer specifically to fluids for stepped automatic transmission fluid

Industry Trends

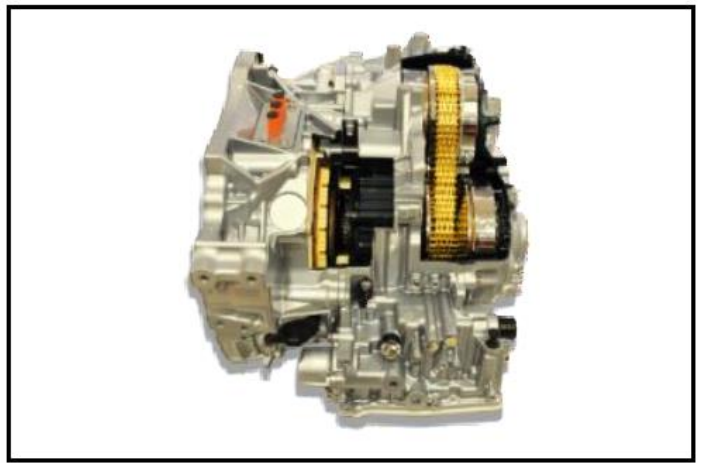
- DIFM continues its decades-held rank as majority shareholder of consumer's wallet



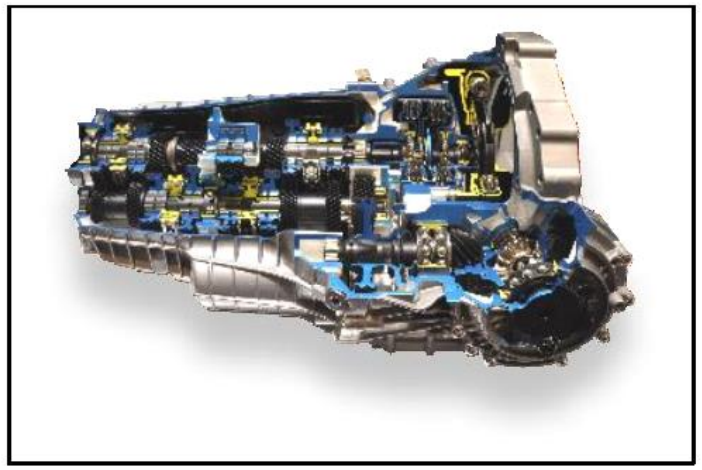
ATF Industry Trends

- ATF technology is in constant change due to emissions and fuel efficiency.
- Latest Automated Transmission technology specifies only synthetic fluids for precise control of fluid properties
- Fill for life and new technology is driving the industry for extended drains in ATF

Step AT



CVT



DCT

Types of Transmission

Stepped Automatic Transmission (AT)

Most common automatic transmission that uses a planetary gear set and a torque converter

Continuously Variable Transmission (CVT)

Automatic transmissions that use variator pulleys with an unlimited number gear ratios

Dual Clutch Transmission (DCT)

Automatic transmissions that use manual gearbox architecture with dual clutches

Automated Manual Transmission (AMT)

Manual transmissions that use servos to engage clutch and change gears automatically

Dedicated Hybrid Transmission (DHT)

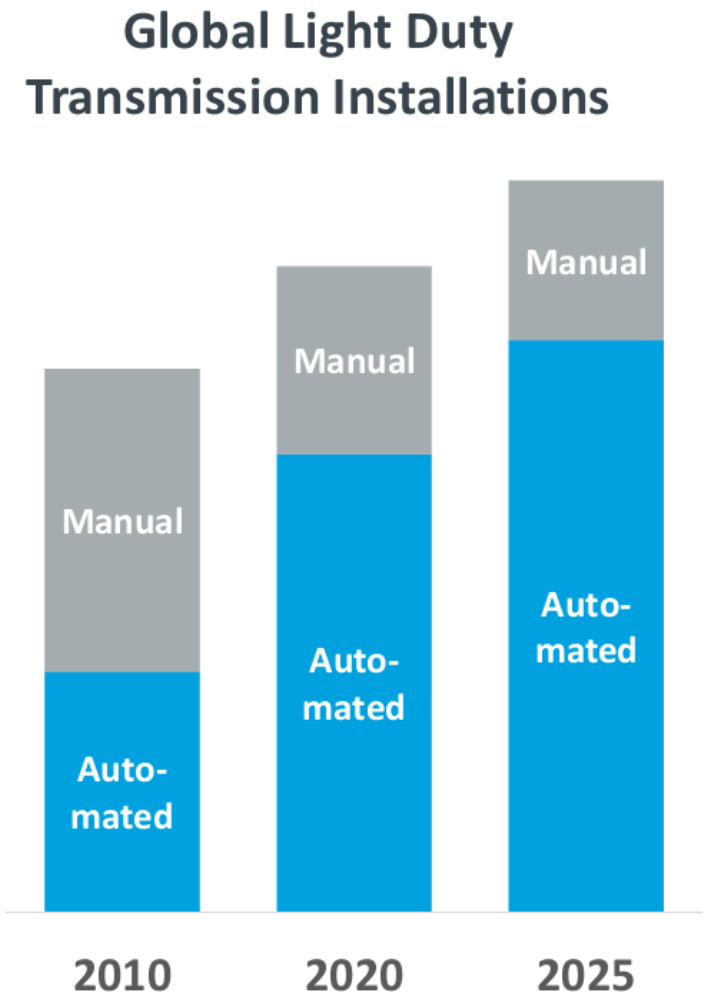
Combines stepped automatic transmission with electric motor
(e.g. Toyota's Hybrid Synergy Drive)

Reduction Transmission (Electric)

Transmissions used by purely electric vehicles to increase torque output from electric motors
(Nissan Leaf)

Manual Transmission (MT)

