

UNDERSTANDING GEAR OILS

SPECIAL PROPERTIES FOR MANUAL GEAR / DIFFERENTIAL OILS

- Capable of providing an easy gearshift for the life of the oil drain. This is a function of both friction modifiers and viscosity.
- Maintain long clutch life and prevent seal leaks.
- Must protect against pitting, spalling, scoring and scuffing caused by the large shear loads placed on the oil by the gear set.
- Protect against copper corrosion. Older technologies were not kind to copper alloys and used to turn them black via chemical attack. Most modern hypoid oils do not tend to do this due to advances in technologies.
- Limited slip oils must enable the cone or clutch to work properly when distributing power to the drive wheels. As such, they contain a special friction modifier to achieve this. It should be noted that oils designed for use in limited slip differentials can be used in standard hypoid differentials.

GEAR OIL DESIGNATION AND DESCRIPTION

For gear oils, API has the following GL (Gear Load) classifications:

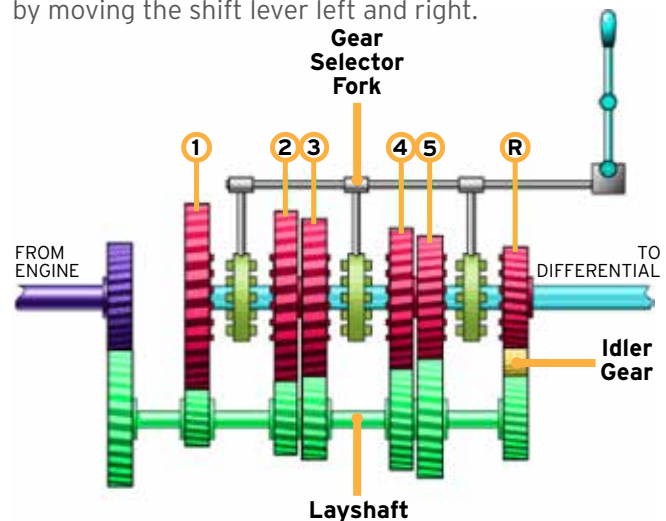
- GL-1 Oil without EP additive.
- GL-2 Usually contains fatty materials.
- GL-3 Contains a mild EP additive.
- GL-4 Equivalent to MIL-L-2105B and is usually satisfied by a 50% GL-5 additive level.
- GL-5 Equivalent to MIL-PRF-2105E. Primary field service recommendation for Passenger cars and trucks worldwide.
- GL-6 For severe service involving high offset hypoid gears. Often used to describe oils used in limited slip differentials. (Obsolete now)
- MT-1 For non-synchronised manual transmissions in buses and trucks at a higher level than GL-4.
- MIL-PRF-2105E Designed by the US military, it takes conventional GL-5 and adds more demands to the specification. Most hypoid oils conform to this standard. Now superseded by SAE J2360 (2003).

SAE J306 (Jun 2005) Gear Oils			
SAE Grade	Max Temperature for a Viscosity of 150,000cP	Viscosity @ 100°C	
		Min cSt	Max cSt
70W	-55	4.1	NA
75W	-40	4.1	NA
80W	-26	7.0	NA
85W	-12	11.0	NA
80	NA	7.0	<11.0
85	NA	11.0	<13.5
90	NA	13.5	<18.5
110	NA	18.5	<24.0
140	NA	24.0	<32.5
190	NA	32.5	<41.0
250	NA	41.0	NA

NOTE: Limit must also be met after testing in 20 hour KRL Shear Stability Test (CEC-L45-T-93 Method C).

HOW DOES A MANUAL TRANSMISSION WORK?

A manual transmission consists of a set of gears along a pair of shafts, the input shaft and output shaft. The gears on one shaft engage with those on the other shaft. The resulting ratio between the gear selected on the input shaft and the gear engaged on the output shaft determines the overall gear ratio for that "gear." Gears in a manual transmission are selected by moving a shift lever, which engages a linkage that controls the movement of the gears along the input shaft. Moving the lever forward or rearward chooses between the two gears available on a given linkage; cars with four gears, or speeds, use two linkages; cars with five or six speeds use three linkages. The driver changes between linkages by moving the shift lever left and right.



