JOE GIBBS DRIVEN™ RACING OIL

Racing Oil 101

How Joe Gibbs Racing Uses Oil
To Increase Power & Extend Part Life

History

1999

- Joe Gibbs Racing begins to lose 1 in 10 new camshafts on break-in
- Pinpoints change in Zinc level as contributing factor

2000

- BR Break-In oil developed for camshaft break-in
- Bobby Labonte wins NASCAR championship with no DNF's

2005

- JGR begins to market Joe Gibbs Racing Oil
- Tony Stewart wins JGR's 3rd Championship

Zinc Facts

Proper Name: Zinc Dialkyl Dithiophosphates

- A family of additives – not a single additive
- Polar molecule – attracted to steel
- Activated by heat and load

Types – High and Low Molecular weight

- Primary – more thermally stable (Slower "burn")
- Secondary – less thermally stable (Faster "burn")
- Aryl
- Lower Molecular weight – Less thermally stable

Developed in 1941

Limited By API – ISLAC Standards

- Began in 1992 – API SH/ILSAC GF-1 – 1,200 ppm max
- Contains Phosphorus
- Source: Automotive Lubricants Reference Book, SAE International

Oil Today vs. Yesterday

Today's engine oils are not the same as they were even a few years ago.

Phosphorus and Zinc Reduction

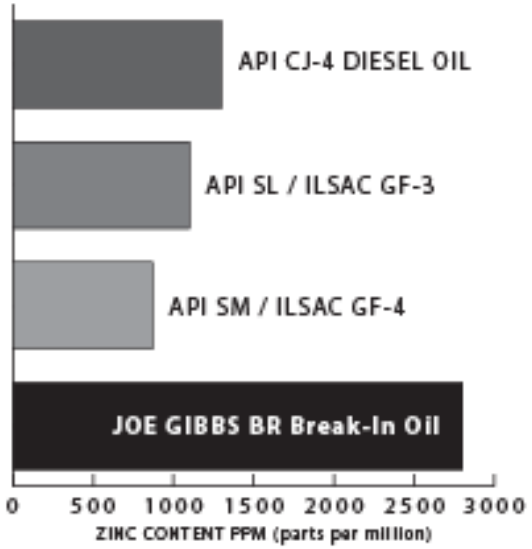
- Phosphorus degrades catalytic converters
- Zinc & Phosphorus content unlimited before 1993
- Phosphorus now limited to max 800 ppm (API SM / ILSAC GF-4)
- Mandated for 10W-30 and lower – still occurring in higher grades
- Diesel oils now limited to 1,200 ppm Phosphorus (Oct. 2006)

Increased Detergents

- Exhaust Gas Recirculation Valves
- Increased drain intervals - less waste oil

Lower Sulfur

- Restricted Sulfur content



Zinc vs. Detergent

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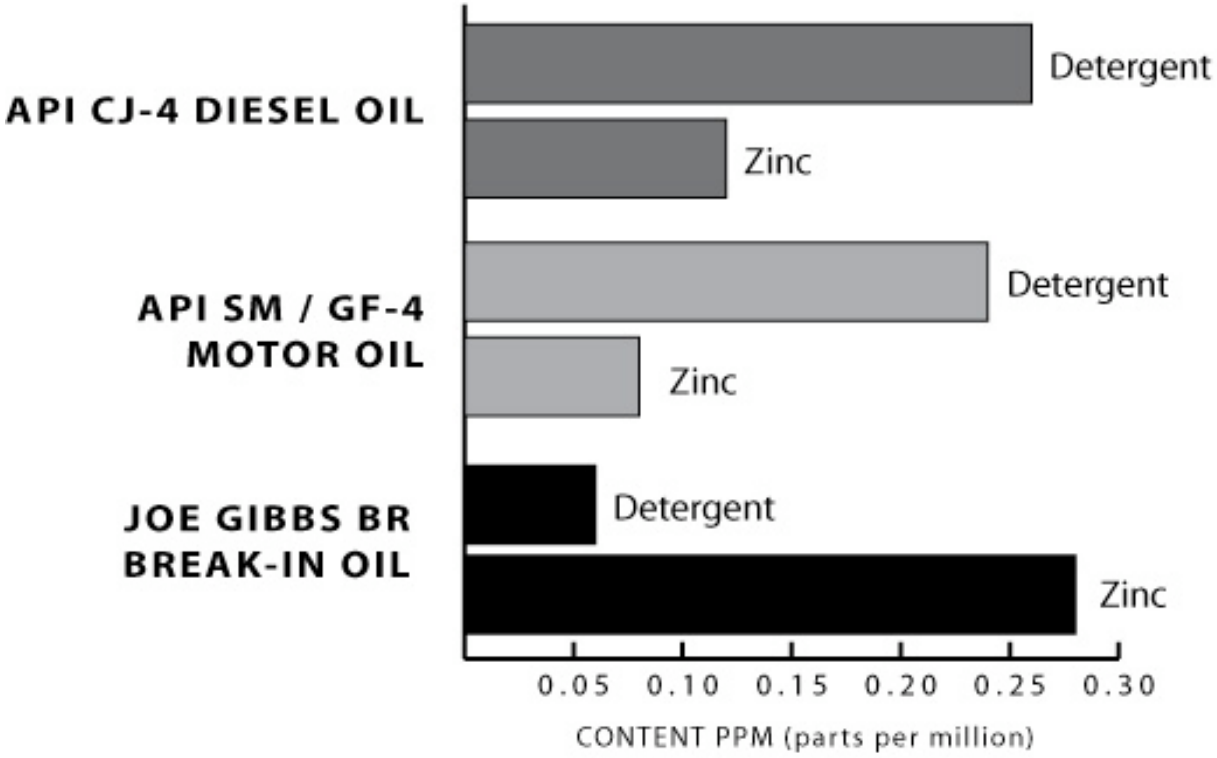
Detergent vs. Zinc Comparison



