



ASHLAND®

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# Automatic Transmission Fluids

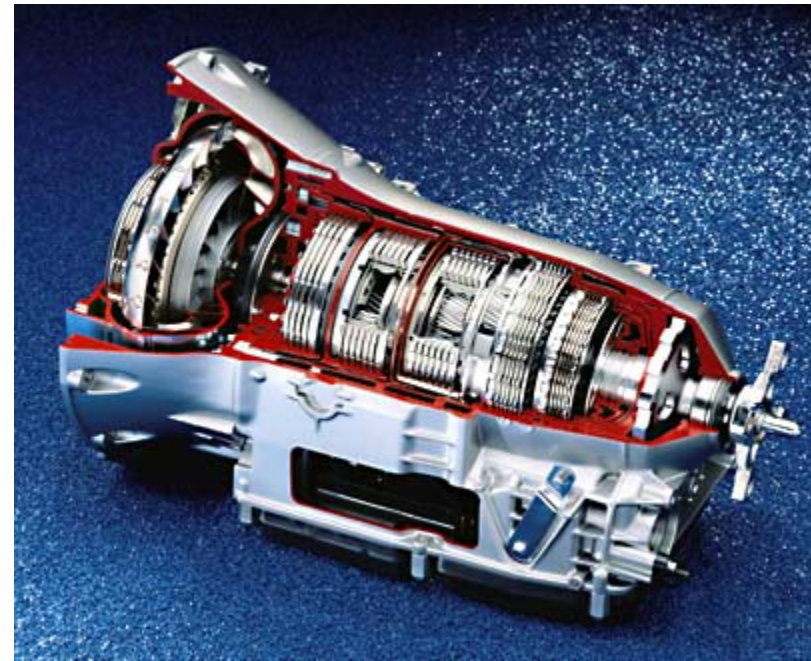
July 12, 2006

*Z. George Zhang, PhD*    [zzhang@ashand.com](mailto:zzhang@ashand.com)

# Overview

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- Functions of ATF
- A Formulator's Note
- Worldwide Market Trends
- OEM Trends
  - Chrysler
  - Ford
  - General Motors
- Valvoline Products

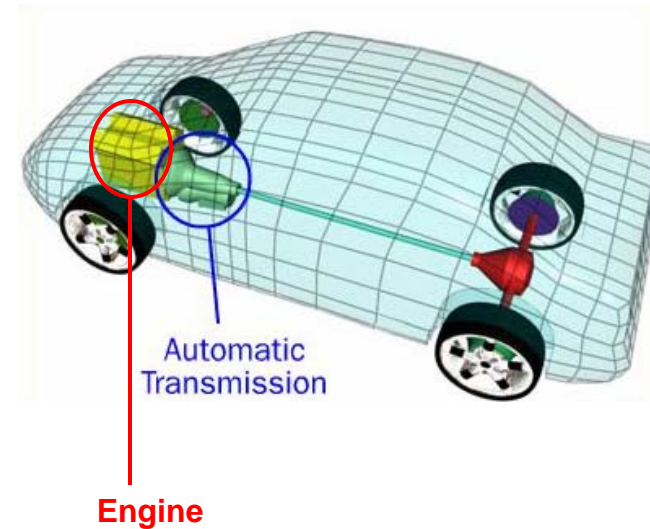


Mercedes-Benz CLK

# Function of ATF

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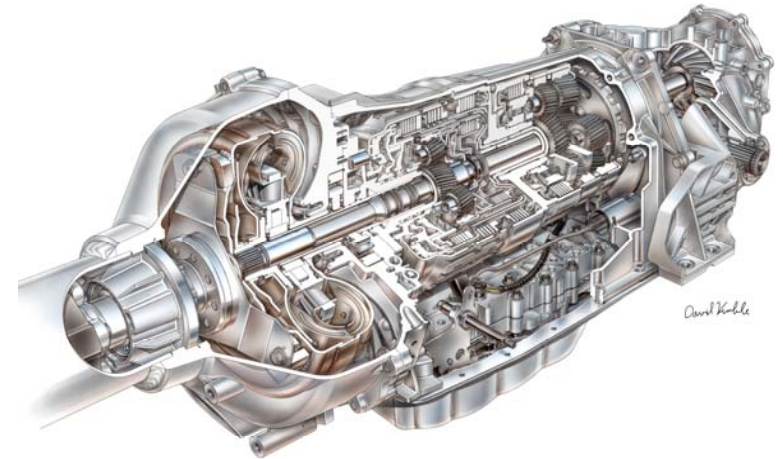
- Transmit of power
- Act as a hydraulic fluid
- Remove heat efficiently
- Provide proper clutch friction
- Lubricate gears and bushings
- Give good seal performance
- Operate at temperature extremes
- High oxidation resistance
- Non-corrosive to transmission components
- Special antifoam properties



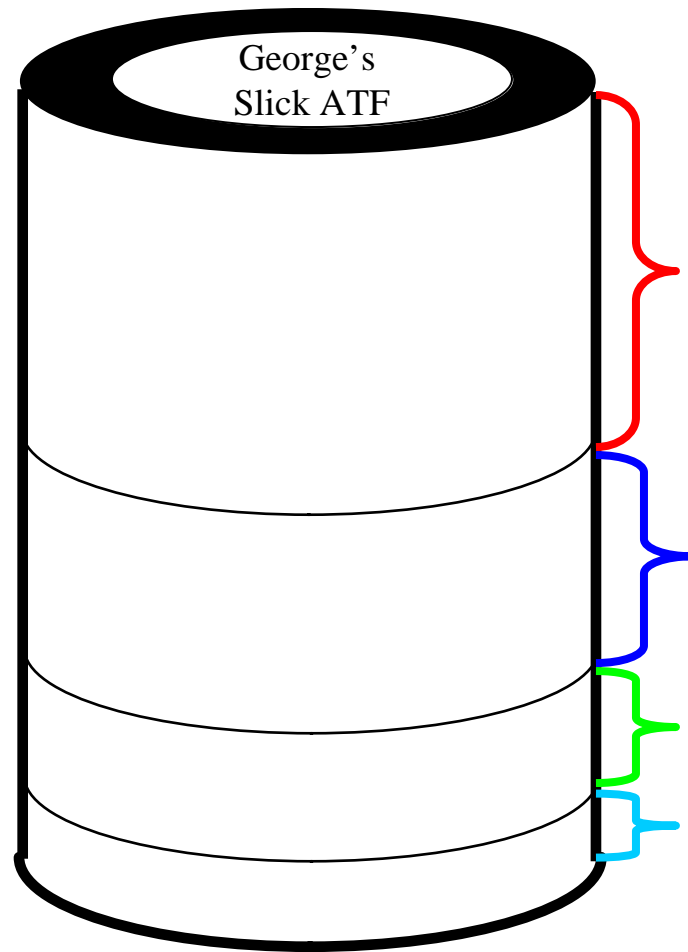
# A Formulator's Note

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- **So** ATF is of vital importance to the transmission
- A good ATF is highly formulated  
(if not over formulated)
- Friction/traction properties are extremely important
- Low temperature properties are important
- Shear stability is important



# A Formulator's Note



George's  
Slick ATF

Baseoils

DI  
(Performance pkg.)

VM

PPD

*Very roughly*

Baseoils ~80%

Additives ~20%

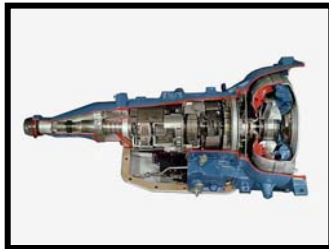
*Typical 100°C Vis*

5.5 – 6.5 or 6.8 – 7.8 cSt



# Automatic Transmission Designs are Changing

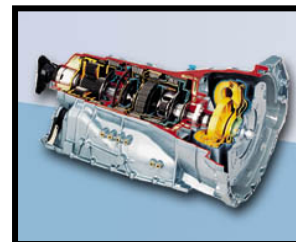
Market Driver – Reduced Emissions and Improved Fuel Economy



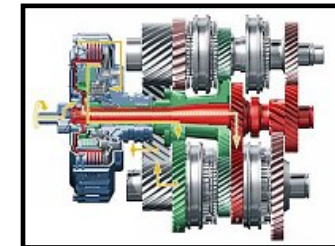
**1948 - Present  
Conventional or  
Stepped  
Transmission  
(AT)**



**Mid 1990's  
Belt Drive Continuously  
Variable Transmission  
(CVT)**



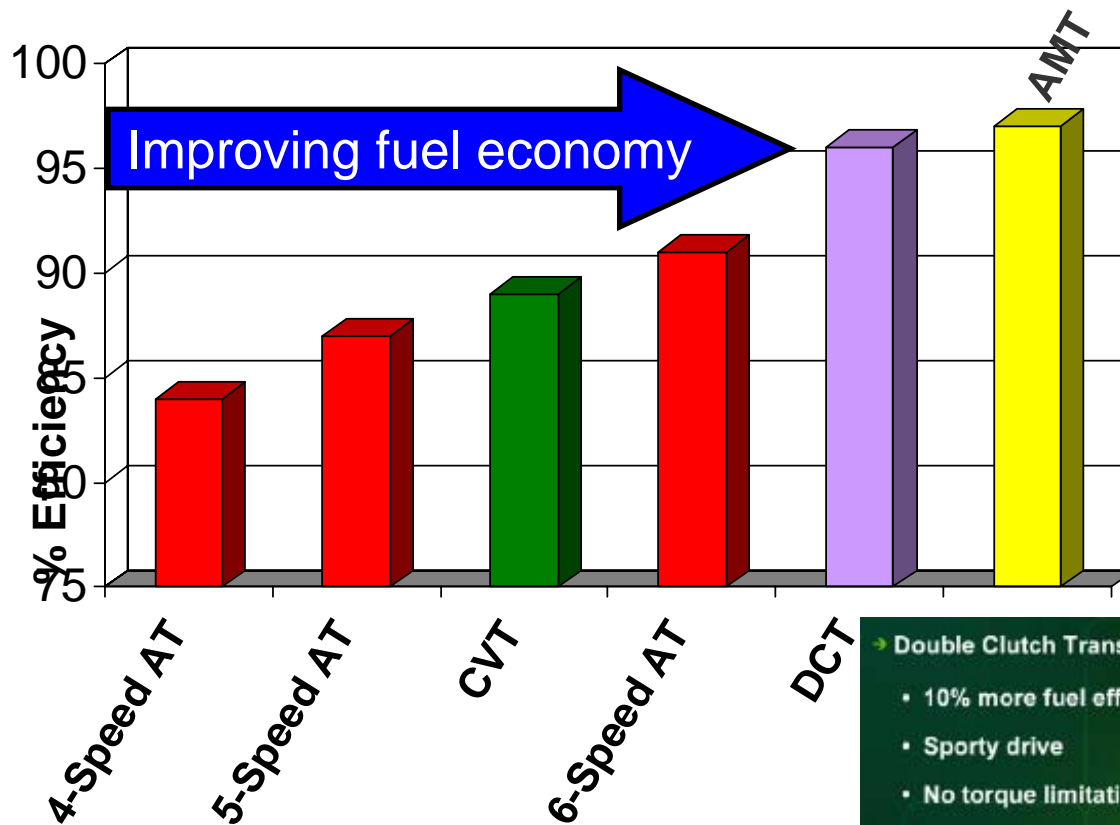
**2002  
6-Speed Conventional  
Automatic  
Transmission (AT)**



