TSB: DT– 2006-06-29

Technical Service Bulletin

Date: 6/29/06

Product Description: AMSOIL Synthetic Gear Lubes SVG,SVO, FGR, FGO and AGL

Subject: Differential Oil Change After Initial Break-in

OBJECTIVE:

To define when most wear occurs in differentials, what internal components are involved and how to get the optimum differential life from your vehicle.

ISSUES:

All components in a vehicle are equally important. If your engine fails, you become stranded. However, you become just as stranded if the differential fails. Most motorists are unaware of the lubricants other than motor oil that require changing in their vehicles. According to one quick lube oil change company, only 2% of its customers change their gear lube. Differential gear lube is one of the oils that should be changed in order to optimize the gear and bearing life, but it is often overlooked or changed only when failure occurs.

TECHNICAL DISCUSSION:

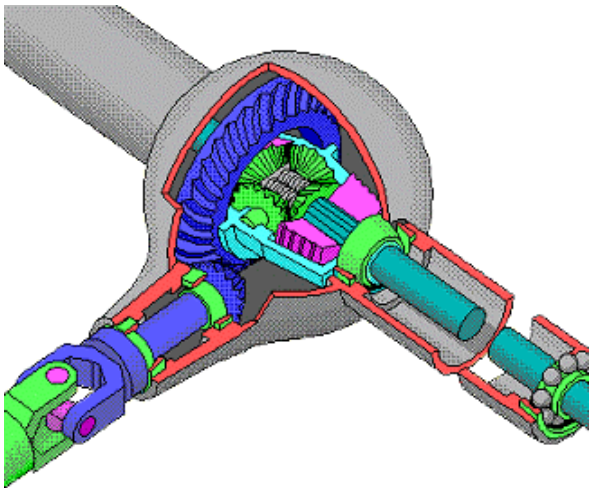
The differential is thought of as only having two parts, the ring and pinion gears. In fact, internal components consist of many parts:

1. One pinion gear
2. One ring gear
3. Two side gears
4. Two spider gears
5. Two pinion bearings
6. Two Carrier bearings
7. Two axle bearings
8. Multiple Limited slip clutches

There are approximately 22 components that make up the average differential (See chart I). All of these components require high quality, clean gear oil in order to perform at an optimal level.

Gears require a break-in period similar to internal combustion engines. Traditionally, new engines get the oil changed after a 3,000 to 5,000 mile break-in period, but differential gear lube is commonly neglected. Because differentials do not have filters, break-in wear particles continue to circulate between gears, bearings and limited slip clutches, often leading to premature wear or failure if subjected to severe service.

Chart I



Some manufacturers are giving special attention to changing differential oil after the first 500 to 3000 mile break-in period (see addendum chart II).

Most pickup trucks, SUV's and vans operate in severe service conditions, including towing, hauling, steep hill driving, commercial use, plowing, off-road use, frequent stop-and-go operation and high ambient temperatures. These severe service operating conditions subject the differential to extreme pressures and operating temperatures. New vehicles such as turbo diesel trucks and vehicles with V-10 engines boast more horsepower and torque than their predecessors, but differential designs have remained virtually unchanged. Differentials today are subjected to severe

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duty service and encounter more stress and heat than was seen only a few years ago. Modern gear oils are faced with the challenge of providing adequate wear protection during severe service and break-in operating conditions, while also providing maximum fuel efficiency. In fact, according to a 2005 SAE paper entitled ***Breaking the Viscosity Paradigm: Formulating Approaches for Optimizing Efficiency and Vehicle Life,*** "Concurrent with the strong drive toward better fuel economy, consumers have been demanding increased performance, which has required axle lubricants with enhanced durability protection and lower operating temperatures. There has been a 34% increase in engine horsepower over the last decade, while axle gear sizes have remained constant, sump capacities have been lowered, and drain intervals extended. In the light truck segment there has been a 93% horsepower increase since 1981."

Further evidence of stress and increased temperatures during the differential break-in period is documented in a 2005 SAE paper entitled ***The Effect of Heavy Loads on Light Duty Vehicle Axle Operating Temperature***. A light duty GM truck towing 14,000 pounds was driven from Orange County, California to the Nevada state line. The test was conducted with both a new axle and a broken-in axle. Over level ground towing, oil temperature was measured at 230 degrees F in the new axle and 203 degrees F in the broken-in axle. Oil temperature over the most grueling portion of the trip, during which a maximum 6% grade was encountered, revealed the new axle was operating at 350 degrees F and the broken-in axle was operating at 300 degrees F. Laboratory dynamometer test simulating a truck hauling a trailer provided similar results, with level ground towing temperatures recorded at 266 degrees F with the new axle and 194 degrees F with the broken-in axle and towing temperatures (at 3.5% grade) recorded at 370 degrees F with the new axle and 295 degrees F with the broken-in axle.