Global Transmission Installations



Passenger Car And Light Duty Truck Transmission Installations

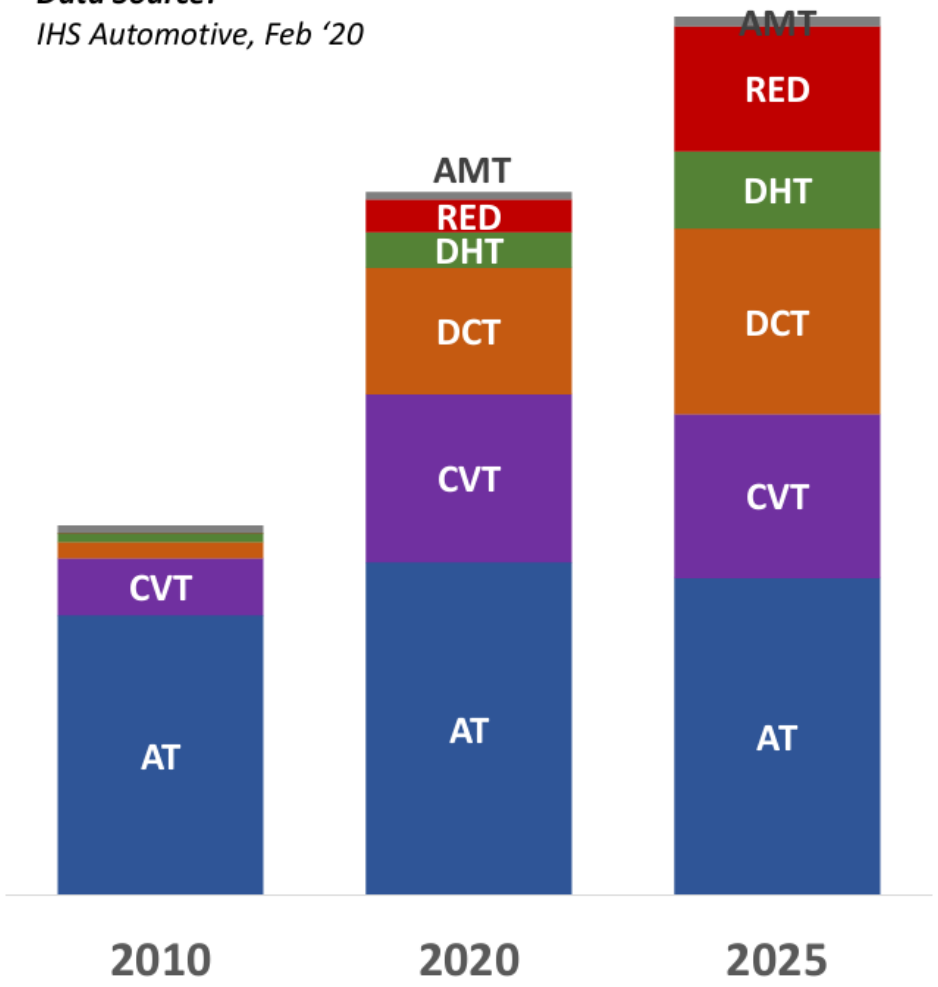
Manual
Market share declining with inherent lower cost now being offset by fuel economy *debit*

Automated
Market share increasing with fuel economy now better than manual. Increasing diversity in design

Source: Infineum

Global Automated Transmission Installations

Data Source:
IHS Automotive, Feb '20



Automated Manual Transmission (AMT)
Some production increase, market share low and declining

Reduction Transmission (Electric)
Large electric vehicle increase, market gaining momentum

Dedicated Hybrid Transmissions (DHT)
Large hybrid vehicle increase, continuing market share growth

Dual Clutch Transmission (DCT)
Large increase, with market share gain in China and Europe

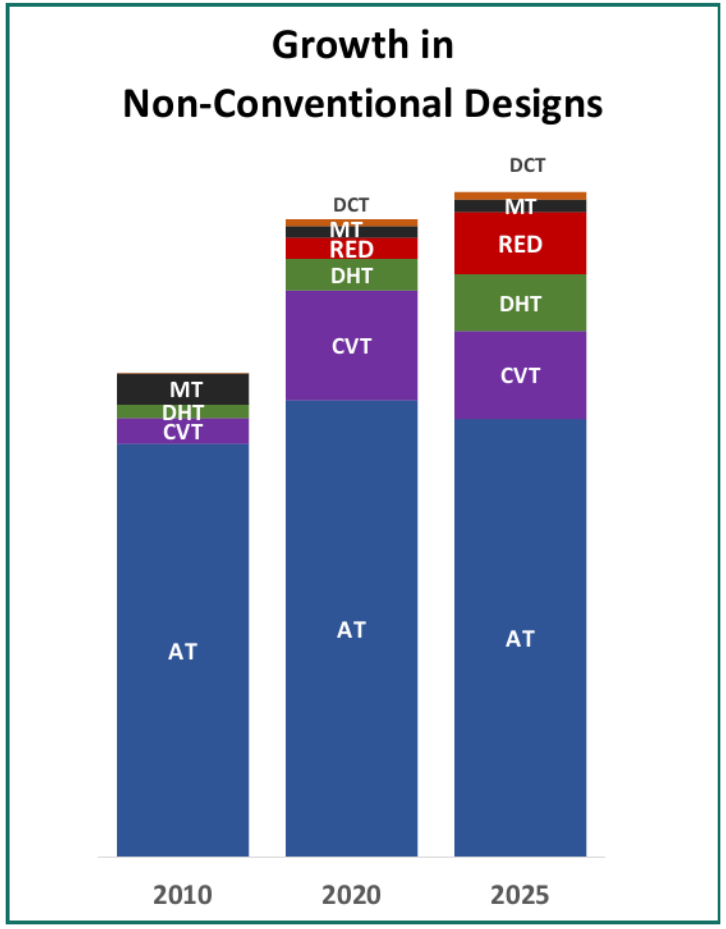
Continuously Variable Transmission (CVT)
Increase in production now peaking with electrification

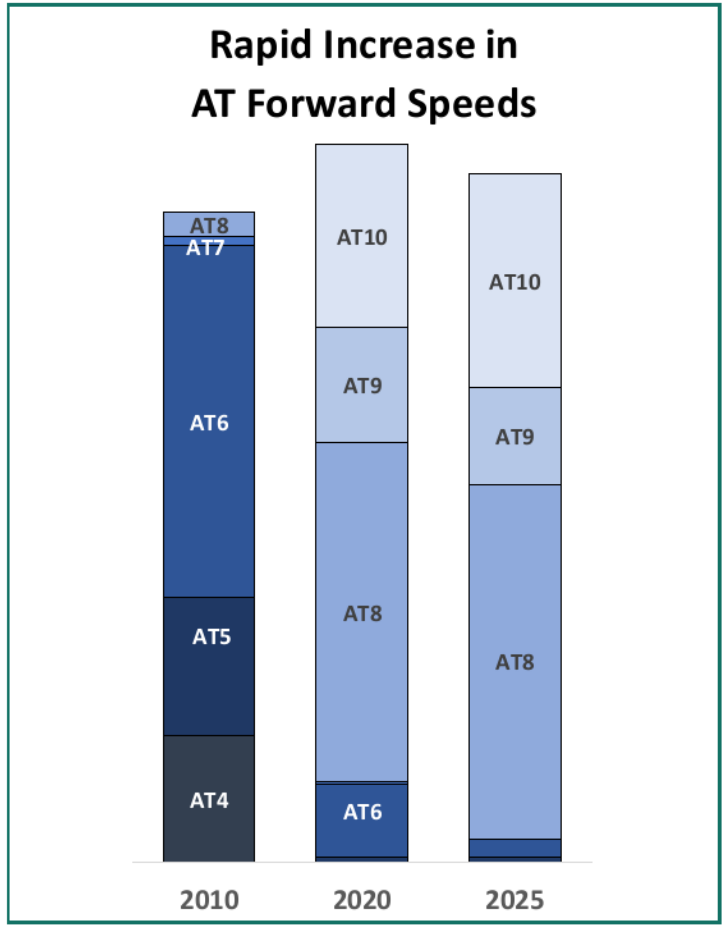
Stepped Automatic Transmission (AT)
Production slowly declining, with growing diversity of designs