**2004  
Dual Clutch  
Transmission  
(DCT)**

- Conventional Stepped Automatics
  - Lock-up AT
  - More available speeds (6 & 7 Speed)
- Continuously Variable Transmissions
- Automated Manuals
  - Dual Clutch

# New Transmission Designs



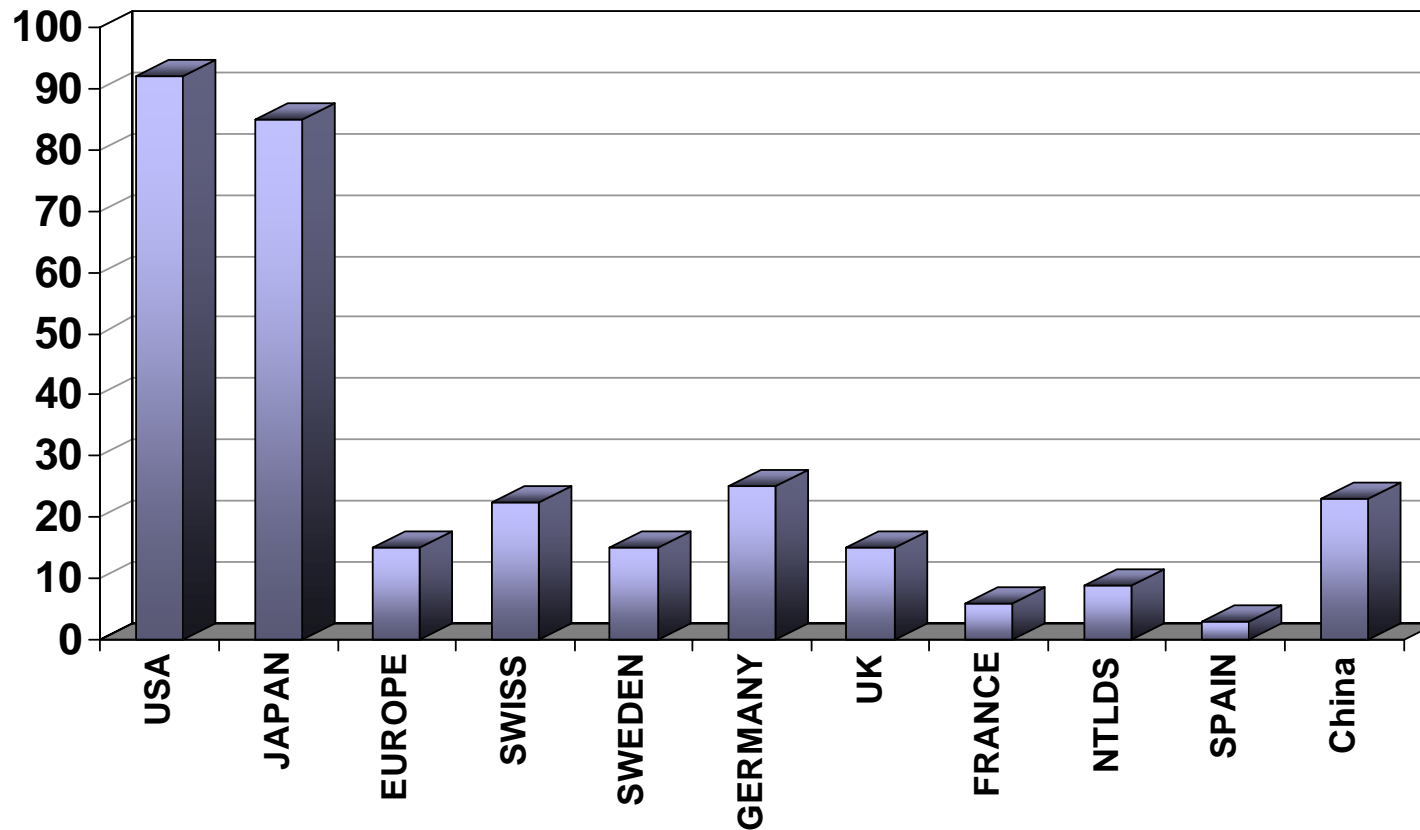
## → Double Clutch Transmissions

- 10% more fuel efficient than manual
- Sporty drive
- No torque limitation
- No torque interruption
- Use existing manufacturing infrastructure



# Passenger Car Production 2003

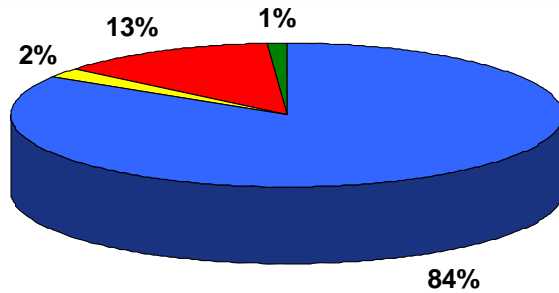
% Installation rate of automatic transmissions