To engage a gear in a manual transmission, the clutch pedal is pressed, disconnecting the engine from the input shaft of the transmission. This frees the gears on the input shaft (Layshaft) to move, so when the engine is sending torque through the input shaft, the gears on it are engaged. Once the clutch has disconnected the power from the engine to the transmission, the user selects the appropriate gear (i.e. first, third, reverse). Both the input shaft gear and the output shaft gear need to be spinning at the same speed to avoid clashing of the gears during engagement. Synchroniser rings are used to allow the two gears to spin at the same speed before engagement, preventing clashing of the gear sets. Once the clutch is released, engine power is re-engaged to the input shaft propelling the vehicle with the selected gear ratio.



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Other types of Manual Transmission include:

Automated Manual Transmission (AMT) - A manual transmission where shifting and clutch operation is done by hydraulic or electric actuators under electronic control. Dual Clutch Transmissions (DCT) allow shifting without torque interruption. This is achieved through employing 2 clutches and an additional countershaft.

WHAT IS A DUAL CLUTCH TRANSMISSION?

A Dual Clutch Transmission (DCT) is effectively two gearboxes in one. Two clutches to eliminate shift shock - one closes as the other opens.

Sophisticated electronics and hydraulics control the clutches, just as they do in a standard automatic transmission. In a DCT, however, the clutches operate independently. One clutch controls the "odd" gears, while the other controls the "even" gears. Using this arrangement, gears can be changed without interrupting the power flow from the engine to the transmission. The gear shafts have constantly meshed gears and synchronisers, so the driving style is very much like a conventional automatic transmission.

Some DCTs use a wet clutch system and some use a dry clutch system - so slightly different oils are required.

Advantages:

- No torque loss or limitation.
- Overcomes "shift shock" associated with the more conventional automated manual transmissions.
- Fuel efficiency: +15% vs 5-speed stepped automatic transmissions.
- Uses existing manual transmission manufacturing facilities.
- Better acceleration than a manual transmission.
- Handles higher torque loads than CVTs.
- Size.

The most common DCT at the time of writing is a six speed unit used by the Volkswagen group. They call it a DSG transmission. VW also have a seven speed DSG and all are now called S-Tronic. It is felt that these will become widely used and across a wide range of vehicles. High performance vehicles made by Ferrari, Mercedes Benz, Nissan and BMW (large capacity, high output engines) also have DCTs.

HOW DOES A DIFFERENTIAL WORK?

The wheels are connected to the differential unit via half shafts. Power from the transmission drives the pinion gear which in turn drives the ring gear. The ring gear is connected to 1 or 2 pairs of smaller bevel gears (known as spider gears), and ultimately power is transferred to the wheels. It is these smaller bevel gears that form the heart of the differential unit: A mechanical device that detects when one wheel is turning faster than the other, and uses the spider gears to absorb the different speeds of both wheels and allow smooth cornering.

TYPES OF DIFFERENTIAL:**Open Differential** (The most basic differential):

- Under good traction, it applies the same torque to both wheels.
- However when traction is poor and one wheel slips on ice or mud, the slipping wheel will receive all the torque whilst the other wheel receives none, even though it does have grip.

Limited Slip Differentials are better suited in poor traction conditions:

- Similar to open differentials but they have clutch packs inside the differential carrier, which apply friction between the side gears and the carrier.
- The friction from the clutches encourages the side gears to turn at the same speed as the differential carrier.
- When torque is applied under slippery conditions, friction from the clutch packs prevents the wheel with little traction from spinning wildly and ensures that some torque is transmitted to the other wheel which has grip.

Locking differentials contain a mechanism to fully lock both halves of the axle at the same speed:

- Must not be locked on a hard surface, but quite common to improve traction in heavy trucks, especially in poor weather conditions and off-road applications.
- Locking differentials may be automatically activated (when the difference in wheel speeds reaches a given point) or driver-actuated.

**Torque Sensing or Torsen® differentials:**

- These tend to be complex arrangements of spur, helical and/or bevel gears, which prevent extreme differences in wheel speeds, therefore maintaining useful traction at each wheel all the time.
- They do not use clutches or electronics, so are both reliable and durable, and are used in many rear, front and centre differentials.

Transfer cases manage the power split between front and rear axles or axle pairs, in vehicles with more than one drive axle:

- Transfer cases can be any of the above mentioned types, or can be a viscous coupling similar to a torque converter in operation.

Limited slip differentials with electronic control:

Similar to Limited Slip differentials with clutch packs to prevent slipping of one wheel. The friction of the clutches is controlled externally using sensors at the wheels to detect slipping. The hydraulic pressure needed for the clutches is electronically controlled.





MANUAL GEAR / DIFFERENTIAL

Penrite has three categories of Manual Gear / Differential oils:

PRO GEAR: Penrite's range of performance automotive gear oils include full synthetics, manufactured utilising a special combination of synthetic base oils with an advanced additive system, as well as a premium mineral oil, to provide performance and protection under severe service. Suitable for use in manual gearboxes, transaxles, transfer cases and differentials.