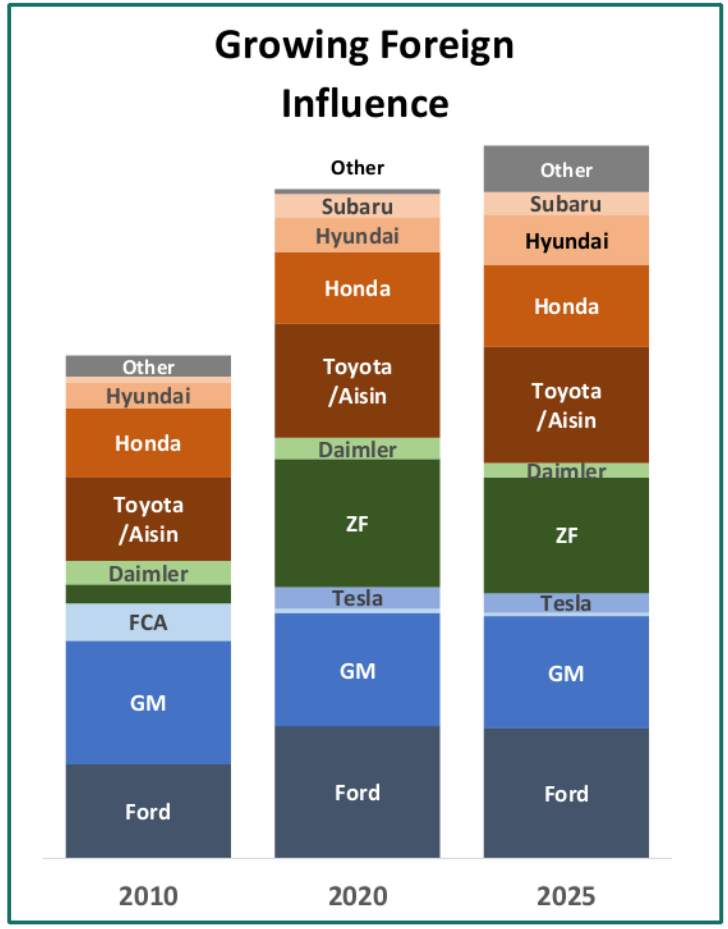
Transmission Hardware Trends:

North America Installations – CAFÉ Impacts

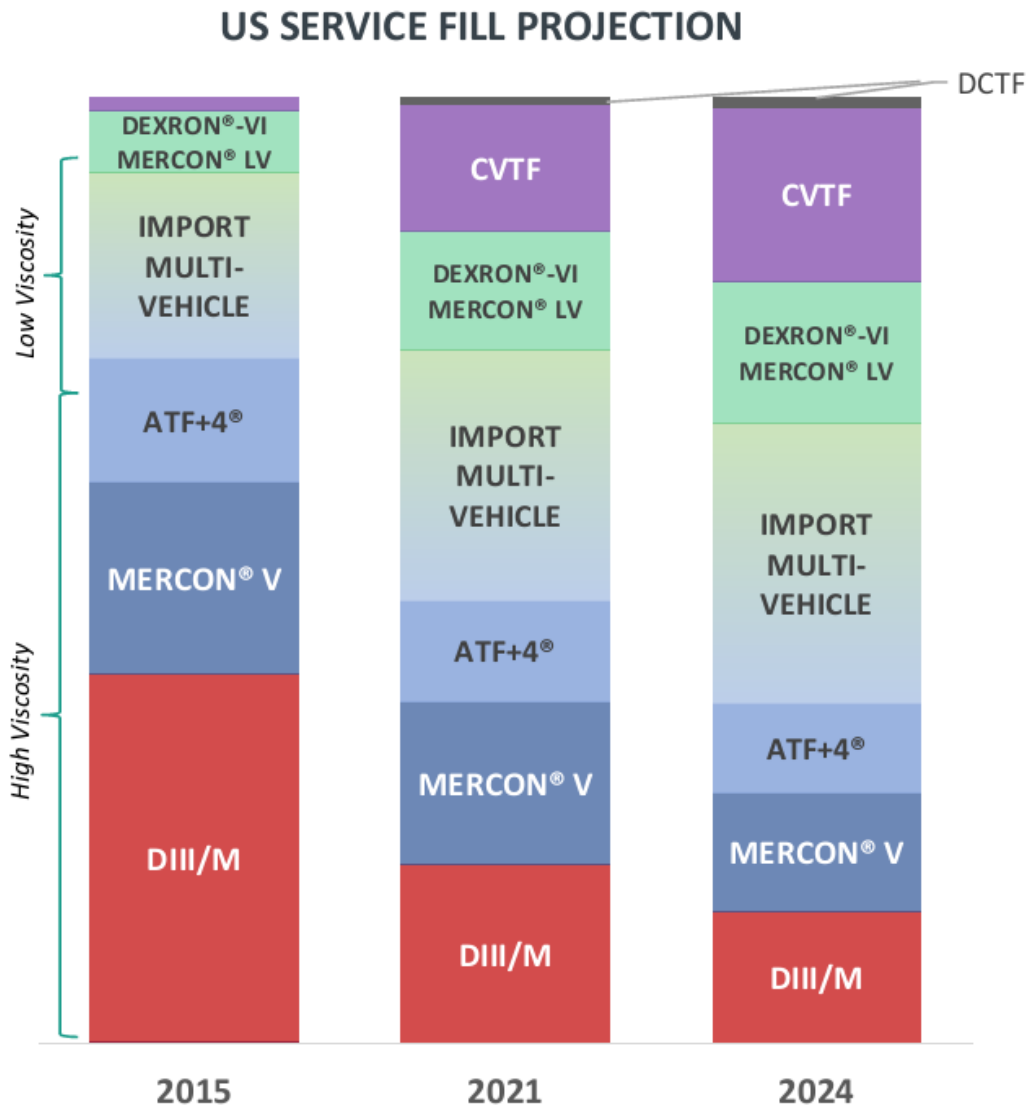
Data Source: HIS Automotive. Feb'20







ATF Market Review: Low Viscosity ATF Growth



Type F: true vehicle requirement <0.1%

low cost, hard shift, other applications

DIII/M: declining to <20%

low cost also keeping market afloat

MERCON® V: also declining to <20%

all out of warranty period

ATF+4®: stable at ~10%

still used by Chrysler

Import Multi-Vehicle; growing to >25%

greater, if also for GM and Ford licensed applications

DEXRON®-VI/MERCON® LV: increasing, >10%

Fords now reaching 150,000 mile ODI

Ultra Low Viscosity [ULV] – negligible demand

Recently introduced, also with long ODI

CVTF: growing to >10% demand

- CVT installations up, with relatively short ODIs

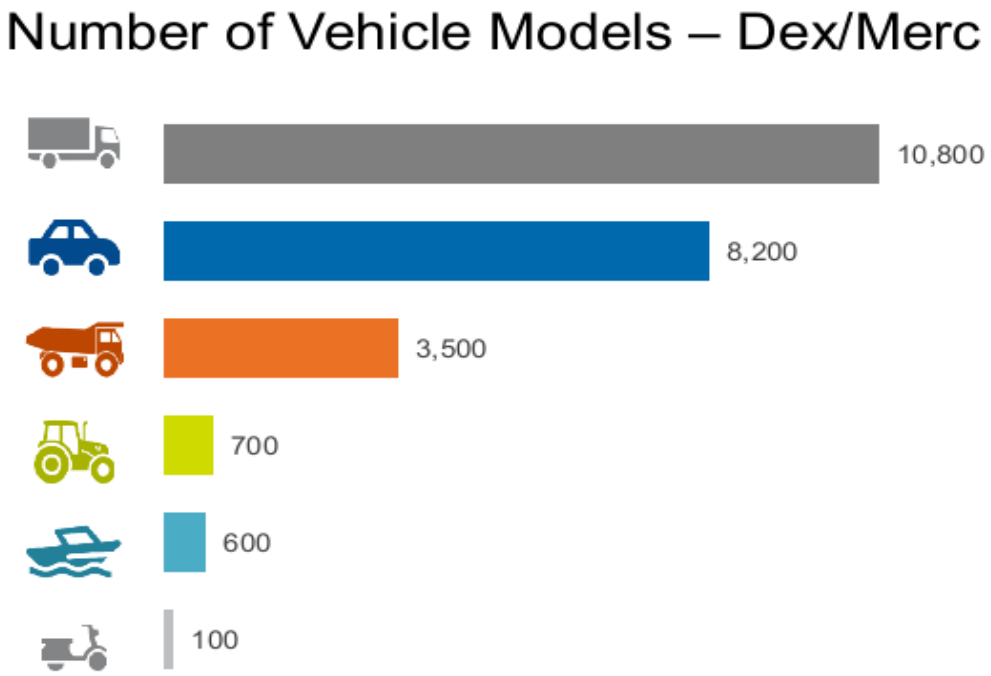
DCTF: less than 1% demand

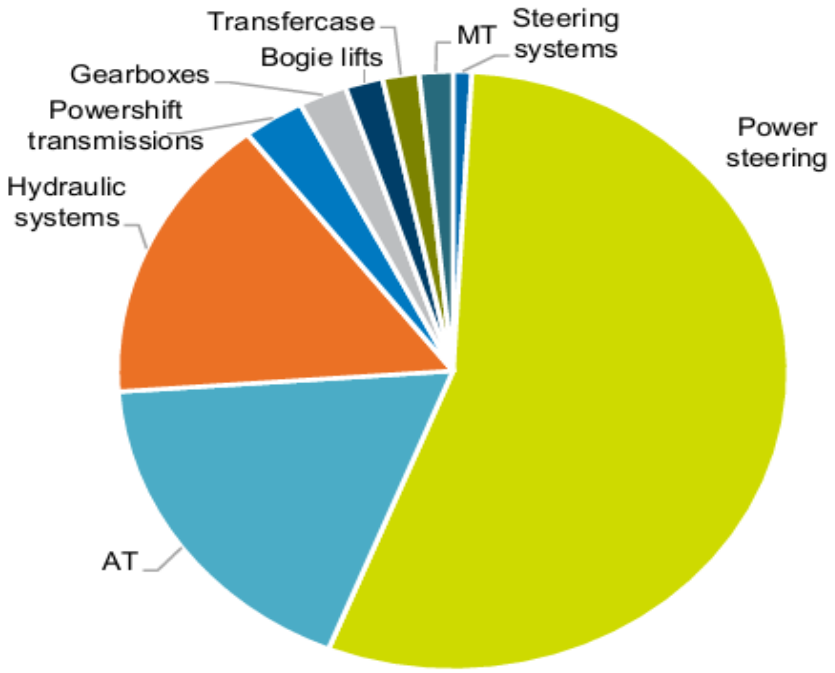
few DCT installations in US

Source: Infineum

Industry Trends

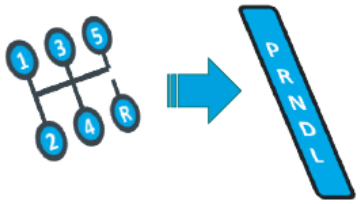
Dex/Merc is more than just PC ATF:





Due to the many applications of Dex/Merc there will still be a demand for many years in the service fill market

Market Summary



Growing use of automated transmissions

- Now providing better fuel economy than manuals
- Manual production is now lower than automatics

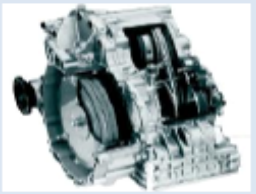
Stepped Automatics are still the majority

- Gaining more gears – most now >8-speeds
- Major manufacturers are Ford, GM, ZF and Toyota
- CVTs and DCTs are gaining market share
- Increasing use of hybrid and reduction gear boxes for electric motors

Most automatic transmission fluids are now lower viscosity

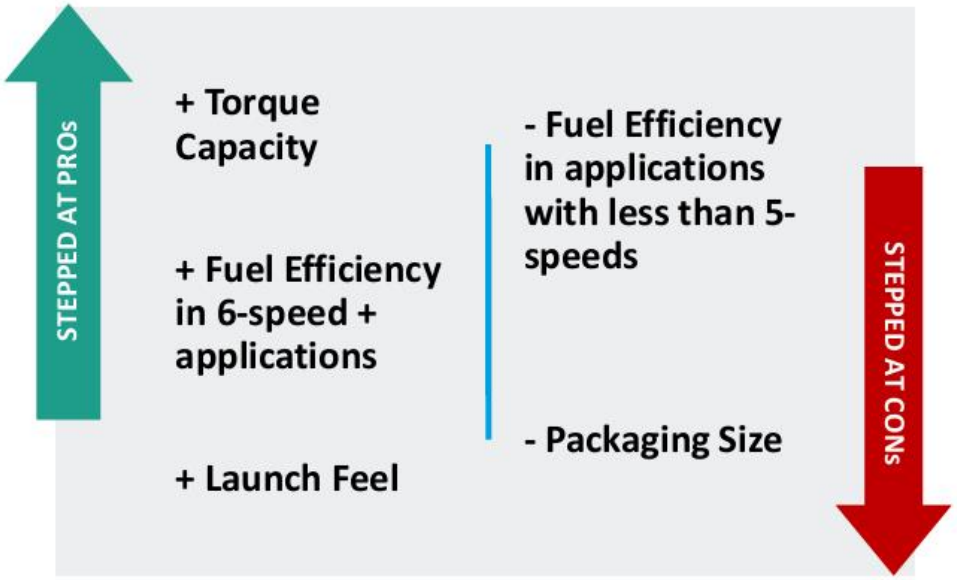
- Less churning loss leads to better fuel economy
- Import multi-vehicle ATFs gaining market share, often with GM and Ford approvals
- CVT fluid demand increasing, with short drain intervals