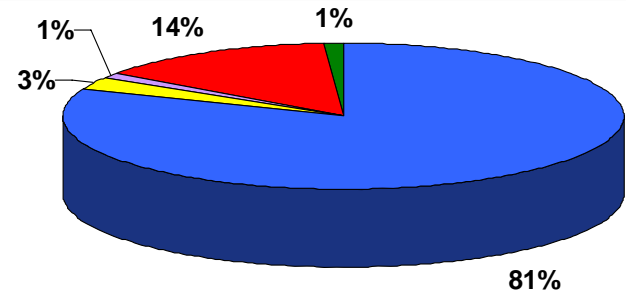
Source AID

# Light Vehicle Transmission Market Share

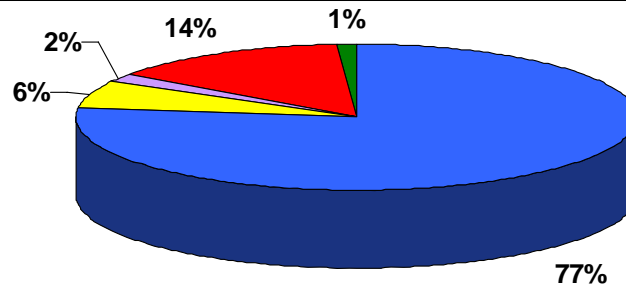
Europe 2002



Europe 2005



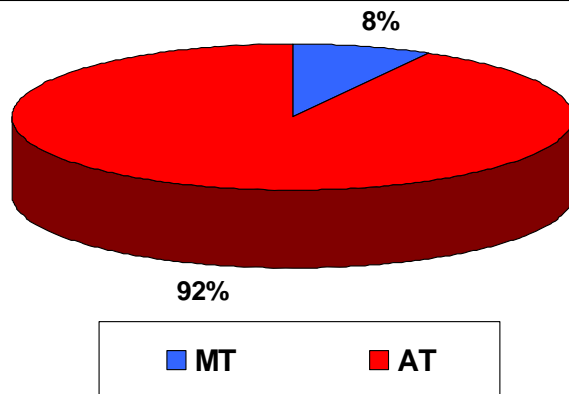
Europe 2009



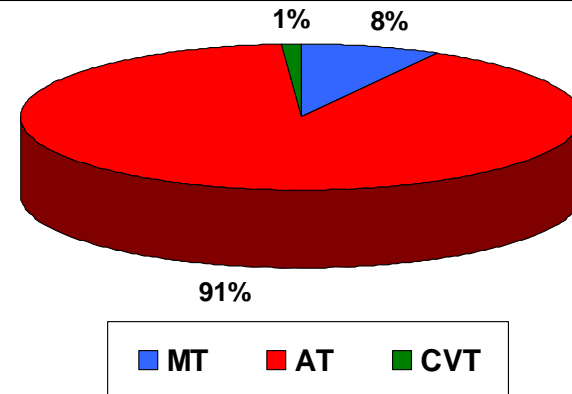
Source: Lubrizol Corporation 2005

# Light Vehicle Transmission Market Share

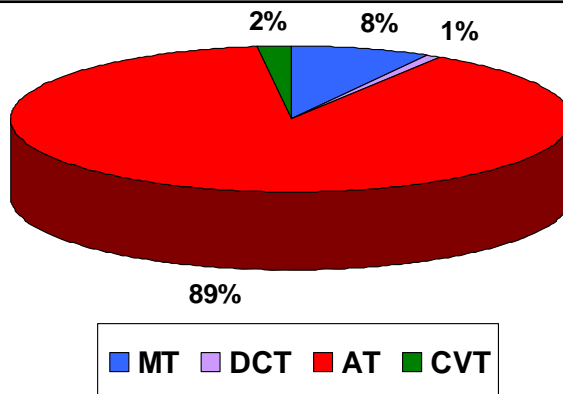
North America 2002



North America 2005



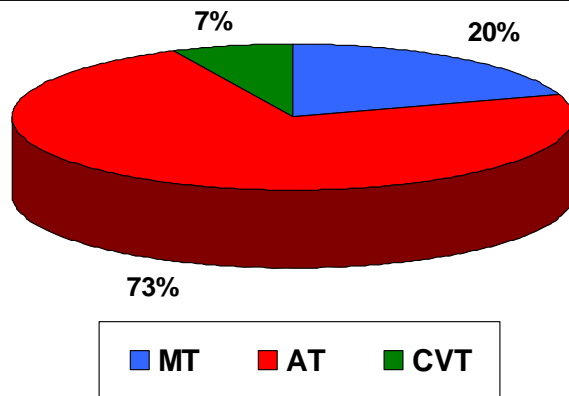
North America 2009



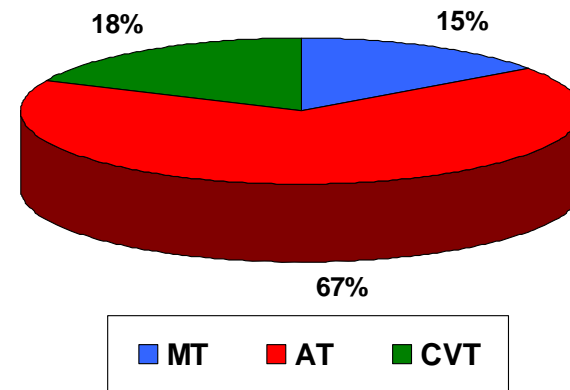
Source: Lubrizol Corporation 2005

# Light Vehicle Transmission Market Share

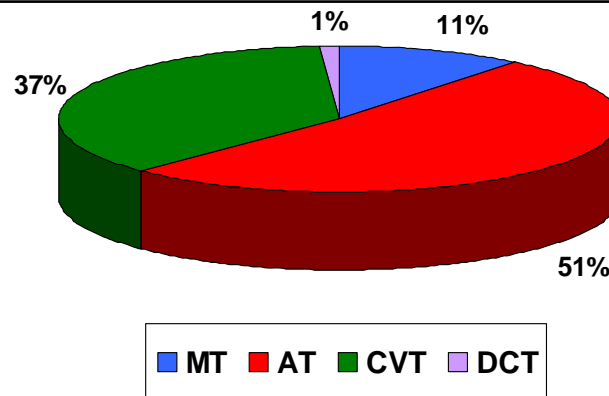
Japan & Korea 2002



Japan & Korea 2005



Japan & Korea 2009

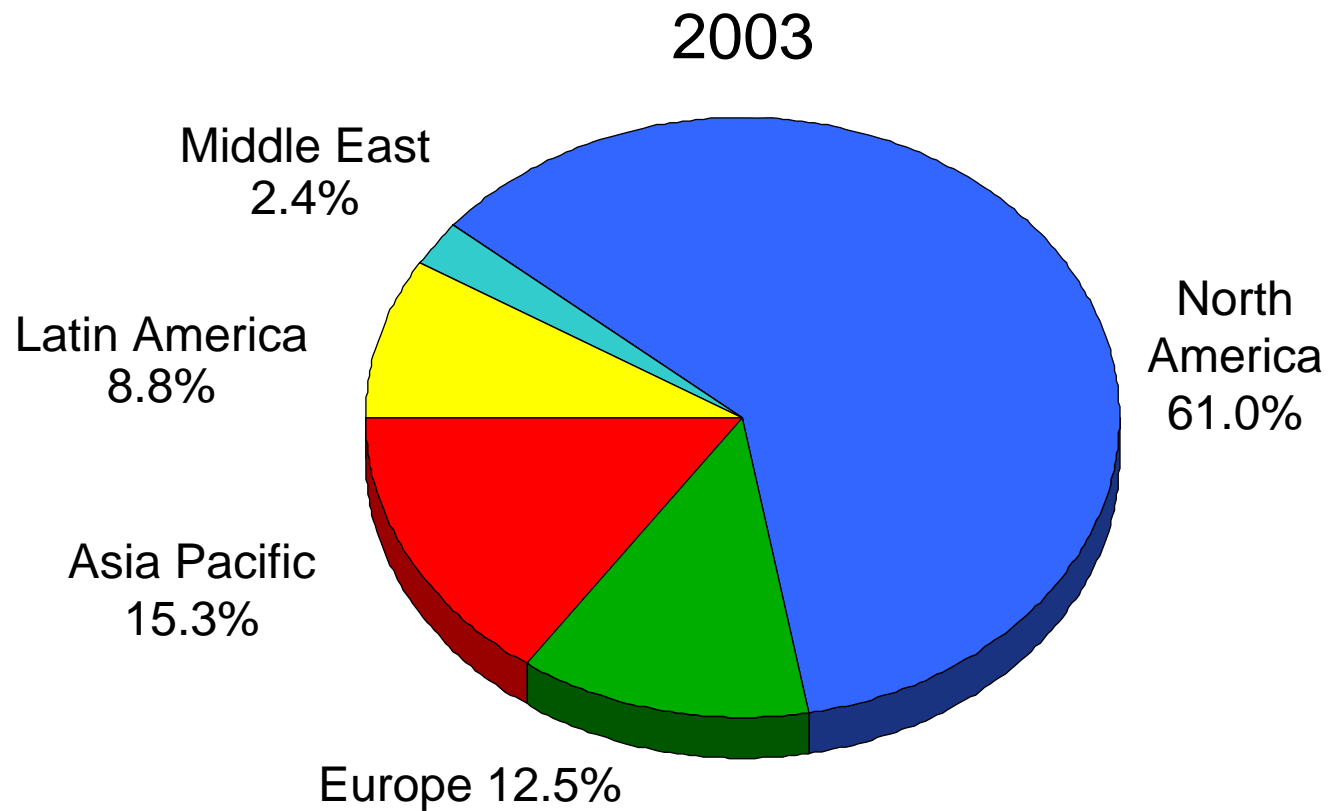


Source: Lubrizol Corporation 2005



# Market Overview

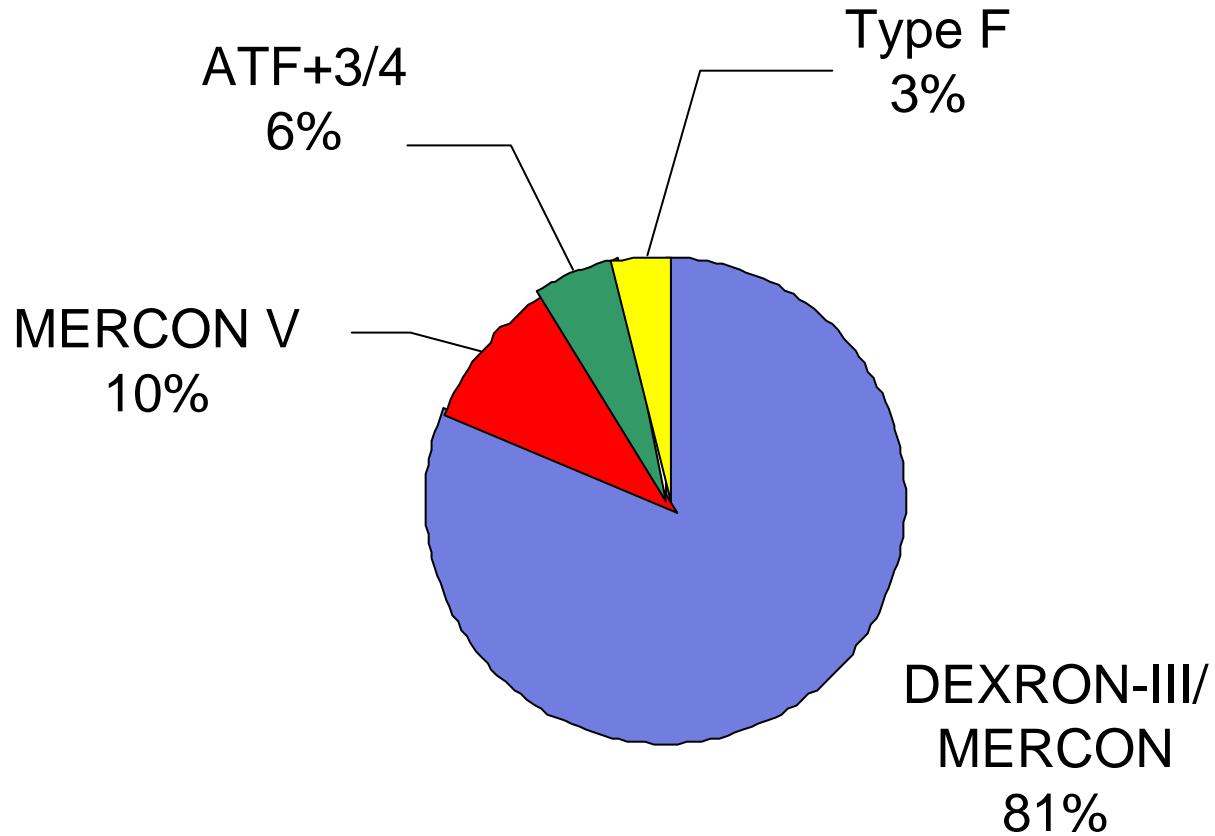
ATF Worldwide Finished Fluid Volume est. 275 MM Gallons



Source: Lubrizol Corporation 2004



# N.A. Current ATF Market





# Recent OEM Moves on ATF

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## *Increasing Global Complexity*