Joe Gibbs Driven Break-In Oil Has More Zinc & Less Detergent

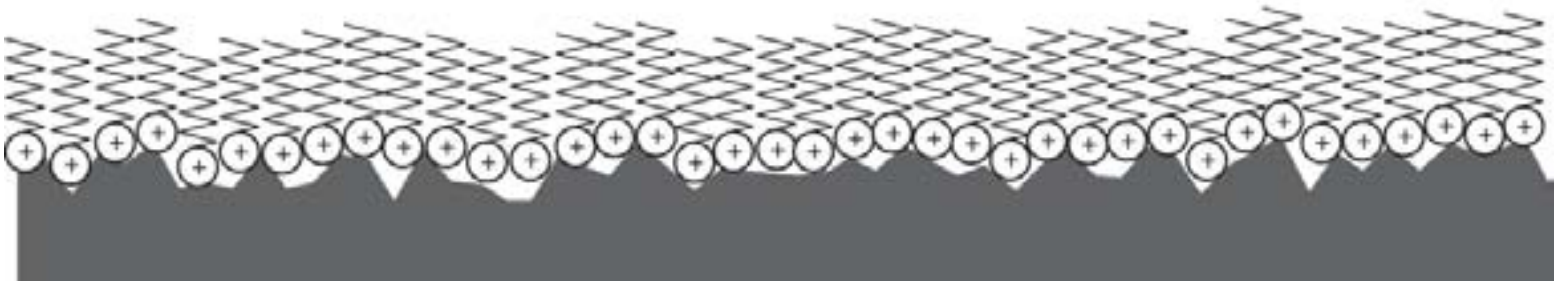
Joe Gibbs Driven BR Performs Like "old school" Non-Detergent Oils

How Does It Work?

ZDP (aka Zinc) and Moly (MoS_2) are polar molecules, so they are attracted to carbon steel surfaces where they react with heat, to create a sacrificial additive coating. The protective coating prevents metal to metal contact, which reduces friction and wear. Moly can withstand pressure up to 500,000 psi.

Detergent additives are also polar, so they "compete" against the Zinc and Moly.

Key Protection For:
Cams, Lifters, Push Rods, Wrist Pins
Distributor Gears, Bearings, Etc…



Why Is Zinc Important?

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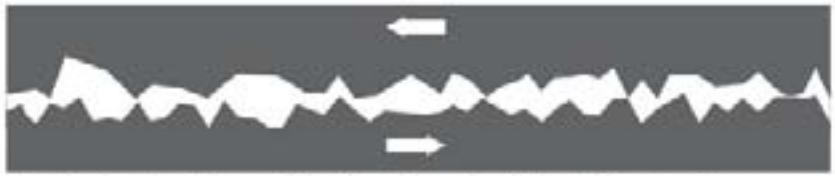
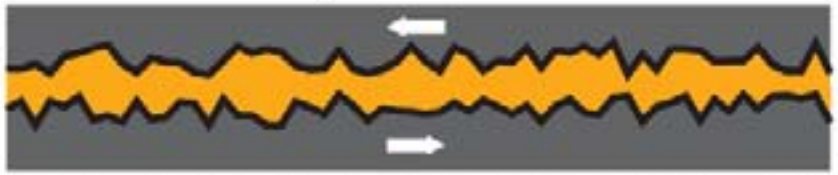
As Load Increases, Lubrication Moves From Full Film (Hydrodynamic) To Boundary Lubrication.
Zinc Provides Boundary Lubrication.

No Oil
High Friction
- High Wear



No Lubrication - Dry Surfaces In Direct Contact

Lightly Loaded



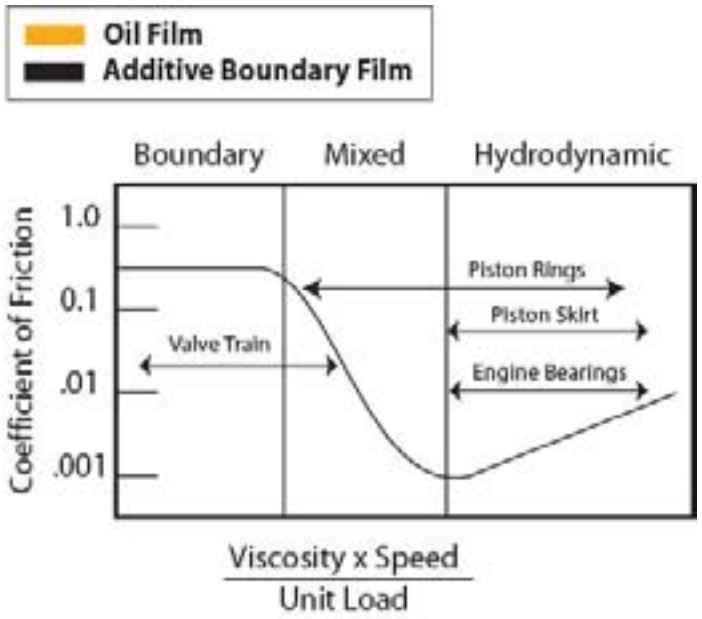
Full Film Lubrication - Oil Film Fully Seperates Surfaces

Moderate Loaded

Mixed Film Lubrication - Both Oil & Boundary Film Play A Role In Lubrication

Heavily Loaded

Boundary Lubrication - Performance Completely Dependent On Boundary Film
Additive film wears instead of metal surfaces



Proper Lubrication

The Right Oil

- Proper viscosity and additives for operating temperature, RPM and load
- There is no "magic molecule" that prevents engine failures
- No amount of Zinc can fix bad geometry – lifters must spin

In The Right Place

- The best oil sitting in the oil pan doesn't help your camshaft
- Oiling system design is critical to proper lubrication
- Look into EDM hole lifters, piston oilers, valve spring oilers

In The Right Time

- On time delivery is critical
- Cold starts and Dry starts account for majority of engine wear – Multigrade oils dramatically reduce cold start wear

In The Right Amount

- Proper oil flow is critical at all times
- Oil is the lifeblood of an engine

What Is Oil?

A quart of oil contains 2 things:

<u>Base Oil</u>

Roughly 85% of what is in the bottle is base oil. Most base oils come from crude oil. There are 5 different classes of base oil based on purity and source material.

- Crude
- Distillation Gases
- Vegetable oils and Animal fats

<u>Additive Package</u>

Roughly 15% of an oil is the additive package, but that 15% plays a big role in performance.

- Detergents
- Anti-Wear (Zinc)
- Friction Modifiers (Moly)
- Viscosity Modifiers

Where Does Oil Come From?

Crude oil is fractioned by distillation into different “cuts” of oil and fuels. Engine oils come from the middle part of the tower, and are then refined by various methods to become base oil. The fraction of oil that becomes engine oil contains 3 families of molecules – Paraffins, Naphthas, and Aromatics.