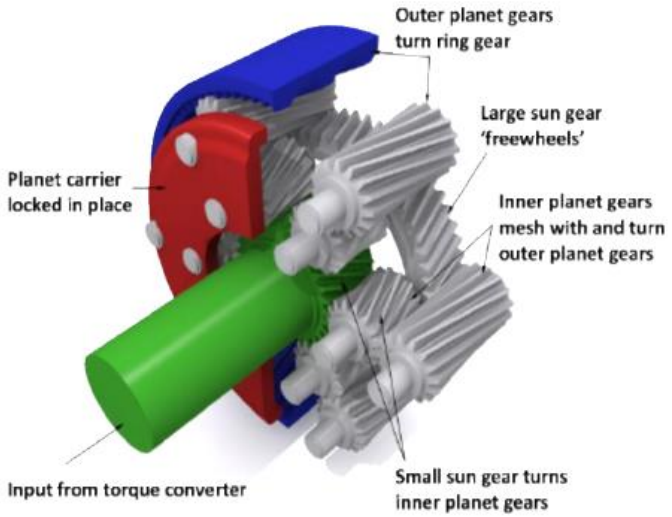
Comparison of Passenger Car Automatic Transmissions

AT Type	Planetary	CVT	DCT
			
Torque Capacity	Best	OK	Good
Fuel Economy	OK	Good	Best
Manufacturing Costs	Expensive	Most expensive	Least expensive
Ideal Car Segment	Full-size/luxury	Micro to medium	Medium – Full
Primary Global Region	North America	Asia	Europe
General Advantages	➢ Easily handles high loads and torque ➢ Smooth start and comfortable gear shifts ➢ Most widely used and proven AT	➢ Infinite gear ratios for optimum engine rpm range ➢ Unnoticeable gear shifting with constant acceleration ➢ Suited for FWD and hybrid vehicles	➢ Rapid comfortable shifting without interruption ➢ Suited for diesel engines and/or front wheel packaging ➢ Choice of driving style (MT or AT)

Source : Afton Chemicals

Stepped Planetary Automatic Transmission





Hardware

- **Planetary Gearset –** gear ratio control
- **Torque Converter –** fluid-coupling to transfer power from engine to transmission
- **Clutch Packs**
- **Valve-Body**

Market

- Most common global transmission type

Manufacture

- GM Hydra-Matic was the first mass-produced fully automatic planetary AT

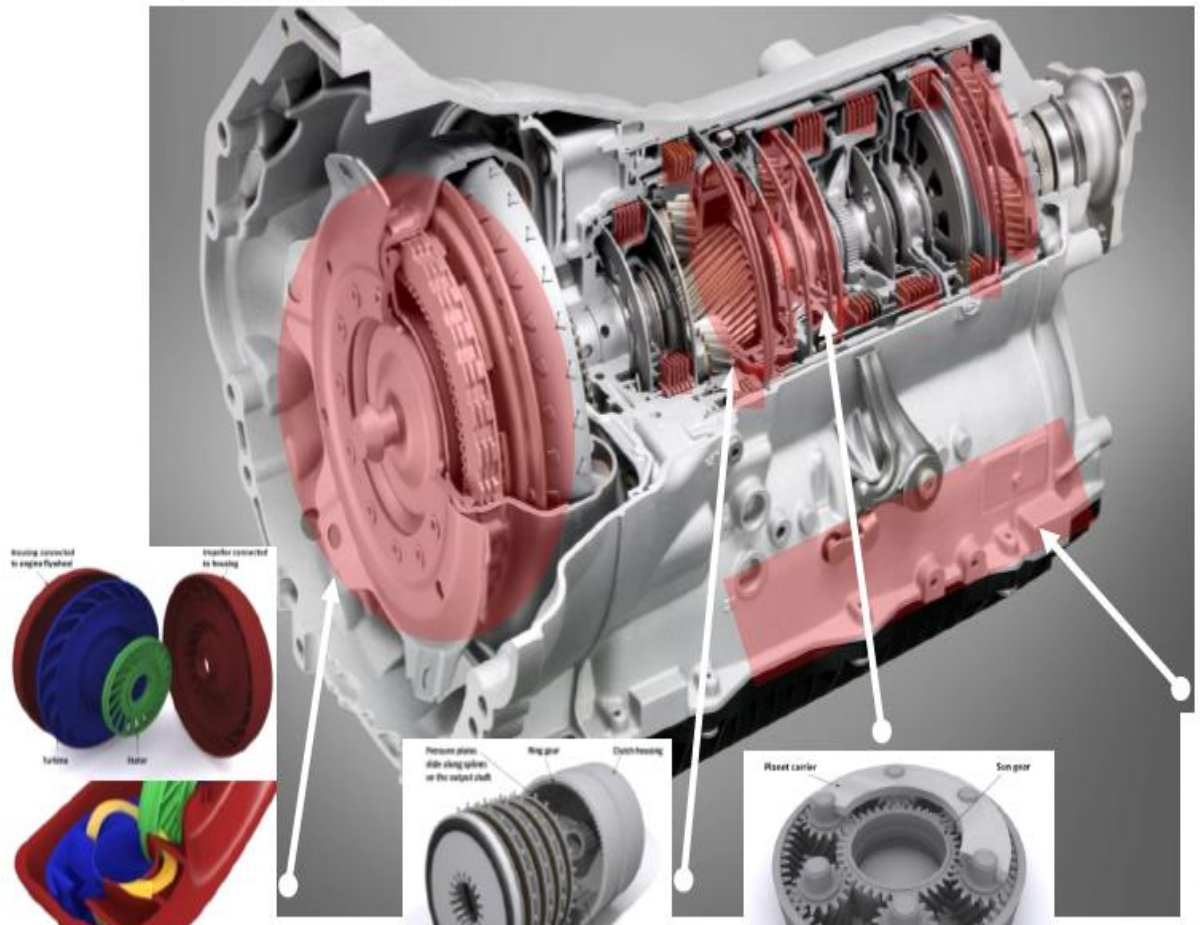
Source: Infineum

Automatic Transmission Hardware

There are 4 major components in the automatic transmission:

- **Torque Convertor:** transfer power from the engine to the transmission
- **Planetary Gear Set:** changes output speed
- **Valve Body:** the "brain" of the transmission
- **Clutches (plate or band):** changes gear ratios