- GM announces expiration of DEXRON® III-H effective January 1, 2007
  - DEXRON®-VI back serviceable
  - DEXRON®-VI more stringent requirement
- Ford announces expiration of MERCON® effective June 1, 2007
  - MERCON® V back serviceable
  - MERCON® V more stringent requirement
- **MERCON® V and DEXRON®-VI are not viscometrically compatible**
- Chrysler announces expiration of ATF+3 (March 31, 2006)
  - ATF+4 back serviceable; additive chemistry specific
  - New licensing program via the Center for Quality Assurance
- A.P. OEM's (Honda, Toyota, Hyundai) pursuing tighter specifications
  - 2X Durability, 2X Oxidation performance, superior pitting performance
- ZF pursuing “fill for life” fluids targeted at bus fleet transmissions



# AT Fluid Market

## Two Main Product Types

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### Standard Viscosity (>6.8 cSt)

- Chrysler ATF+3
- Chrysler ATF+4
- Ford MERCON®
- Ford MERCON® V
- GM DEXRON®-III
- Toyota T-IV
- Honda Z-1
- Nissan Matic-J
- Hyundai SP-III

### Low Viscosity (5.5 – 6.5 cSt)

- M-B NAG-2
- Ford MERCON® SP
- Ford NGF
- GM DEXRON®-VI
- Toyota WS

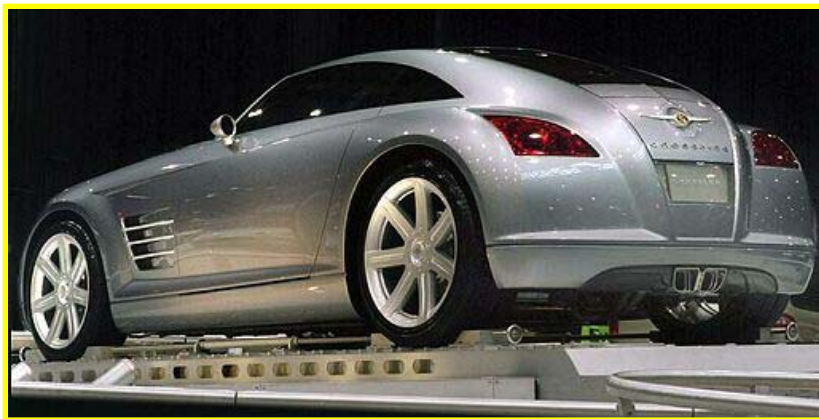


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# Automatic Transmission Fluids

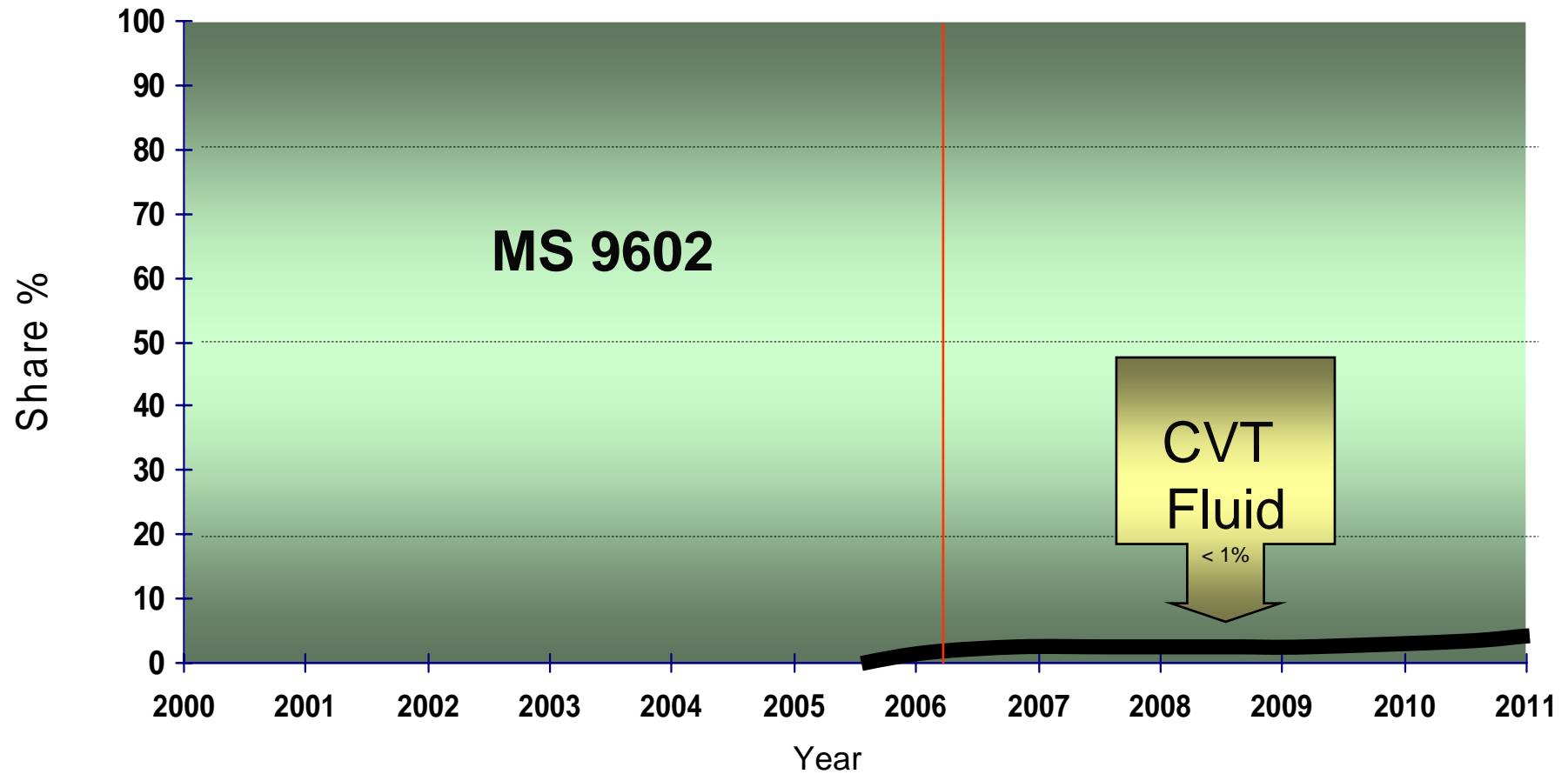
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## DaimlerChrysler Trends





# Chrysler NA Factory Fill ATF Trends





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# Automatic Transmission Fluids

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## MS-9602 Factory-Fill ATF

- Used in all DaimlerChrysler North American automatics
- Used for power steering fluid (FF and SF)



# Chrysler Group Service Fill ATF

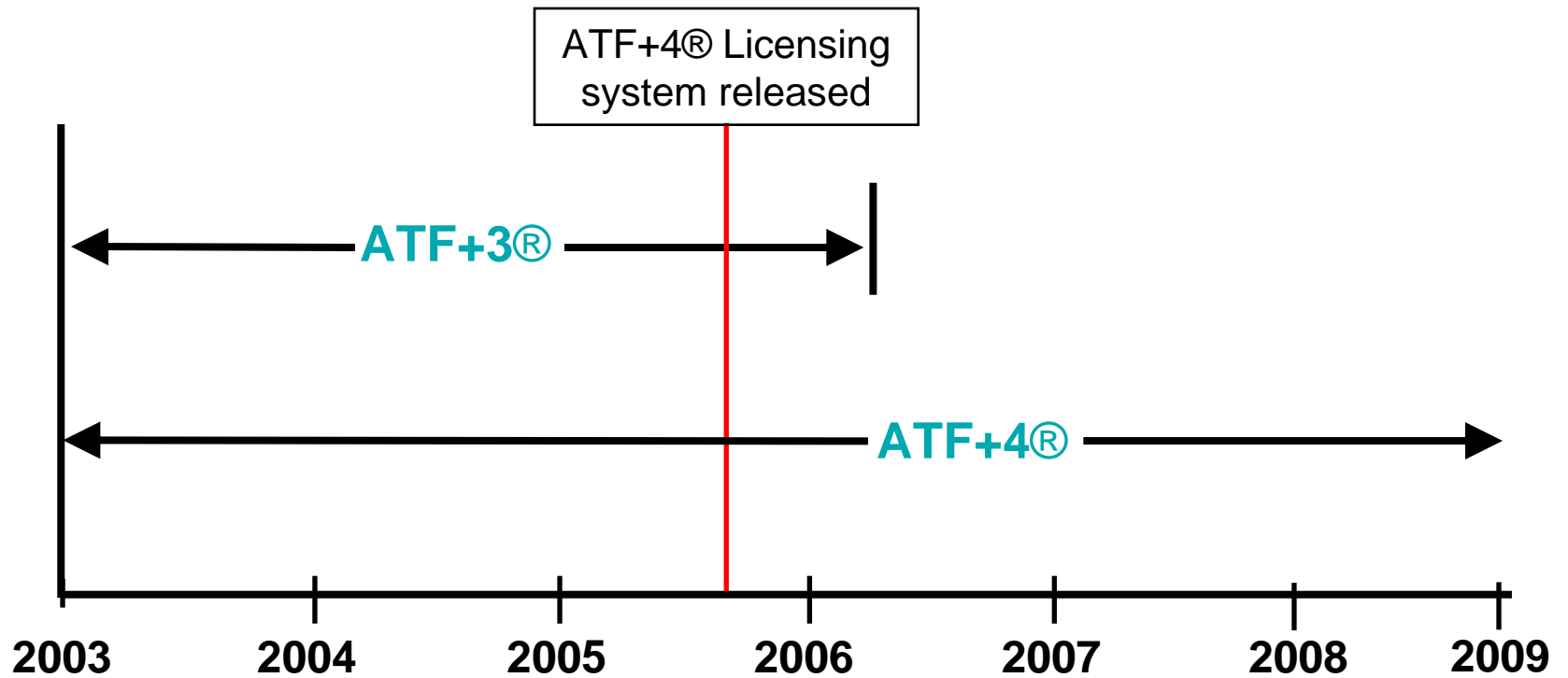
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## ATF+4® Licensing