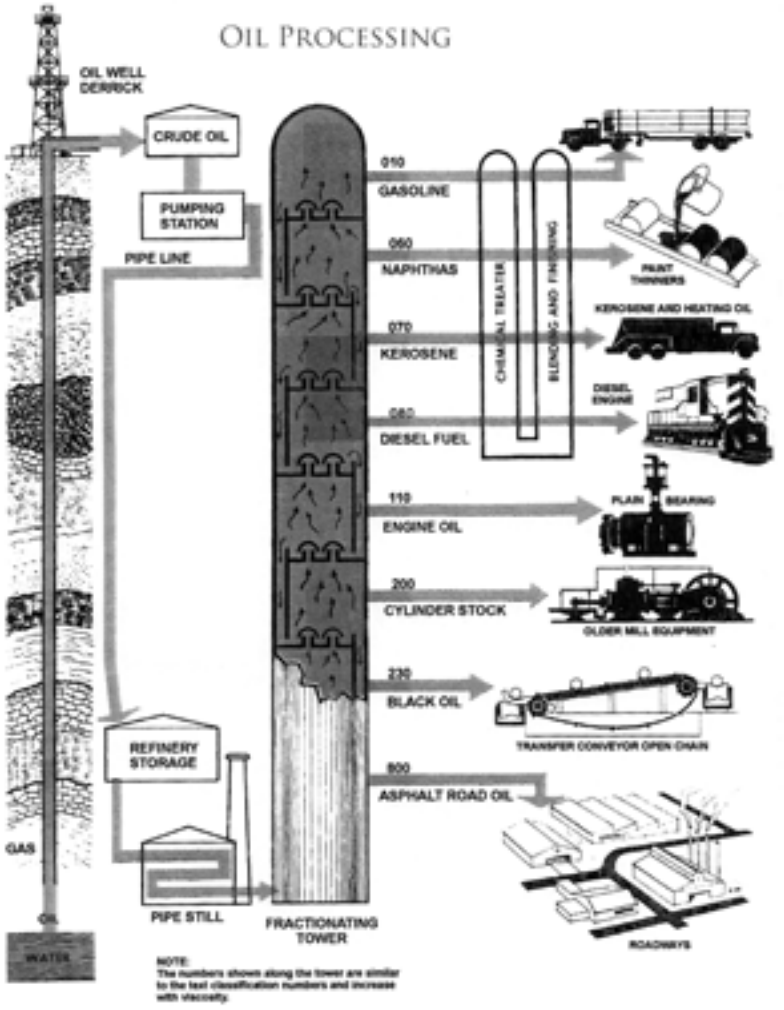
Paraffins: Good VI, preferred molecule

Naphthas: Low VI

Aromatics: Very Volatile

Base Oil Choices

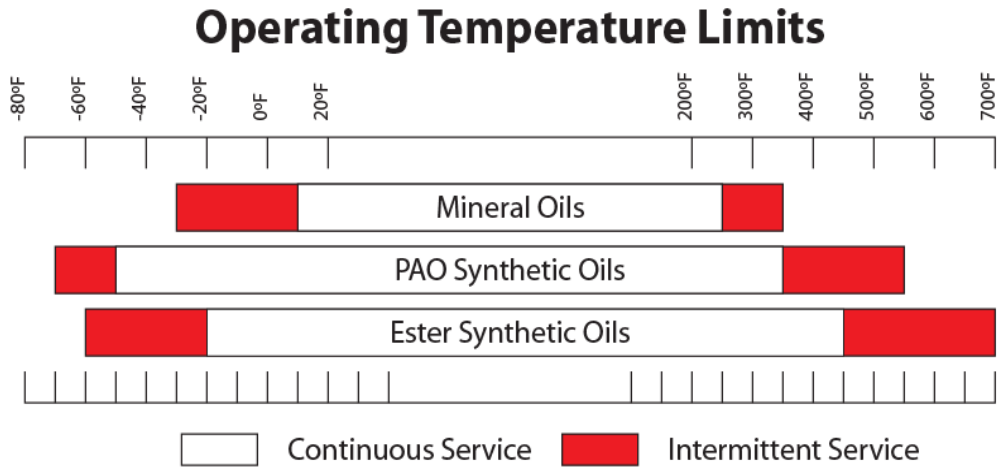
- Group I, II & III are mineral oils (Crude Oil)
- Group IV – PAO Synthetic (Distillation Gases)
- Group V is everything else (Animal fats and Vegetable oils)



Synthetic vs. Mineral

The difference between synthetic and mineral oils are the structure of the molecules and the purity of the oil. Refined crude oil contains complex mixtures of different molecular structures and saturates (Nitrogen, Sulfur and Oxygen). There is no way to select only the best materials from this mixture. Thus mineral oils contain both the most suited materials and the least suited materials for an engine oil. Synthetic oils are man made, and have tailored molecular structures with predictable properties. Because of this, synthetics can have the best properties of a mineral oil without the un-desired materials. Synthetic oils have two unique advantages over mineral oils – lower traction coefficients and higher oxidation stability. This translates into improved energy efficiency – less friction - and longer drain intervals.

Synthetic	Advantage vs. Mineral
PAO	High Temp Stability Improved Wear Protection Long Life High Viscosity Index
Ester	High Temp Stability Long Life Solvency / Detergency Low Temp Fluidity



Application Specific

Oil is Not One Size Fits All

To achieve maximum lubricant performance, an oil must be formulated to meet the specific need of the application.

The choice of oil for any application should be guided by the following operating conditions:

-Speed

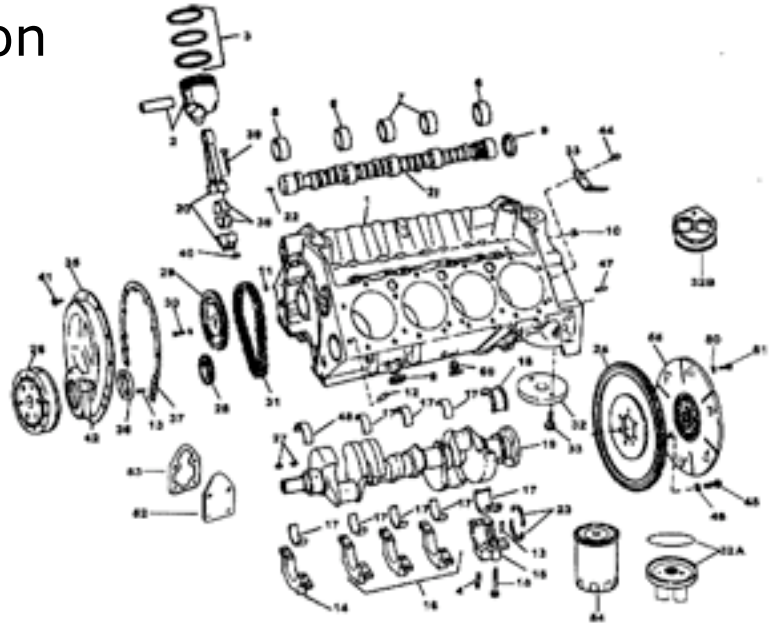
-Load

-Temperature

-Service Interval

-Equipment Design

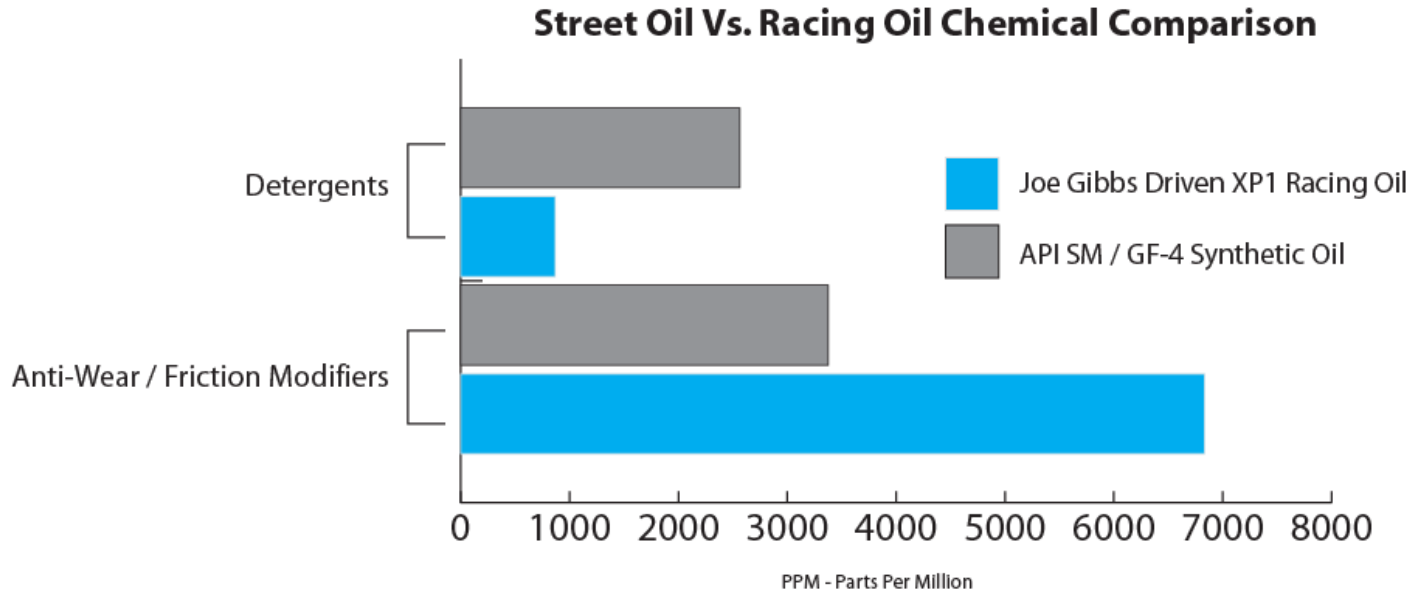
-Operating Environment



Street Oil vs. Racing Oil

Modern Engine Set-Ups
- Low RPM (Low Load - Less Need For Anti-Wear)
- Overhead cams (No Flat Tappets or Push Rods – Less Need For Anti-Wear)
- EGR Valves (More need for Detergents)
- Extended Drain Intervals (increased detergents & acid neutralizers)
- Modern engines built to use modern oils in order to achieve cleaner emissions

Race Engine Set-Ups
- High RPM (High Load – More Need For Friction Modifiers)
- Flat Tappet cams and Push-Rods – More Need For Anti-Wear
- Short Drain Intervals and EGR valves – Needs Fewer Detergents

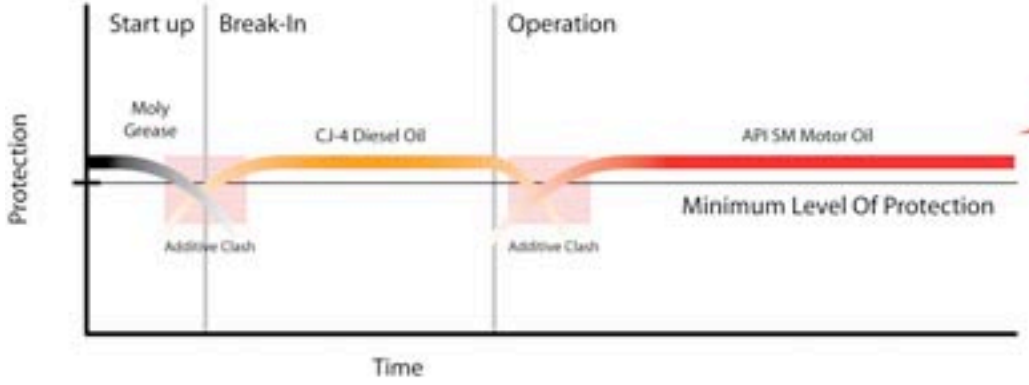


Racing Oil's Have More Anti-Wear & Friction Reducing Additives Than API Rated Street Car Oil's

Additive Clash

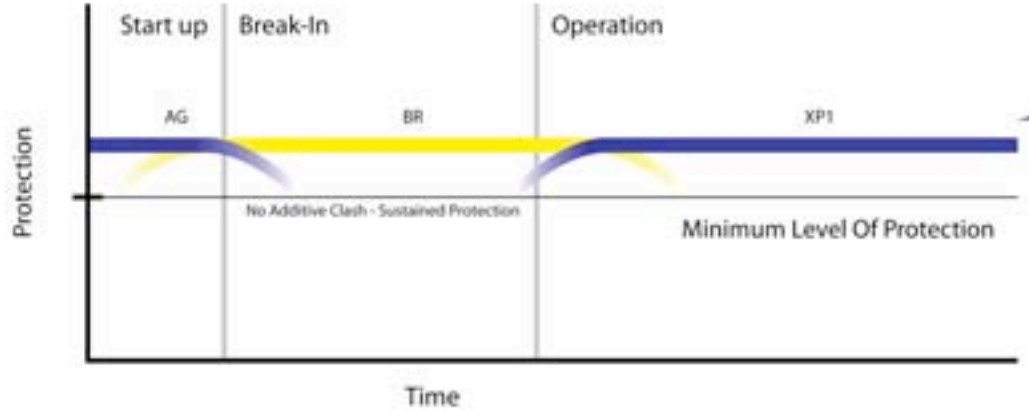
Additive clash occurs when two different additive chemistries interact antagonistically resulting in dips in protection. The high levels of detergent in API oils can contribute to Additive Clash.