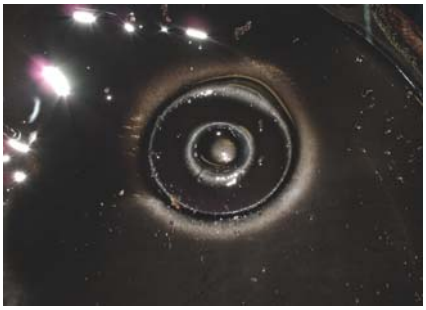
The importance of changing the factory fill break-in gear lube within the first few thousand miles was proven in a field test using four similar vehicles. Oil analysis confirmed that most of the wear occurs during the break-in process and that the oil should be changed for optimizing differential life. The pictures of vehicles 1 through 3 show high concentrations of iron break-in wear particles attracted to the magnets on the inside of the differential covers. Differential #4 used AMSOIL after the break-in period, providing visual proof that by changing out the break-in oil and installing AMSOIL, iron wear is greatly reduced.

Vehicle 1

6,869 miles on the vehicle & oil
Factory fill break-in gear lube SAE 75W-90
493 parts per million iron wear

Vehicle 2

16,766 miles on the vehicle & oil
Factory fill break-in gear lube SAE 75W-90
542 parts per million iron wear



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Vehicle 3

50,994 miles on the vehicle & oil
Factory fill break-in gear lube SAE 75W-90
608 parts per million iron wear

Vehicle 4

146,764 miles on the vehicle
18,101 miles on the oil
AMSOIL Severe Gear SAE 75W-90 Gear Lube
83 parts per million iron wear

Recommendation:

All vehicle differentials go through a break-in period. Addendum Chart II is an abbreviated reference list that refers to Original Equipment Manufacturers' differential oil drain intervals. Differential break-in should be complete after the first 5,000 miles. AMSOIL recommends that all vehicle differential gear lube, especially vehicles operating in severe service, be changed shortly after the break-in period of 5,000 miles or sooner where stated by the OEM. Draining the break-in gear lube and installing AMSOIL Severe Gear 75W-90 or 75W-140 Gear Lube ensures the optimum differential component life.

References:

1. SAE Paper # 2005-01-3860
Breaking the Viscosity Paradigm: Formulating Approaches for Optimizing Efficiency and Vehicle Life.
Baker, Mark R.; Grisso, Bryan A.; Rhoads, Gabe; Schenkenberger, Chris; and Qureshi, Ferrukh S.
The Lubrizol Corporation
Andrew Gelder
Lubrizol Limited, United Kingdom

2. SAE Paper # 2005-01-3893
The Effect of Heavy Loads on Light Duty Vehicle Axle Operating Temperature.
O'Conor, B.M.; and Schenkenberger, C.
The Lubrizol Corporation

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Addendum Chart II

Manufacturer drain interval source: Motor Check Chart, Quick Lubrication Guide, 2005 Edition

MFG & Model (Trucks, Vans & SUV's)	Model Year	Drain interval (Miles)					
		500	3000	5000	12000	15000	30000
All Dodge full size pickups and Ramcharger Front & Rear Differential	2003-2005					S	
All Dodge full size pickups and Ramcharger Front & Rear Differential	1995-2002				S		
Dodge Full Size Vans	1995-2003				S		
Ford E-Series, Excursion, Expedition, F-Series & F-Super Duty, Lincoln Blackwood, Navigator & Aviator	1997-2005		S Petroleum Gear Lube				
Chevrolet Silverado, GMC Sierra, Suburban, Tahoe, GMC Yukon, Yukon XL, Denali & Cadillac Escalade	1999-2002	First 500 miles (break in period) Trailer towing					
Chevrolet C and K models 1500 2500 & 3500	2001		N Initial oil change Only (Break In)			S	
Chevrolet Avalanche	2002-2005	First 500 miles (break in period) Trailer towing					
Chevrolet SSR							
Locking diff	2003-2005		N Initial Oil change Only (Break In)			S	
Standard diff	2003-2005					S	
Nissan							
Standard Diff	All						S
Limited Slip Diff	All					S	N
Toyota							
Sequoia	2001-2002			N			
Sequoia	2003-2005						S
Tundra	2004-2005						S
Tacoma Limited Slip	2004-2005					S	N

S = Severe Service

N = Normal Service

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