TRANS GEAR: Penrite's range of semi synthetic automotive gear oils are manufactured from a blend of highly refined base oils, the latest technology additives, friction enhancers and an advanced viscosity modifier. Suitable for use in manual gearboxes, transaxles, transfer cases and differentials.

GEAR OIL: Penrite's range of premium mineral automotive gear oils are manufactured with modern extreme pressure additives and friction modifiers. This new formulation allows the one range of gear oil to be used in both Limited Slip and Hypoid type differentials, eliminating the need for multiple products. Can also be used in some manual gearboxes, transaxles and transfer cases.



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Pro Gear 70W-75

Product Code	Pack Size	Carton Qty
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PROG7075001	1 Litre	6
PROG70750025	2.5 Litres	4
PROG7075020	20 Litres	1
PROG7075060	60 Litres	1
PROG7075205	205 Litres	1

Base Oil: Full Synthetic
Colour: Amber

Viscosity: 70W-75

Key Specifications: API GL-4 Plus, ZF TE-ML 11 (manual), MTF BOT 338, Tremec (T-56)

Application: Manual Gearboxes, Transfer Cases, Transaxles

Penrite Pro Gear 70W-75 is a premium full synthetic, high performance gear oil, manufactured from a blend of synthetic base oils including ester. It uses the latest technology, purpose designed additives for long service life and meets the performance requirements of API GL-4 Plus as well as many other manufacturer specifications. It has very fast flow at start up for slick gear shifts. Ideal in many manual gearboxes and transfer cases where the manufacturer originally specified automatic transmission fluids.



Pro Gear 75W-85

Product Code	Pack Size	Carton Qty
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PROG7585001	1 Litre	6
PROG75850025	2.5 Litres	4
PROG7585020	20 Litres	1
PROG7585060	60 Litres	1
PROG7585205	205 Litres	1

Base Oil: Full Synthetic

Viscosity: 75W-85

Replacement Viscosities: 80W-85, SAE 80 **Colour:** Amber

Key Specifications: API GL-4 Plus, GM 12346190, MB 235.10/235.4, Chrysler MS 9224, ZF TE-ML 01/02/08, BTR 5M-42, MAN 341

Application: Manual Gearboxes, Transfer Cases, Transaxles

Penrite Pro Gear 75W-85 is a premium full synthetic, manual gearbox oil manufactured from a blend of carefully selected synthetic base oils. It uses the latest technology, purpose designed additives for long service life and excellent load carrying capacity. It contains a unique viscosity modifier for stay-in-grade performance for the life of the drain. It meets the performance requirements of API GL-4 Plus as well as many manufacturer requirements.



Pro Gear GL-5 75W-85 **NEW**

Product Code	Pack Size	Carton Qty
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PROGL5001	1 Litre	6
PROGL50025	2.5 Litres	4
PROGL5020	20 Litres	1

Base Oil: Full Synthetic

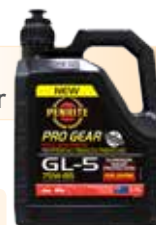
Viscosity: 75W-85

Replacement Viscosities: SAE 80 **Colour:** Amber

Key Specifications: API GL-5

Application: Hypoid & Limited Slip Differentials, Transaxles

Penrite Pro Gear GL-5 75W-85 is a premium full synthetic, gear oil optimised for use in differentials and transaxles that specifically require the use of an API GL-5, SAE 75W-85, low viscosity gear oil. It is manufactured with a blend of carefully selected synthetic base oils and purpose designed additives for long service life and excellent load carrying ability. It meets the performance requirements of API GL-5.



Pro Gear 75W-90

Product Code	Pack Size	Carton Qty
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PROG7590001	1 Litre	6
PROG75900025	2.5 Litres	4
PROG7590020	20 Litres	1
PROG7590060	60 Litres	1

Base Oil: Full Synthetic

Viscosity: 75W-90

Replacement Viscosities: 80W-90, SAE 90 **Colour:** Amber

Key Specifications: API GL-5/GL-6/MT-1, MIL-L-2105D, BTR 5M-50, ZF TE ML-01/02/05/07/08

Application: Hypoid & Limited Slip Differentials, Manual Gearboxes, Transaxles

Penrite Pro Gear 75W-90 is a premium full synthetic, heavy duty gear oil that uses a special combination of synthetic base oils which include PAO & Ester, with an advanced additive system to provide ultimate performance and protection under all operating conditions. It meets the performance requirements of API GL-5/GL-6/MT-1 as well as many other manufacturer specifications. Suitable for use in both hypoid and limited slip differentials. No further addition of Limslip Additive is recommended. It is pre-dosed with the correct amount and any further addition may result in seal degradation.