Photo source: BMWBLOG.COM



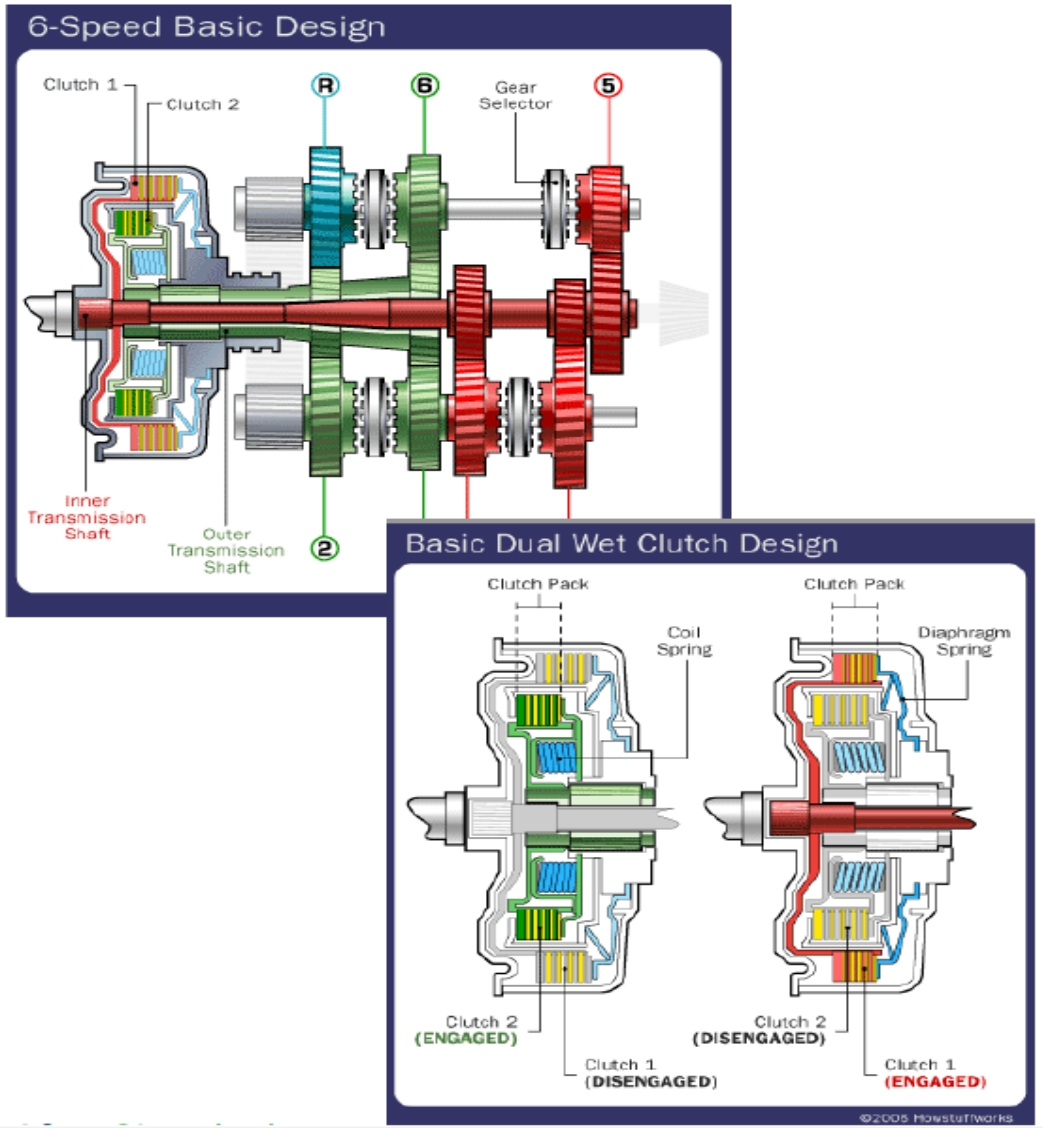
Torque Convertor

Clutches

Planetary Gear

Valve Body

Dual Clutch Transmission

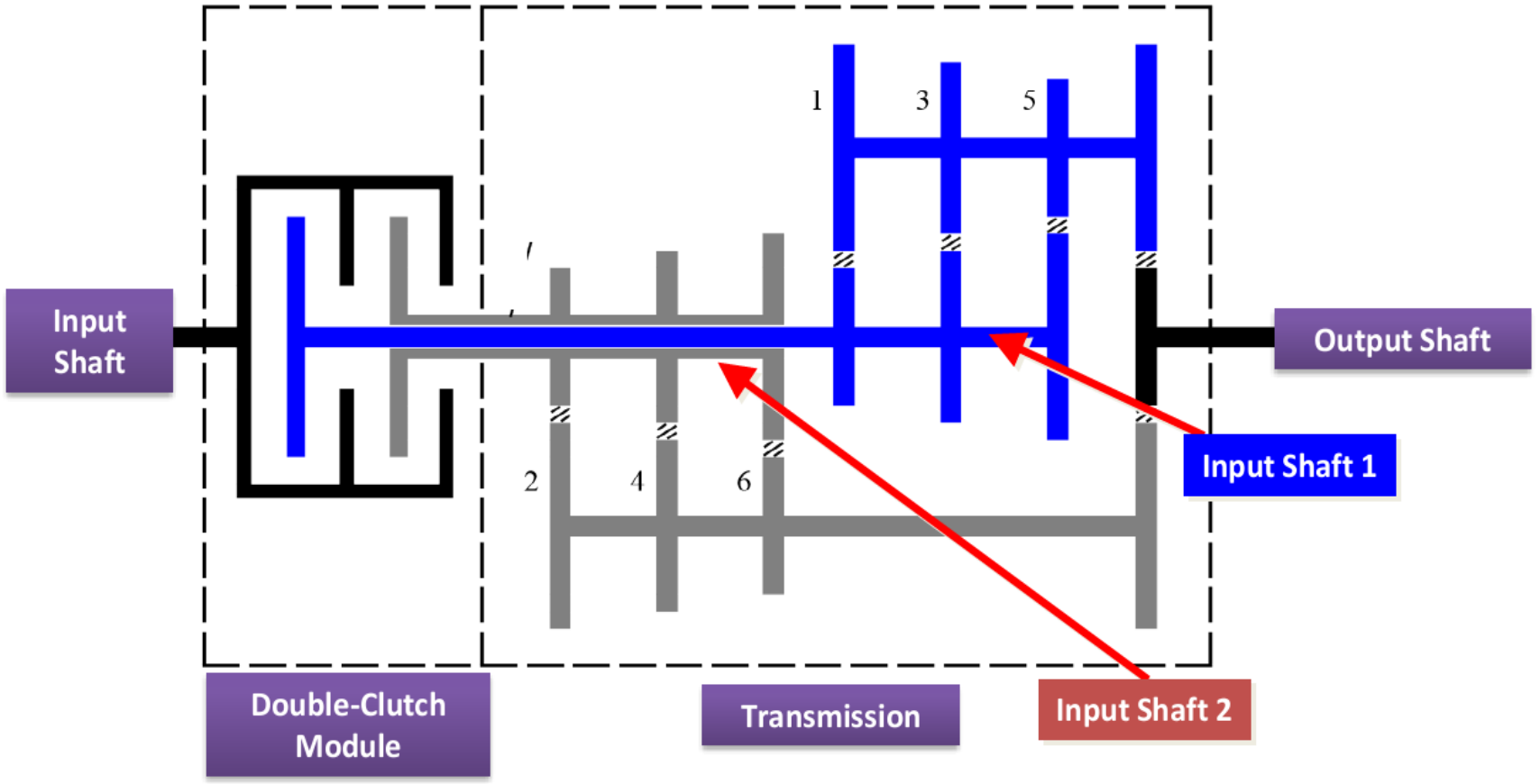


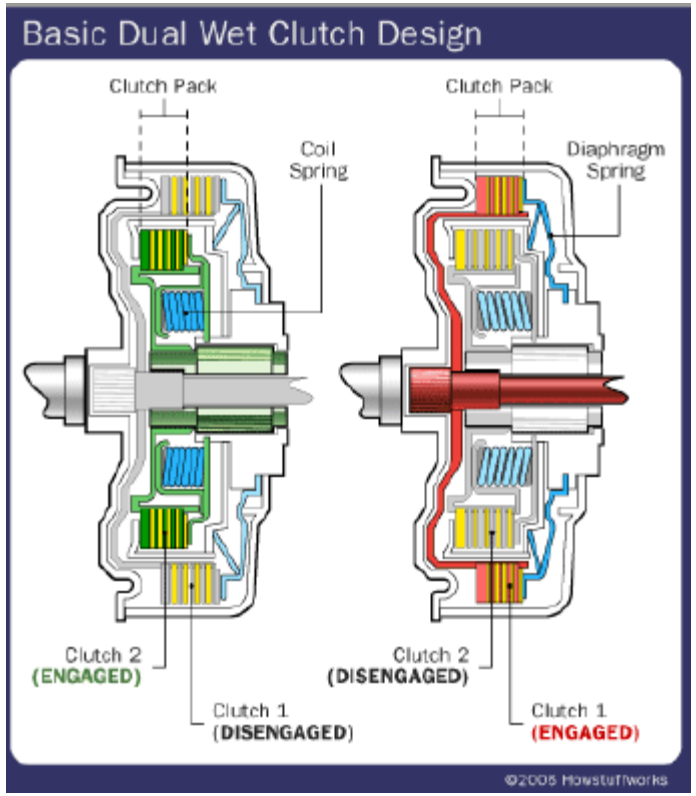
- Gear sets are similar to manual transmission
- Co- liner shafts with constantly meshed gears and synchronizers
- Two clutches eliminates shift shock
- To activate hydraulic pressure forces coil springs and diaphragm springs and to disengage clutch, fluid pressure is reduced.
- “Wet” DCT application- clutch components bathed in lubricating fluid
    - Reduce friction
    - Limit heat production
- “Dry” DCT – application
    - Clutch is more similar to manual transmission clutch
    - Lower torque capacity
    - Better fuel economy
- Driving style is similar to conventional stepped automatic.

Source: Infineum

Dual Clutch Transmissions, How They Work

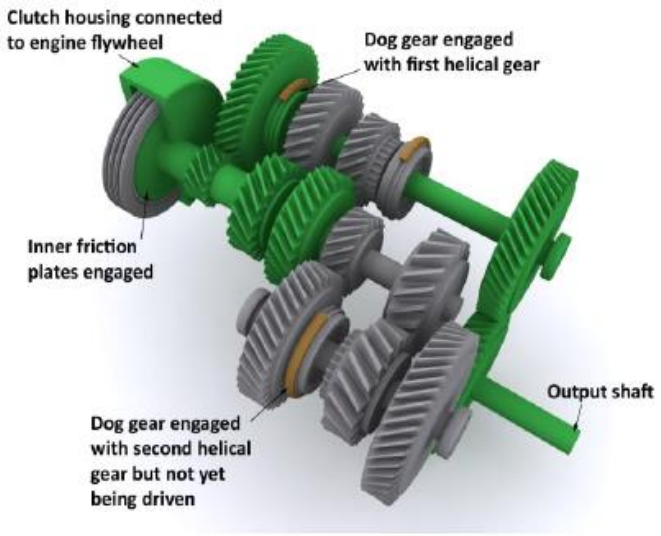
- Two input shafts are connected to two different clutches
  - 1, 3, 5 gears are connected to one
  - 2, 4, 6 gears are connected to the other