Typical Break-In Procedure:



Three different lubricant chemistries working against each other.

Joe Gibbs Driven System Approach:



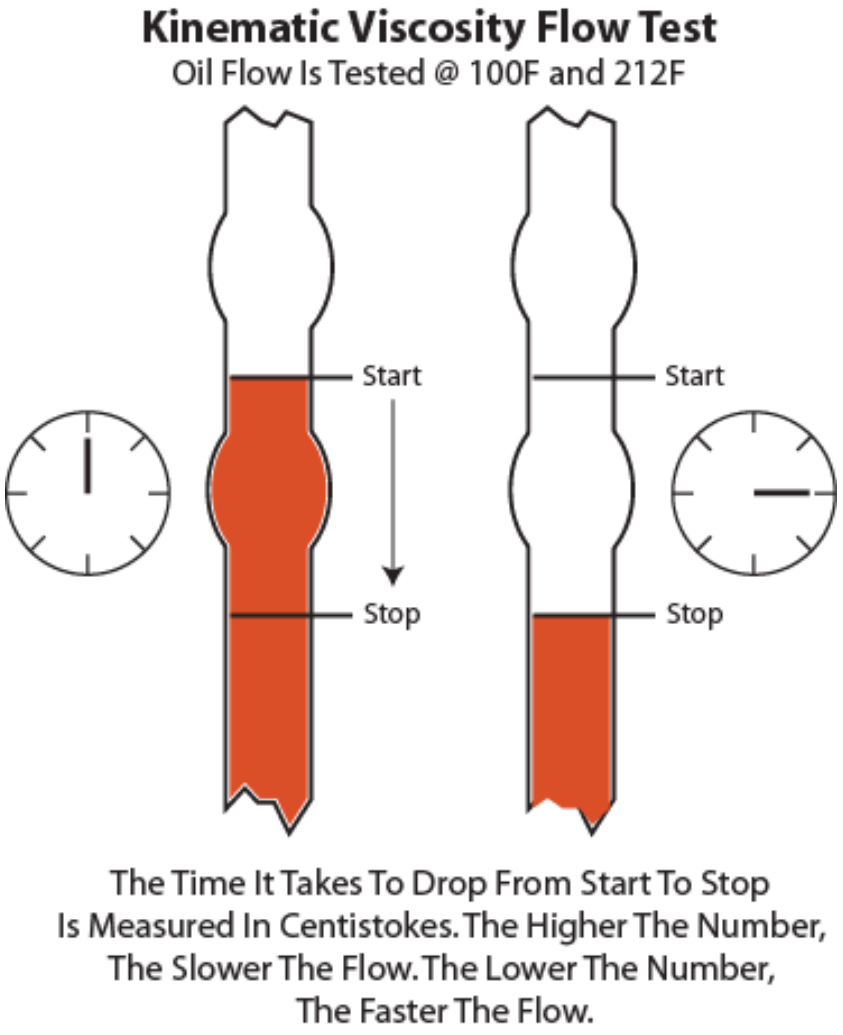
Matched lubricant chemistries working together to provide sustained protection.