- In response to marketplace demands and evolving vehicle technology, the Chrysler Group has established a licensing program for ATF+4®
- To better serve customers and make ATF+4® available outside the Chrysler Group (Mopar fluids)
  - By replacing other ATF's and Additive Supplements claiming ATF+4 "Like" performance
  - Chrysler only recommends ATF+4® using *Lubrizol* Additive technology
  - Lubrizol ATF+3® additive will be phased out
- Beginning September 1, 2005 the fluid will now be made available to retail outlets and through independent repair facilities for Chrysler, Jeep®, and Dodge vehicle automatic transmissions
- Oil Companies with Blender approval
  - ExxonMobil
  - PetroCanada
  - Shell
  - Valvoline



# ATF+4<sup>®</sup> Licensing Program Timing





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# Automatic Transmission Fluids

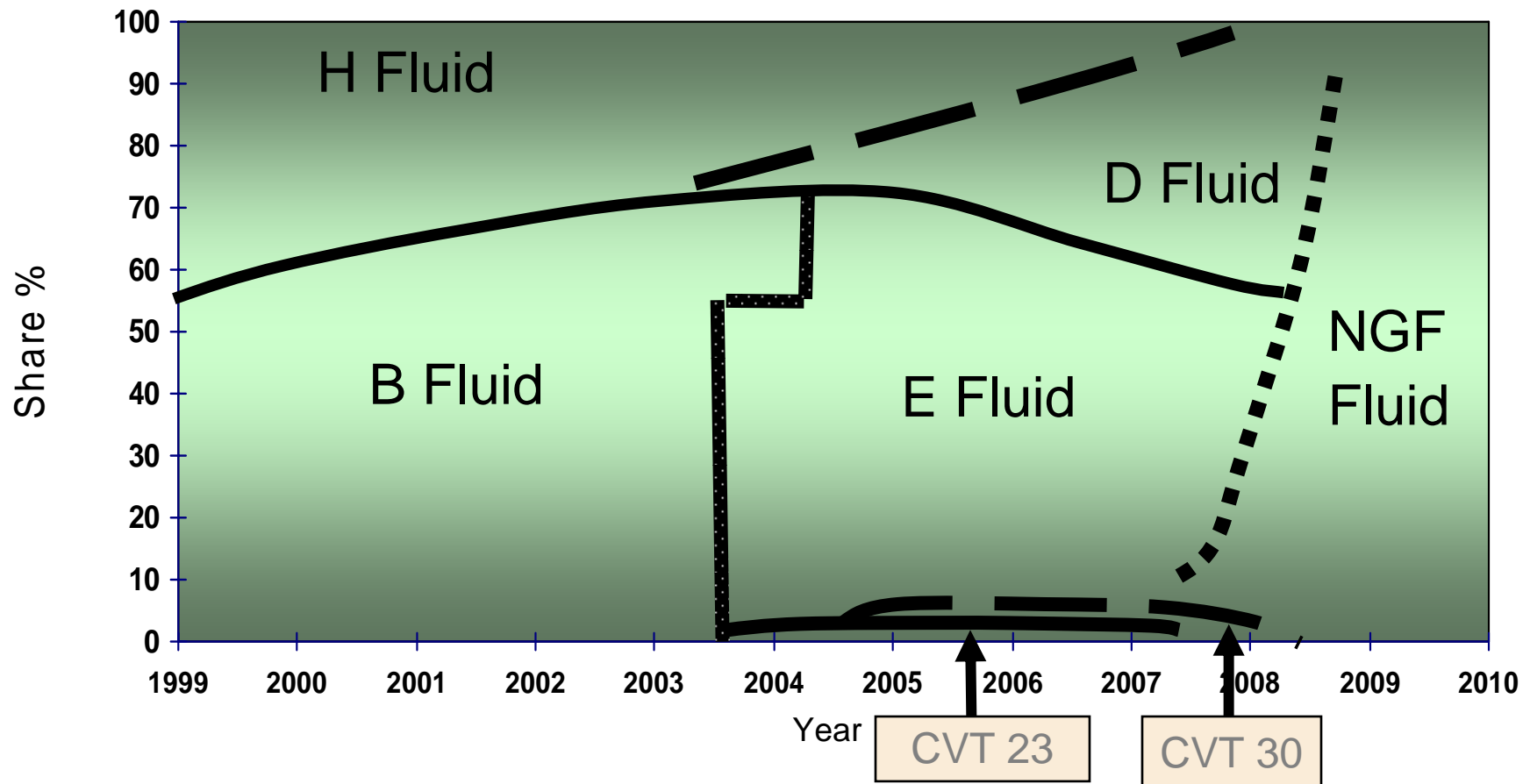
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## Ford Motor Company Trends





# Ford N.A. Factory Fill ATF Trends - Complex





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# Ford Motor Company Specifications

## Factory Fill

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- Currently requires three fluids
  - M2C 166H
    - MERCON<sup>®</sup> Type
  - M2C 919E
    - MERCON<sup>®</sup> V Type
  - M2C 919D
    - MERCON<sup>®</sup> SP Type (LZ is only approved chemistry)
- Ford's ultimate goal is to have "One Fluid" for all conventional stepped automatic transmissions by MY 2008
  - New fluid will be low viscosity
  - Better low temperature properties
  - Improved oxidation performance
  - Stable friction





# Ford Specifications

## Service Fill

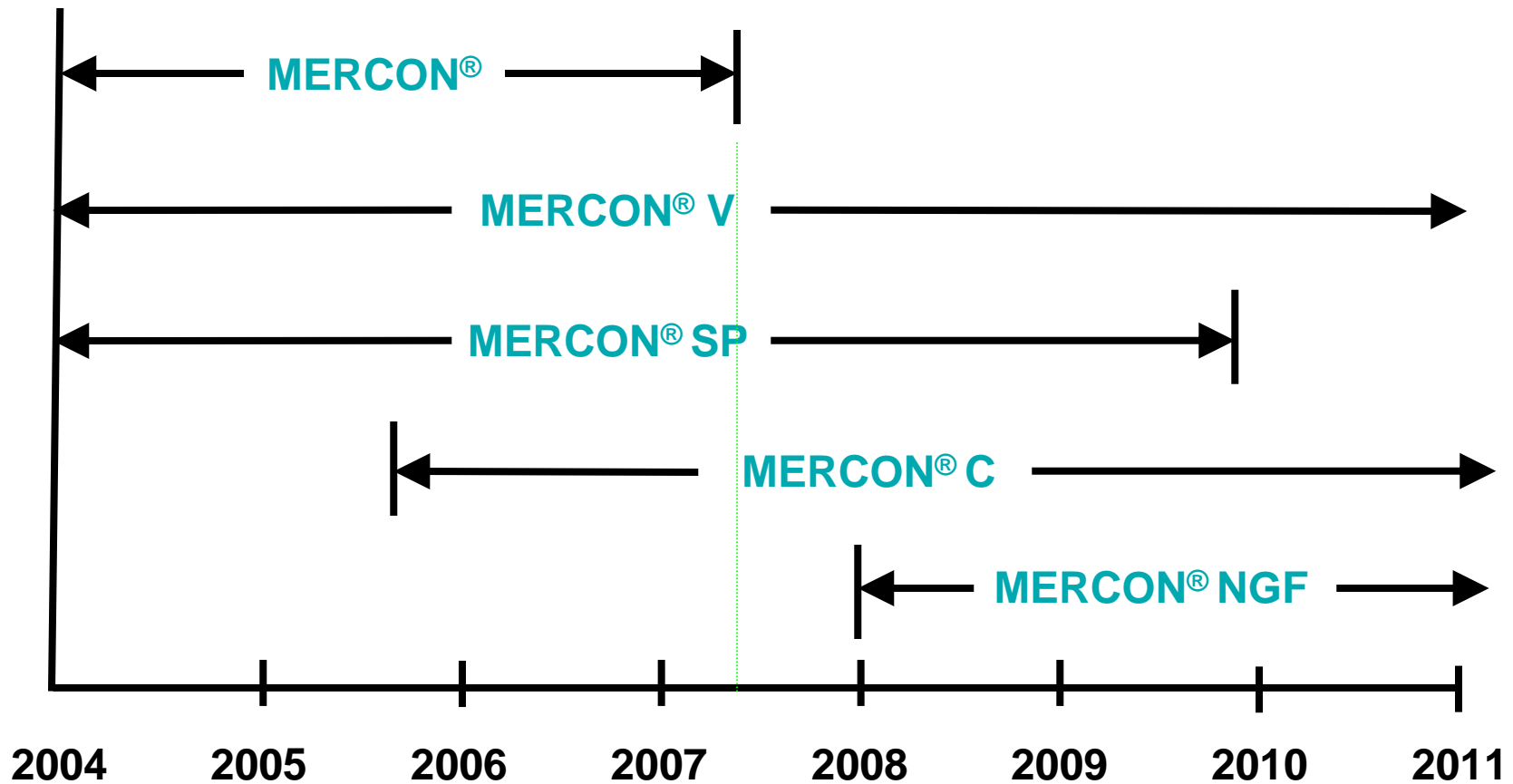


- Currently requires four fluids
  - MERCON<sup>®</sup>: To be obsolete
  - MERCON<sup>®</sup> V
  - MERCON<sup>®</sup> SP: Introduced in 2004
  - MERCON<sup>®</sup> C: New specification for CVT applications which will have “extensive requirements”
- Ford has updated their approval processes and testing requirements
  - 15K test moves to 20K test (MERCON<sup>®</sup>)
  - 20K test moves to 30K test (MERCON<sup>®</sup> V) } Clutch Friction Durability Test on SAE #2
  - Requires site licenses with testing on “plant” batches



# Automatic Transmission Fluids

## Ford Service Fill Specification Timeline





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# Automatic Transmission Fluids