Source: Infineum

Dual Clutch Transmission Technology



DCT Pros

+ Fuel Efficiency

+ Shift Feel

+ MT manufacturing (EU)

- Launch feel may be not as smooth as stepped AT

DCT Cons

Hardware

Combines elements of both manual and automatic transmissions

Market

DCT currently attracting great interest

Especially in Europe where market share projections approach 20% by 2020

Manufacture

First commercial transmission introduced by VW

Driven by fuel efficiency and driver comfort

Source: Infineum

Continuously Variable Transmission

Continuously Variable Transmission

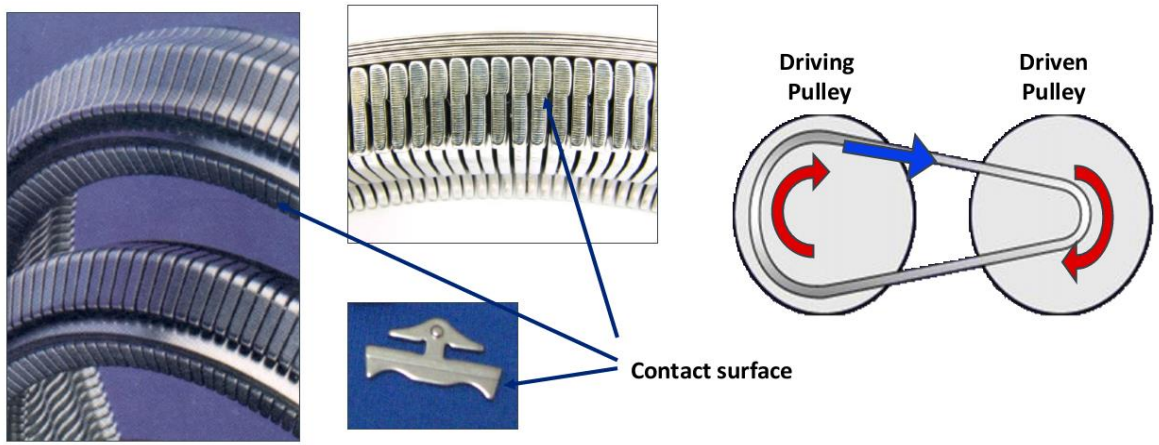
- CVT's constantly changes gear ratios in response to engine power.
- CVT allows for smooth power delivery, no 'shift shock'
  - Power can be optimized for acceleration or fuel economy
- CVT cannot handle higher torque applications
- CVT has few parts compared to other automatic transmission types
  - Uses two variator pulleys and a belt or chain instead of planetary gear sets
  - Has a continuum gear ratios rather than discrete steps of ratio