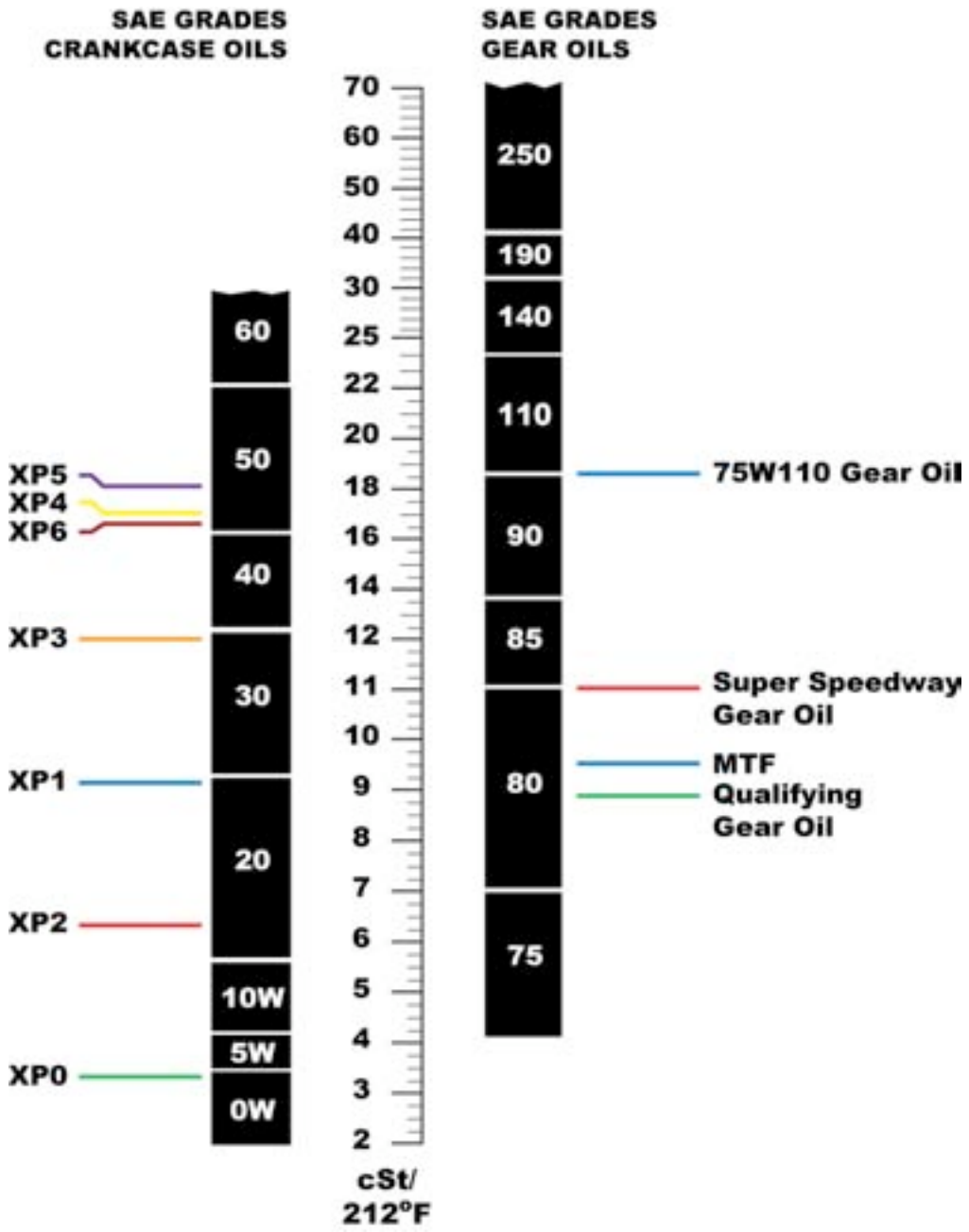
System Approach

Establishing an effective anti-wear / EP film in an engine is not unlike painting your car. Think of this system of **assembly grease** followed by **break-in oil** and then **synthetic oil** like the **primer**, **sealer** and **base color** of automotive paint. It makes a difference when you apply the right products for the job in the correct order!

What Is Viscosity?

- Viscosity is a measure of flow. Oil viscosity is generally thought of in terms of SAE grades, like 15W-50.
- An oil's flow rate increases as temperature increases.
- SAE grades are ranges, not an exact measurement of an oil's flow rate.
- The number before the W is measured at -22F. The Number after the W is measured at 212F.
- Kinematic Viscosity measures the exact flow rate of an oil at both 100F and 212Fdegrees.



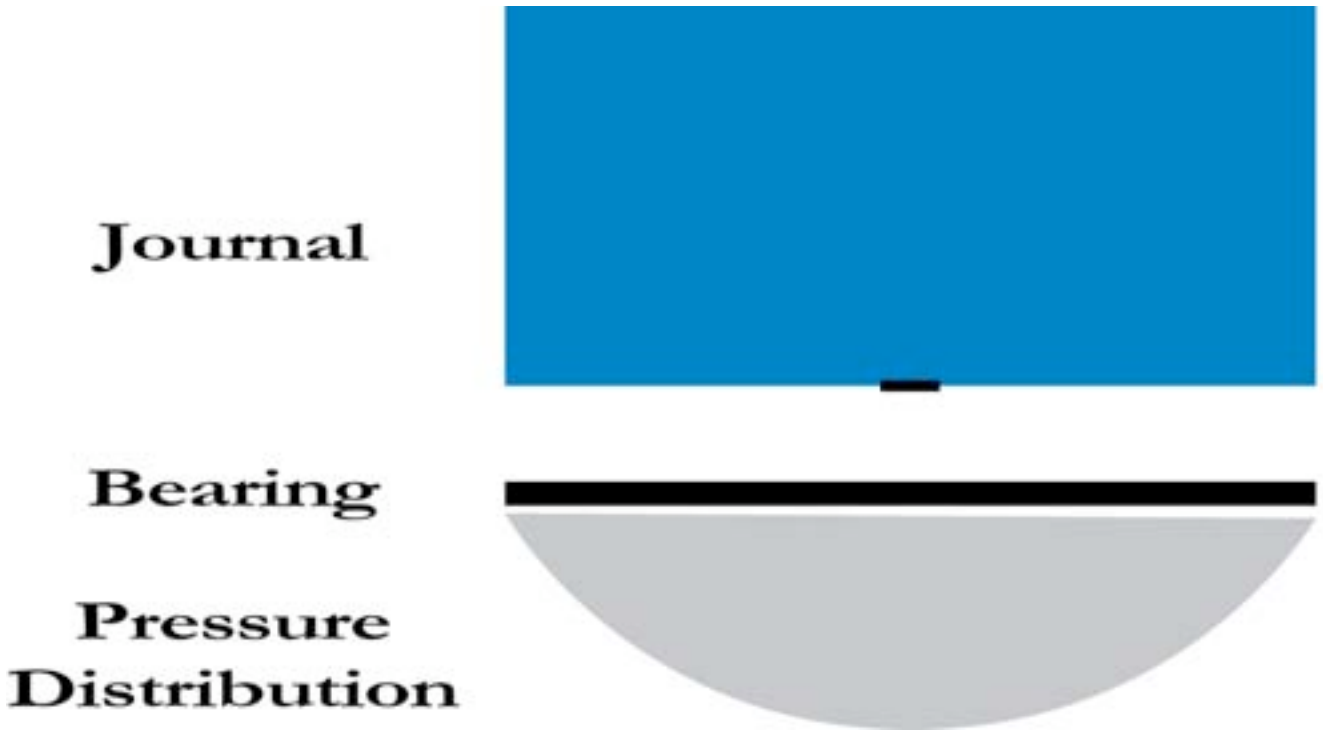


SAE Grades

SAE grades are only measured at 212F. The number before the “W” in a 15W-50 or 0W-30 is a cold cranking index that is measured at -22F.