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## General Motors Trends

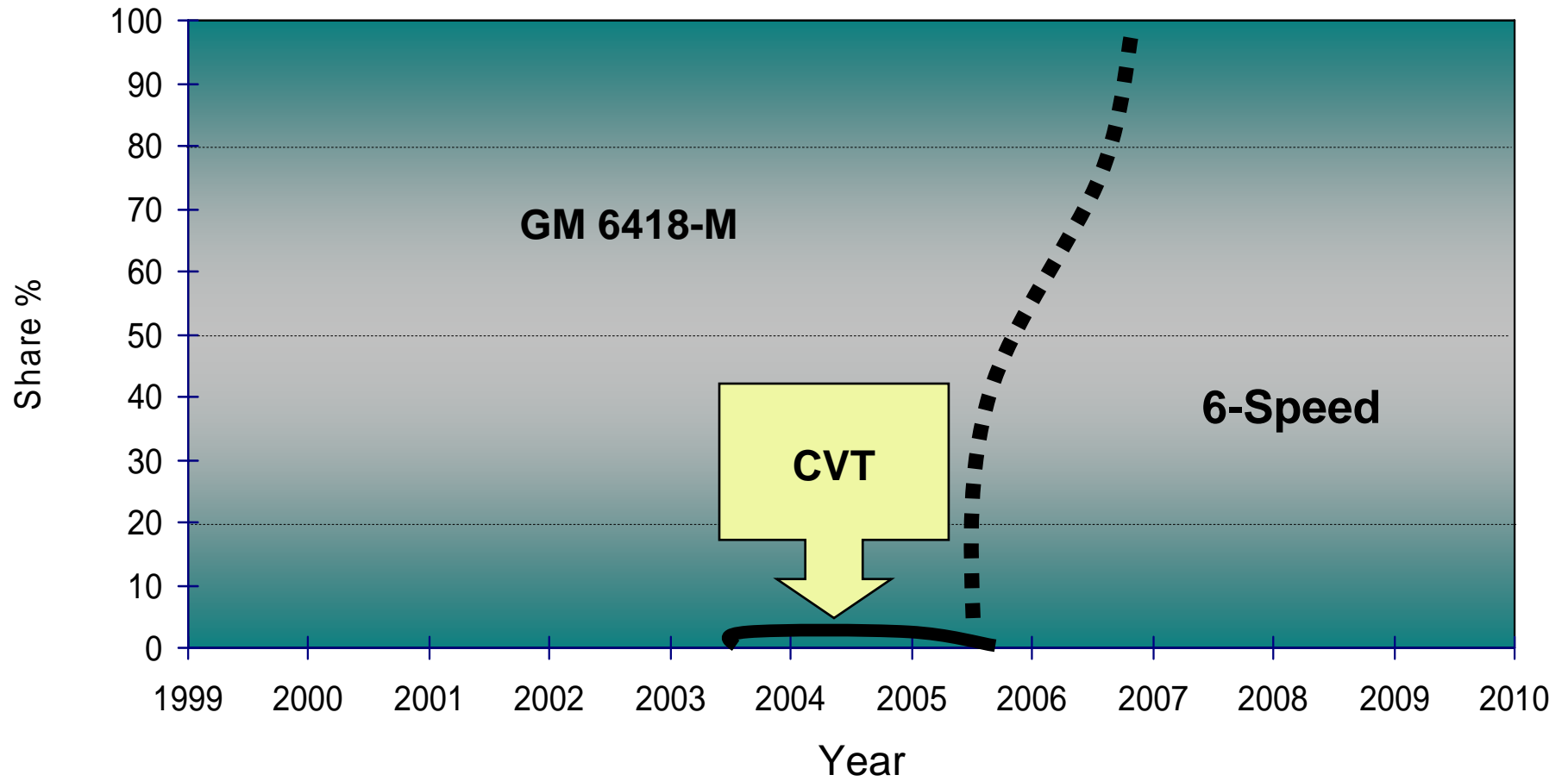




# Automatic Transmission Fluids



## General Motors NA Factory Fill ATF Trends





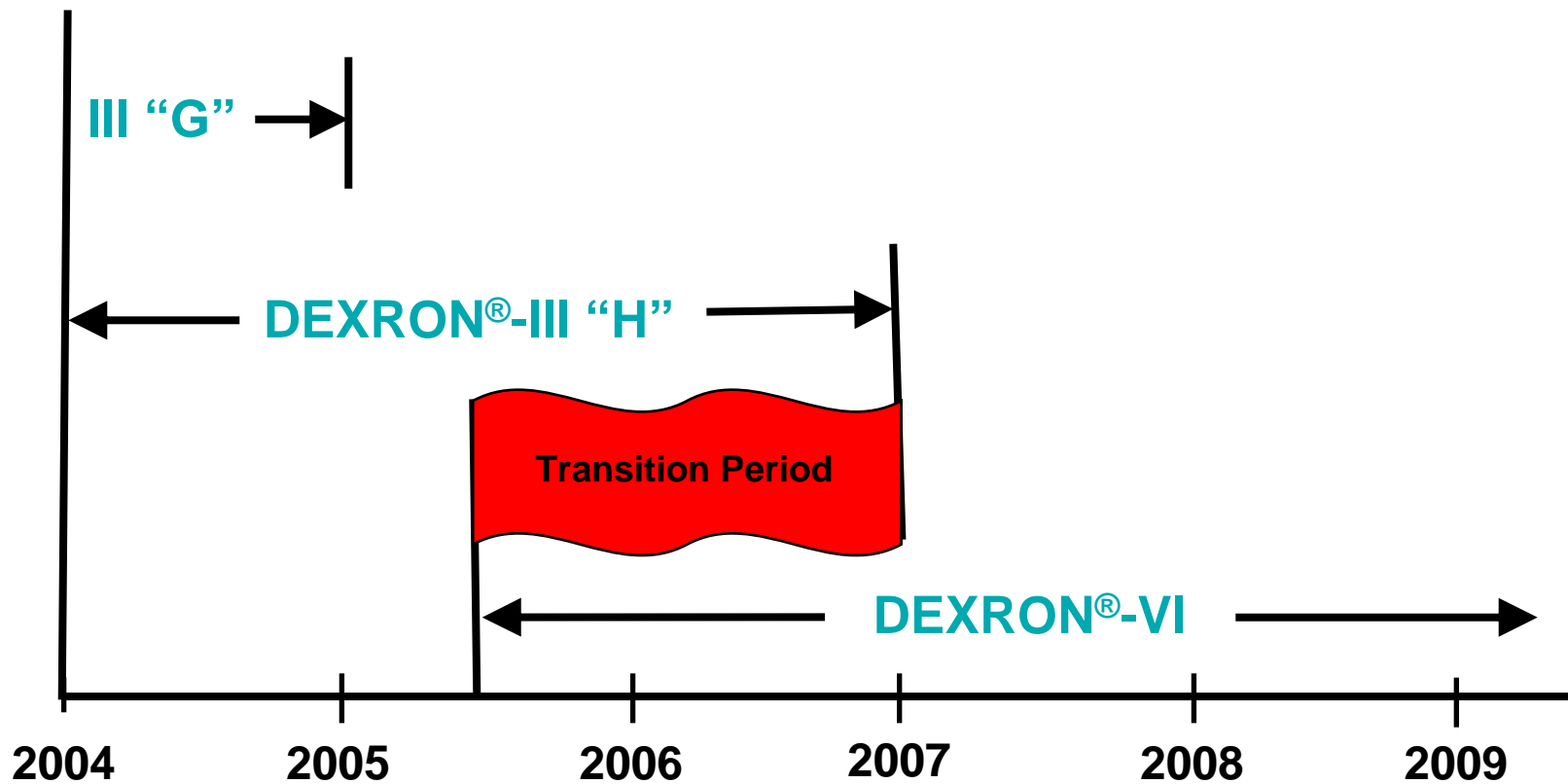
## General Motors **Factory Fill**

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- Automatic Transmissions – 2006  
DEXRON<sup>®</sup>-VI
  - Will require a new low viscosity fluid with improved low temperature performance, shear and friction stability
  - Complete conversion to the new factory fill ATF will occur in model year 2006



# Automatic Transmission Fluids Service Fill Specification Timeline





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# DEXRON<sup>®</sup>-VI Update

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- The only approved chemistry for DEXRON<sup>®</sup>-VI is the factory fill additive from *Afton*
- GM has a license agreement with *Afton* for the latter to be the sole supplier of DEXRON<sup>®</sup>-VI additive
  - The term is five years, ending in March, 2010
  - GM does not intend to approve any new additive chemistry during the term of the license agreement