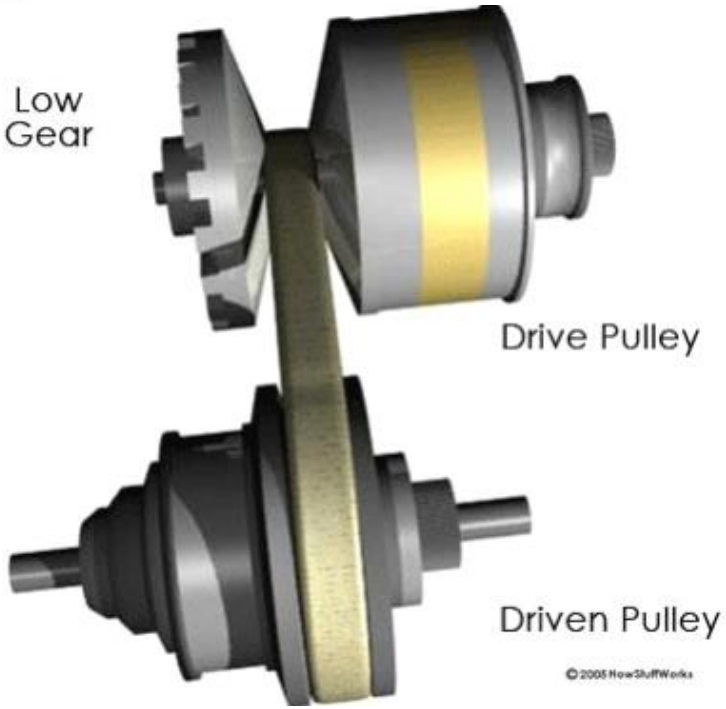
OEMs Using CVTs Today

- Nissan
- Subaru
- Honda
- Toyota
- Audi
- Ford
- GM

Continuously Variable Transmission

- Types of CVT Equipment
  - Steel belt – push or pull belt types (most common)
  - Toroidal – traction driven
  - Hydro mechanical – combination of hydraulic and mechanical
- There are two primary types of CVT's in passenger cars:
  - Variable-diameter pulleys and
  - Toroidal
- Variable –diameter pulley CVT
  - Use a belt or chain links and two variable-diameter pulleys to continuously change gear ratios
- Three primary components (in variable diameter pulley CVTs)
  - Belt (rubber or metal links)
  - Variable input (driving) pulleys
  - Variable output (driven) pulleys





Passenger Car ATF Specification

	OEM	High Viscosity	Low Viscosity	Ultra Low Viscosity
North American OEMs	Ford	MERCON® **MERCON® V**	**MERCON® LV**	MERCON® ULV
	CHRYSLER	ATF +3® ATF +4®	948TE	-
	GM	DEXRON® II DEXRON® III	**DEXRON® VI** DEXRON® HP	DEXRON® ULV
European OEMs	Mercedes-Benz	MB 236.10	MB 236.12	MB 236.14
	BMW	Lifeguard 5	Lifeguard 8	-
Asia Pacific OEMs	Toyota	Toyota T-IV	Toyota WS	-
	Nissan	Matic J/K	Matic S	-
	Honda	Honda Z-1	Honda DW-1	-
	Hyundai	Hyundai SP-III	Hyundai SP-IV	-

ATF Formulation Focus

ATF Requirements

- Acts as a hydraulic fluid
- Large operation range (-40°C to 175°C)
- Should resist oxidation
- Provide anti-wear performance by protecting the gear sets
- Removes heat efficiently
- Should be shear stable
- Protects against corrosion
- Ensure seal performance
- Deliver specialized friction characteristics

COMMON ATF PROPERTIES		
• Hydraulic fluid • Foam & aeration control • Flow at low temperatures • Protect seals	• Wear protection • Corrosion inhibition • Dissipate heat	• Friction control • Friction durability • Harness compatibility • Conductivity
Planetary AT	CVT	DCT
		
• Friction characteristics for torque converter and clutches • Optimum torque transfer	• Steel-on-steel friction	• Synchronizer performance • Wet start clutch • Load carrying

Source: Afton Chemicals

Basic ATF Formulation

Additive Package	Vol %
Performance package	5-10%
Seal Swell agent	0-3%
Pour Point Depressant	0-0.5%
Viscosity Modifier	3-10%
Total Additive treat:	**8-24%**

Base Oil
(Group II,III)

Red Dye

CITGO TRANSGARD Multi-Purpose ATF

- Market Need:
  - 25% of Consumer Demand
  - Primarily US OEMs
- Consumer Benefits:
  - Designed for use in GM transmissions calling for DEXRON®-III, DEXRON-IIE and DEXRON-II fluids.
  - Also for use in Ford MERCON® type ATF

CITGO TRANSGARD Synthetic MV High Viscosity ATF

- Market Need:
  - 5% of Consumer Demand
- Consumer Benefits:
  - Synthetic, superior ATF and powershift performance.
  - Suitable for Ford MERCON® V, Ford MERCON® (obsolete), GM DEXRON®-IIIH (obsolete), and Allison C-4, TES-295 (not OEM approved) and TES-389 (not OEM approved).
  - In California, we recommend TRANSGARD, MERCON V ATF for MERCON V applications.

CITGO TRANSGARD Synthetic MV Low Viscosity ATF

- Market Need:
  - 30% of Consumer Demand
- Consumer Benefits:
  - Full Synthetic
  - Suitable for use where the following products are recommended: DEXRON®-III, DEXRON®-VI, MERCON® LV/SP, Toyota WS, Honda DW-1, Nissan Matic S, Hyundai SP-IV and many others
  - In California, we recommend TRANSGARD DEXRON VI ATF for DEXRON VI applications

CITGO TRANSGARD MERCON® V ATF

- Market Need:
  - 9% of Consumer Demand
  - Ford Specification
- Consumer Benefits:
  - Licensed
  - advanced extended life automatic transmission fluid designed for Ford transmissions and transaxles. This product may also be used in automatic transmission units that require a fluid qualified against the Ford MERCON® specification.

CITGO TRANSGARD DEXRON® VI ATF

- Market Need:
  - 10% of Consumer Demand
- Consumer Benefits:
  - Full synthetic, licensed by GM.
  - Designed to provide twice the normal service life of a DEXRON®-IIIH ATF.
  - Offers enhanced performance for both new and older model transmissions.

CITGO TRANSGARD ATF + 4®

- Market Need:
  - 6% of Consumer Demand
- Consumer Benefits:
  - Licensed and approved by Chrysler Group LLC (FCC)
  - Full Synthetic Formulation provides outstanding protection under the most demanding conditions.
  - Superior viscosity profile for improved shift performance and extended transmission life.

CITGO TRANSGARD TYPE F ATF

- Market Need:
  - 2% of Consumer Demand
- Consumer Benefits:
  - Recommended for use in all automatic transmissions for which a Type F fluid (Ford Specification M2C33-F) is specified.
  - Recommended for service fill of power steering units of many Ford passenger cars and light trucks, and can be used in various AW hydraulic fluid applications.

CITGO TRANSGARD CVT FLUID

- Market Need:
  - 20% of Consumer Demand
- Consumer Benefits:
  - Full Synthetic, designed for Domestic, European and Japanese passenger car transmissions
  - Belt and chain-driven CVTs

Questions

- Please post your questions using the Q&A function.

How to Contact Us

- Lubes Answer Line

- **800-248-4684**

  – 8:00 AM - 12:00 PM, 1:00 PM – 5:00 PM CT (Mon – Thurs)
  – 8:00 AM - 12:00 PM, 1:00 PM – 4:30 PM CT (Fri)

- **lubeshelp@citgo.com**

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December 3, 2021	ISO Cleanliness Requirements
December 17, 2021	Railroad Industry Products