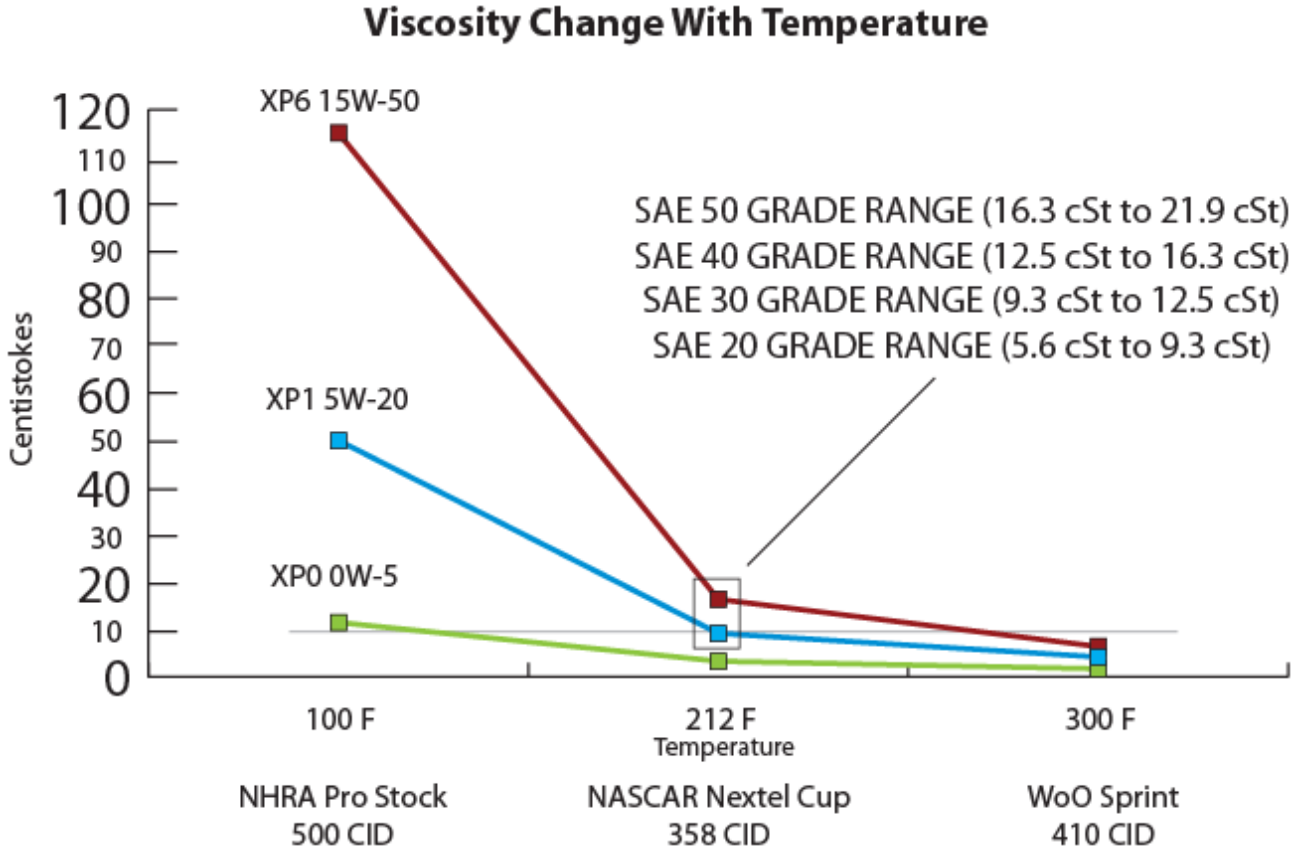
Oil Clearances

Wider Bearing Clearances Require Higher Viscosity Oil To Maintain Hydrodynamic Oil Wedge

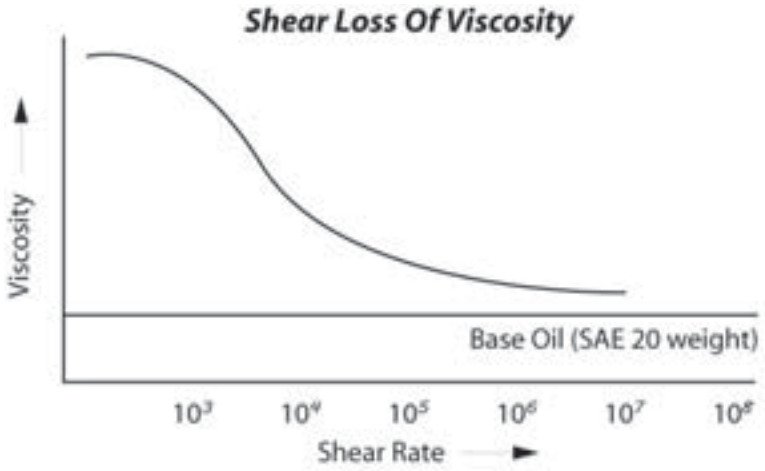


Operating Viscosity

The “Operating” viscosity is the Centistoke flow rate of an oil at the operating oil temperature of an engine. Some engines run low oil temperatures, and other engines run extremely high temperatures. Low viscosity oils work well in low temp applications, and high viscosity oils work well in high temp applications. The SAE Grade viscosity of these oils are very different, but the operating flow rates are very similar.



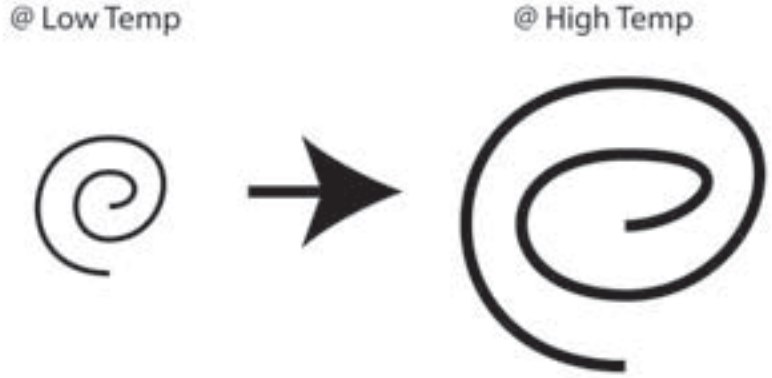
Viscosity Modifiers



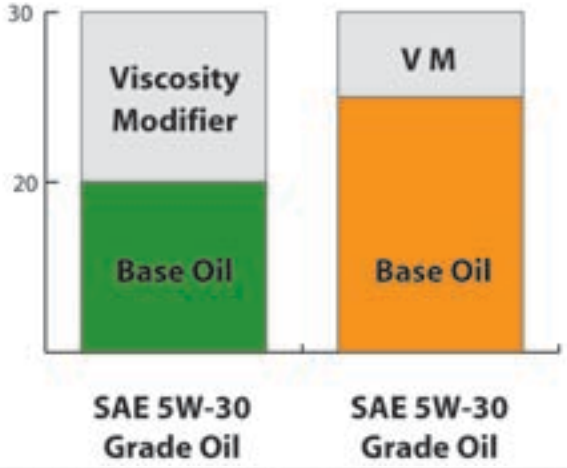
Viscosity Modifiers

- *Polymer based oil additive - makes multi-grade oils possible*
- *"Shrink" under shear forces*
- *Shear forces in race engines are greater than in production engines*
- *Prone to permanent shear loss under extreme pressures*
- *Adds friction modifying and dispersant functions*