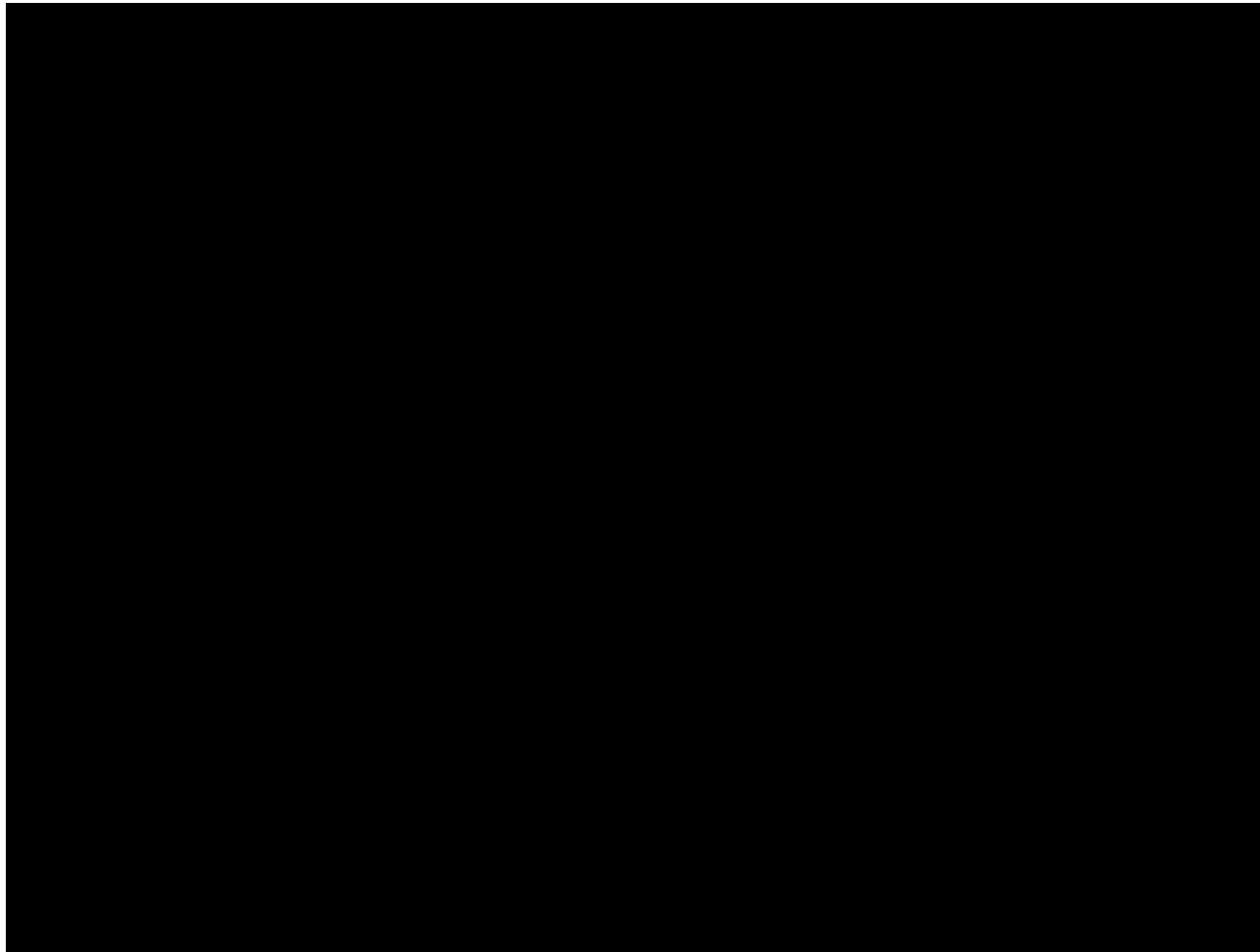


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# GM DEXRON<sup>®</sup>-VI Development

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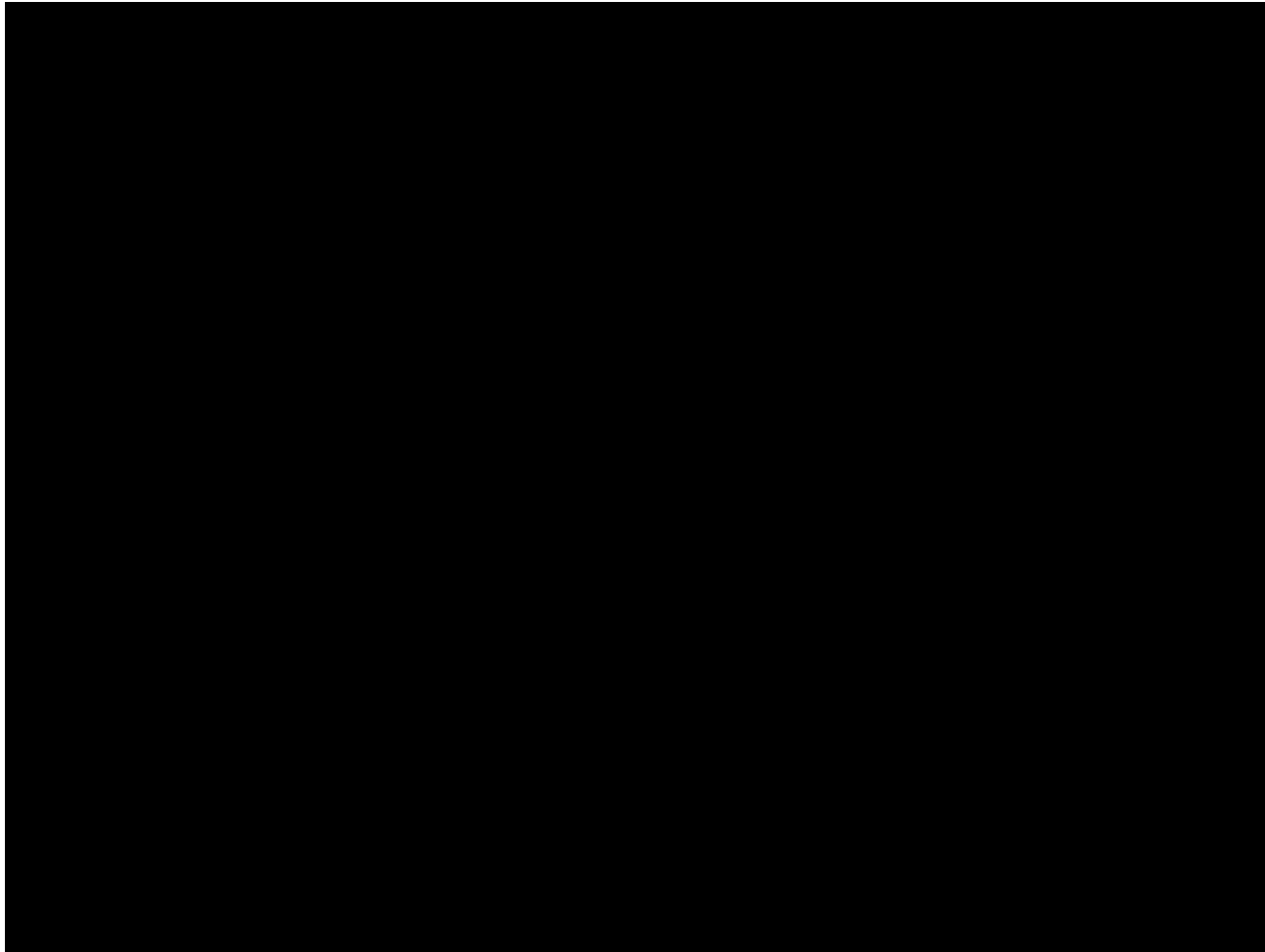


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# GM DEXRON<sup>®</sup>-VI USE

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IN THE FUTURE,

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the general market fluid for Automatic  
Transmission Fluid will be

a Multi-Purpose  
Un-licensed Fluid

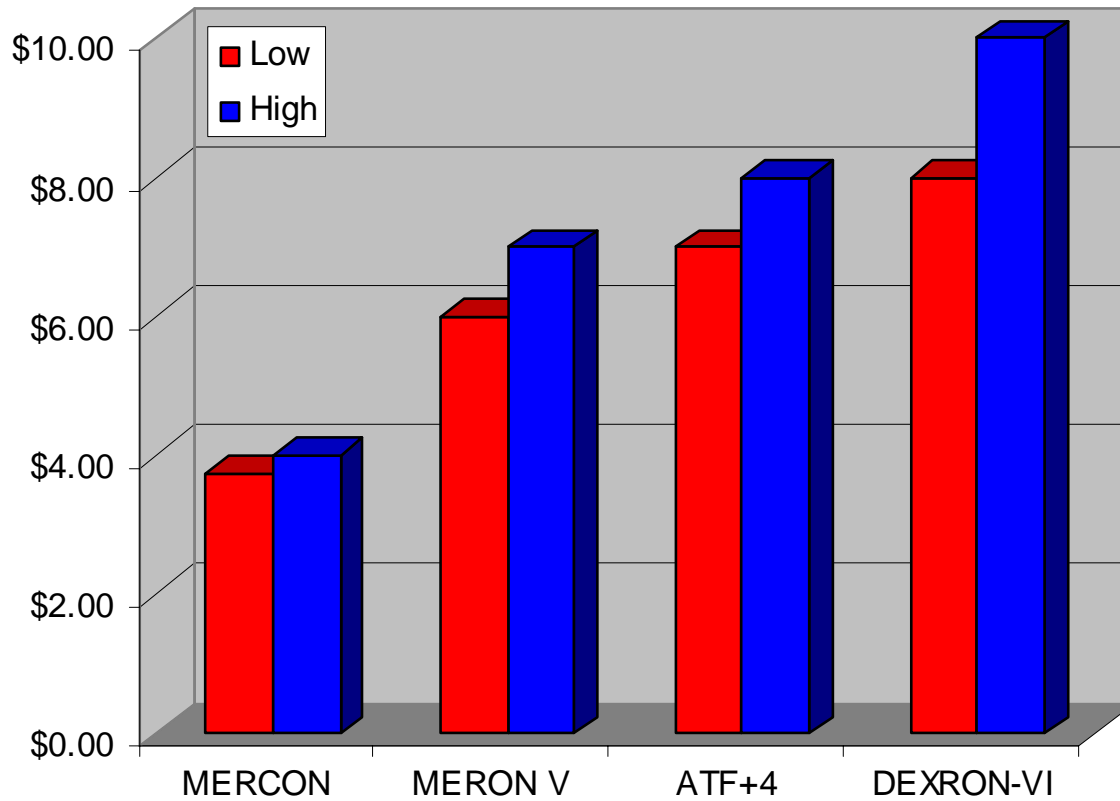
&

DEXRON<sup>®</sup>- VI will be a Niche!



# Cost to Consumers?

ATF Price by Type (Bulk Price per Gallon)

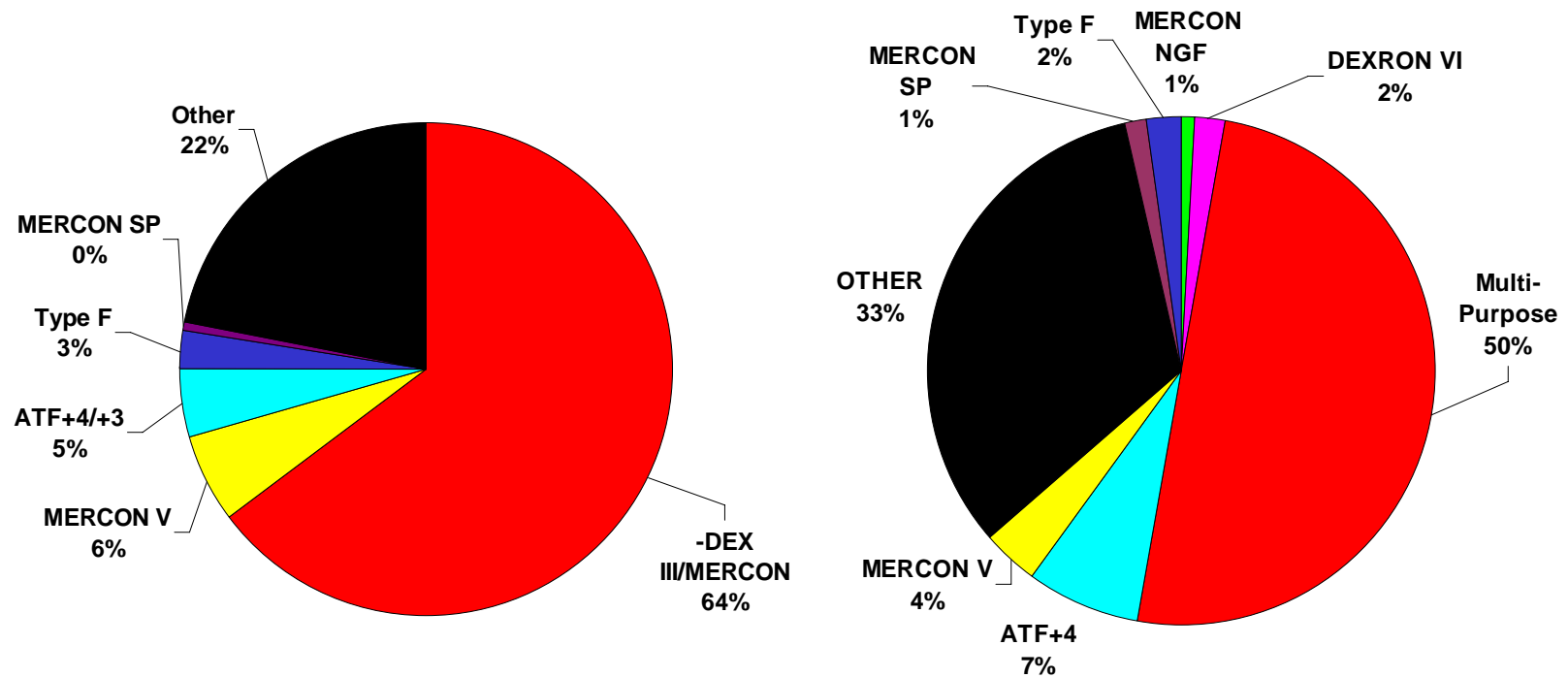




# 2006 vs. 2010 N.A. Service Fill ATF Market

2006

2010



Total Volume: 140 MM Gallons

*Other Includes: Asian, European & Multi-Vehicle Fluids*



# Summary

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## GM Licensed Fluids

Type A - 1949  
Type A, Suffix A - 1957  
DEXRON® - 1967  
DEXRON®-II - 1973  
DEXRON®-IIE - 1990  
DEXRON®-III - 1993  
**DEXRON®-VI - 2005**

## Ford Licensed Fluids

Type A/B - 1959  
Type F/G - 1967 (Non-Friction Modified)  
M2C138CJ - (DEXRON®-II)  
M2C166H - (DEXRON®-II + Lock-up TC)  
MERCON® - 1987  
MERCON® (Revised) - 1992  
**MERCON® V - 1995**

## Chrysler Licensed Fluids

MS-7176D/MOPAR ATF+2  
MS-7176E/MOPAR ATF+3  
MS-7176D withdrawn April 1998  
MS-9602/MOPAR **ATF+4** - 1998



# Valvoline ATF Products

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## Valvoline DEXRON<sup>®</sup>-III / MERCON<sup>®</sup>

Mainline product  
DEXRON<sup>®</sup>-III  
MERCON<sup>®</sup>  
Allison C4

## MERCON<sup>®</sup> V

Partial synthetic  
DEXRON<sup>®</sup>-III  
MERCON<sup>®</sup>/MERCON<sup>®</sup> V  
Allison C4

## ATF+4

Full Synthetic  
Fully approved  
Licensed with Chrysler

## Type FA

For use in older Ford and  
certain import transmissions  
Mainly used in industrial  
applications today (e.g.  
hydraulic)

## MaxLife

## MaxLife plus Stop Leak



# MaxLife ATF

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- Designed for older transmissions
  - Additional seal conditioners to minimize oil leaks and maintain seal performance
  - Utilizes premium base oils
    - Superior low temperature performance
    - Enhanced oxidation control
  - Utilizes advanced MERCON<sup>®</sup> V chemistry
    - Enhanced oxidation resistance
    - Enhanced friction durability
  - Utilizes premium viscosity modifiers
    - Enhanced shear stability



# MaxLife ATF

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- Meets full DEXRON<sup>®</sup>-III requirements
- Meets full MERCON<sup>®</sup> requirements
- Meets full Allison C4 requirements
- Meets most MERCON<sup>®</sup> V requirements
  - Shear stability and low temperature performance between MERCON<sup>®</sup> and MERCON<sup>®</sup> V
- Lower cost than MERCON<sup>®</sup> V
  - Wholesale 22% lower
  - Retail 40¢/quart lower
- Suitable for most transmissions
  - Ford, GM, Honda, Mitsubishi, Toyota



# ATF Selling Points

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## Good

- ✦ DEXRON®-III/MERCON®
  - ✧ Mainline mineral oil product
  - ✧ Allison C4 approved

## Specialty

- ✦ ATF+3®/ATF+4®
  - ✧ Premium base oils
  - ✧ Approved for Chrysler ATF+3/+4 applications
- ✦ Type FA
  - ✧ Primary use now industrial hydraulics

## Better

- ✦ MERCON® V ATF
  - ✧ Premium partial synthetic
  - ✧ Superior shear stability
  - ✧ Superior oxidation control
  - ✧ Superior low temperature performance

## Specialty-Best

- ✦ MaxLife
  - ✧ Premium Base Oils
  - ✧ Superior oxidation control and friction retention than standard MERCON® V
  - ✧ Lower cost than MERCON®V
  - ✧ Suitable for broadest application

THOMAS R. SMITH  
 Technical Director, Valvoline Brand

February 14, 2006

To Whom It May Concern:

Valvoline has received several inquiries regarding the topic of MaxLife ATF and its use in various vehicles beyond those requiring DEXRON®-III or MERCON® approved products. In response to these questions Valvoline has issued the following statements:

Valvoline supports the use of MaxLife ATF in a broad range of transmissions beyond those requiring DEXRON III and MERCON fluids including those in most North American and Asian manufactured vehicles and those applications listed below:

- Allison C-4
- Allison TranSynd (TES-295)
- Audi G-052-025-A2
- BMW LT71141 or LA2634 fluids
- Ford MERCON® V
- GM 9986195
- GM DEXRON II
- Honda/Acura ATF-Z1 (except in CVTs)
- Hyundai
- JWS 3309
- KIA SP-II and SP-III Fluids
- MAN 339 Type F
- MB Sheet 236.x
- Mitsubishi Diamond SP-II or SP-III
- Nissan Matic-D, Matic-J, and Matic-K
- Toyota / Lexus Type T, T-III or T-IV
- Voith H55.6335.33 (G607)
- Voith H55.6336.33 (G1363)
- Volvo 1161521 and 1161540
- VW TL52162
- ZF TE-ML-14B, 16L and 17C

Valvoline has conducted in-house testing to support MaxLife ATF performance in these transmissions. However, it is important to note that these vehicle manufacturers have neither evaluated nor approved MaxLife ATF.

Valvoline stands behind all of its products, including MaxLife ATF. Use of MaxLife ATF in transmissions where recommended by Valvoline WILL NOT void the vehicle's warranty. In the unlikely event that you or your customer experiences any transmission damage while using MaxLife ATF, please contact Valvoline at 1-800-Team-VAL for assistance.

While MaxLife ATF is designed to meet the special needs of higher mileage transmissions, new transmissions can also benefit from its enhanced oxidation protection, shear stability, seal compatibility, and anti-shudder protection and many consumers have chosen to take advantage of this level of performance.

MaxLife ATF is recommended for the new 5 and 6 speed transmissions, except the Ford 5R110 and Ford 6RXX (MERCON® SP), the Toyota/Lexus 6-speed (Toyota WS), and the Mercedes Benz W7A700 (7G-Tronic) which all require a low viscosity ATF fluid.

Valvoline does not recommend MaxLife ATF for use in continuously variable transmissions (CVT's) or in automatic transmissions where Ford Type F fluids are recommended.

Sincerely,



Thom Smith  
 Technical Director, Valvoline Brand  
 Valvoline, a division of Ashland Inc.



# Selling Tool

This kind of letter issued by technical personnel of Valvoline is helping greatly the selling of MaxLife ATF

Distributors and installers love the fact that they do not to inventory multiple products of ATF's



## POSSIBLE “BRANDED” ATF PRODUCT LINE — 2007

Product Positioning	Multi-Purpose (Formerly Licensed DEX/MERC NAME TBD)	Current MaxLife ATF (Formerly Licensed DEXRON/MERCON)	ATF+4™ (Full Synthetic)	MERCON V Synthetic Blend	Type FA	*DEXRON VI (Full Synthetic)
	Conventional	Premium	Premium	Premium	Niche	Niche
Primary Claims	API	API	Chrysler ATF+4	MERCON V MERCON DEX-IIIH Allison C-4	Ford Type F	DEXRON -VI
Secondary Claims	MERCON DEXRON-III H Allison C-4 Toyota Mazda Other imports	MERCON, MERCON V DEXRON-III H Allison C-4 Toyota/Lexus Honda/Acura Nissan Mazda Mitsubishi Hyundai/Kia MB 236.x BMW VW/Audi	Chrysler PSF Chrysler MTF		M2C-33F M2C-33G Hydraulic	

\*Items in yellow new additions