How Viscosity Modifiers Work



How Viscosity Modifiers Effect Oil Formulations



Shear Effect

Description	VALVOLINE VR1 RACING OIL	VALVOLINE VR1 RACING OIL	
SAE Grade	20W-50	20W-50	
	No Shear	With Shear	Change
Viscosity @ 100 F	179.5		
Viscosity @ 212 F	20.4	13.2	-7.2
Viscosity @ 300 F	7.8	5.1	-2.7
Viscosity Index	133		
Description	**Mobil 1 15W50 Extendec Performance**	**Mobil 1 15W50 Extended Performance**	
SAE Grade	15W-50	15W-50	
	No Shear	With Shear	Change
Viscosity @ 100 F	127.5		
Viscosity @ 212 F	17.7	10.5	-7.2
Viscosity @ 300 F	7.2	4.4	-2.8
Viscosity Index	154		
Description	**Joe Gibbs XP6**	**Joe Gibbs XP6**	
SAE Grade	15W-50	15W-50	
	No Shear	With Shear	Change
Viscosity @ 100 F	115.0		
Viscosity @ 212 F	16.4	12.1	-4.3
Viscosity @ 300 F	6.4	4.7	-1.7
Viscosity Index	154		
Description	**Joe Gibbs XP3**	**Joe Gibbs XP3**	
SAE Grade	10W-30	10W-30	
	No Shear	With Shear	Change
Viscosity @ 100 F	73.8		
Viscosity @ 212 F	12.0	8.9	-3.0
Viscosity @ 300 F	4.9	3.6	-1.3
Viscosity Index	158		

Drain Intervals

Chemical Identity	XP3 Drain, 500 laps, Darrell Lanigan	XP1 Drain, #18 Car, Atlanta	XP1 Drain, #11 Car, Atlanta	New XP1	New XP3
ELEMENTAL ANALYSIS					
ALUMINUM %	0.0081	0.0004	0.0005		
CHROMIUM %	0.0020	0.0004	0.0005		
COPPER %	0.0020	0.0018	0.0025		
IRON %	0.0079	0.0007	0.0006		
LEAD %	0.3064	0.0812	0.0847		
SILICON %	0.0052	0.0023	0.0014		
TITANIUM %	0.0232	0.0001	0.0001		
KINEMATIC VISCOSITY, D2270					
VISC @ 40ºC cSt	76.1	51.3	51.1	50.0	73.8
VISC @ 100ºC cSt	11.9	9.1	9.1	9.10	11.9
VI	152	160	161	165	158
REMARKS	No Loss	No Loss	No Loss		
GASOLINE FUEL DILUTION, D3525B					
DILUTION %wt	0.46	0.24	0.26		
FTIR, OXIDATION AND NITRATION RESULTS					
OXIDATION	2.47	0.09	0.19		
NITRATION	0.42	0.05	0.05		
REMARKS	Little to none	None	None		

Drain Intervals

DESCRIPTION	New XP5 Typicals	XP5, Alcohol Motor, 4 Races, 300F	XP5, Alcohol Motor, 300 Laps No filter change
FTIR,OXIDATION - NITRATION			
OXIDATION	0	Minimal	Minimal
NITRATION		Minimal	Minimal
KINEMATIC VISCOSITY, D2270			
VISCOSITY @40 cSt	130	125	122.9
VISCOSITY @100 cSt	17.7	15.91	15.26
VI	150	135	129
HTHS BY TBS AT 150C, D4683			
APP VISC 150 cP	4.7	4.37	4.26
ELEMENTAL ANALYSIS, ICP			
ALUMINUM %		0.0007	0.0048
BORON %		0.0005	0.0001
CALCIUM %	0.0590	0.0206	0.0522
CHROMIUM %		0	0.0009
COPPER %		0.0005	0.0049
IRON %		0.0006	0.0155
MAGNESIUM %		0	0.0007
MOLYBDENUM %	0.0340	0.0301	0.0339
SODIUM %		0	0.0014
PHOSPHORUS %	0.1150	0.1292	0.1007
LEAD %		0.0009	0.0045
SULFUR %	0.4400	0.4776	0.4400
SILICON %		0.0006	0.0043
TIN %		0	0.0005
ZINC %	0.1270	0.1519	0.1292
TITANIUM %		0.0007	0.0061
CRANKING VISCOSITY, D5293			
CCS @ -10 DEGC cP			
COMMENTS		Little oil degradation, some shearing, little wear contamination.	Little oil degradation, some shearing, significant wear contamination, dirt contamination (Silicon)

Operating Costs

By changing your filter every **100 laps** and topping off the oil tank, you are able to increase the drain interval. As a result, the **operating cost** of oil goes **down**.

	Initial Fill	*100 Laps*	*200 laps*	*300 laps*	*400 laps*	
Wix Filter	19.99	19.99	19.99	19.99	19.99	
Valvoline VR1 (8 quarts)	39.92	39.92	39.92	39.92	39.92	
XP6 (8 quarts)	115.92	14.49	14.49	14.49	14.49	
Oil + Filter						**Total (500 Laps)**
Valvoline VR1 20W-50	59.91	59.91	59.91	59.91	59.91	299.55
XP6 15W-50	135.91	34.48	34.48	34.48	34.48	273.83
					Savings	**25.72**

Valvoline VR1 20W-50 - $4.99/qt - Prices from Jegs.com 1/20/08 | XP6 $14.49/qt

Break-In Oil

JOE GIBBS DRIVEN RACING OIL

Save Cams, Save Time & Save Money!

* Joe Gibbs Break-In oil has 2,800 ppm Zinc - Double the Zinc of Rotella!
* No More Mixing - Joe Gibbs Break-In oil does not need any GM EOS!
* 5 quarts of Break-In oil costs no more than Rotella plus GM EOS!
* Less Detergent For Better Ring Seal!

5 Quarts
@ $3.59/qt.
= $17.95

+

1 Pint
= $19.95

= $37.90

5 Quarts
@ $7.49/qt.

= $37.45

For Ultimate Flat-Tappet Protection, Use Joe Gibbs Assembly Grease to Pre-Lube Lifters and Lobes

Hot Rod Oil

JOE GIBBS DRIVEN RACING OIL

Cost Effective Protection!

> Joe Gibbs Hot Rod Oil Provides More Zinc Than API Oils

> No More Mixing - Joe Gibbs Hot Rod Oil Requires No Additives

> Unmatched Rust & Corrosion Protection

> Excellent Cold Start Protection - Less engine wear

5 Quarts
@ $7.29/qt.
= $36.45

+

1 Pint
= $15.99

= $52.44

5 Quarts
@ $10.49/qt.

= $52.45

For superior Flat-Tappet Protection, Use Joe Gibbs Break-In Oil & Assembly Grease for initial break-in.

What To Use...

New or Rebuilt Engine
BR & Assembly Grease

Choose an oil based on application!

Race Car
XP Series Oil

Restoration
Hot Rod Oil

Daily Driver
API Licensed Oil