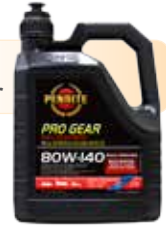
Pro Gear 80W-140

Product Code	Pack Size	Carton Qty
PROG80140001	1 Litre	6
PROG80140025	2.5 Litres	4
PROG80140020	20 Litres	1
PROG80140060	60 Litres	1
PROG80140205	205 Litres	1

Base Oil: Full Synthetic **Viscosity:** 80W-140
Replacement Viscosities: 75W-140, 85W-140, SAE 140 **Colour:** Amber

Key Specifications: API GL-5/GL-6/MT-1, MIL-L-PRF-2105E, Ford M2C190-A
Application: Hypoid & Limited Slip Differentials, Manual Gearboxes, Transaxles

Penrite Pro Gear 80W-140 is a premium full synthetic, heavy duty gear oil that uses a special combination of synthetic base oils which include PAO & Ester, with an advanced additive system to provide ultimate performance and protection under all operating conditions. It meets the performance requirements of API GL-5/GL-6/MT-1 as well as many other manufacturer specifications. Suitable for use in both hypoid and limited slip differentials. No further addition of Limslip Additive is recommended. It is pre-dosed with the correct amount and any further addition may result in seal degradation.



Pro Gear 85W-110

Product Code	Pack Size	Carton Qty
PROG85110001	1 Litre	6
PROG85110025	2.5 Litres	4

Base Oil: Premium Mineral **Viscosity:** 85W-110
Replacement Viscosities: 80W-90, SAE 90 **Colour:** Amber

Key Specifications: API GL-5, US Steel 224, AGMA 250.04 (No 6), Harley Trans Oil 99892-84, China National GB 13895-1992
Application: Hypoid Differentials, Manual Gearboxes, Transaxles

Penrite Pro Gear 85W-110 is a premium mineral, heavy duty gear oil formulated with a special, highly effective extreme pressure additive system to provide ultimate performance and protection under all operating conditions. It meets the performance requirements of API GL-5 as well as many other manufacturer specifications. Suitable for use in Harley Davidson FL/FX series transmissions.



Trans Gear 75W-80

Product Code	Pack Size	Carton Qty
TG7580001	1 Litre	6
TG7580025	2.5 Litres	4
TG7580020	20 Litres	1
TG7580060	60 Litres	1
TG7580205	205 Litres	1

Base Oil: Semi Synthetic **Viscosity:** 75W-80
Colour: Amber

Key Specifications: API GL-4 Plus, ZF TE-ML 02D, Chrysler MS 9224, Land Rover MTF 94, MB 235.10, Honda MTF 7289
Application: Manual Gearboxes, Transfer Cases, Transaxles

Penrite Trans Gear 75W-80 is a premium performance, semi synthetic manual gearbox oil. It uses the latest technology, purpose designed additives for long service life and contains a unique viscosity modifier for enhanced low temperature performance. It meets the performance requirements of API GL-4 Plus as well as many other manufacturer requirements.



Trans Gear 75W-90

Product Code	Pack Size	Carton Qty
TG7590001	1 Litre	6
TG7590025	2.5 Litres	4
TG7590020	20 Litres	1
TG7590060	60 Litres	1
TG7590205	205 Litres	1

Base Oil: Semi Synthetic **Viscosity:** 75W-90
Replacement Viscosities: 80W-90 **Colour:** Amber

Key Specifications: API GL-5/MT-1, BTR 5M-31, MIL-L-2105D, ZF TE ML-01/02/05/07/08, China National GB 13895-1992
Application: Manual Gearboxes, Transfer Cases, Transaxles

Penrite Trans Gear 75W-90 is a premium performance, semi synthetic, manual gearbox and transaxle oil. It is manufactured from a blend of highly refined base oils, the latest technology additives, friction enhancers and an advanced viscosity modifier. It meets the performance requirements of API MT-1 and GL-5 as well as many manufacturer requirements.



Gear Oil 80W-90

Product Code	Pack Size	Carton Qty
G08090001	1 Litre	6
G080900025	2.5 Litres	4
G08090020	20 Litres	1
G08090060	60 Litres	1
G08090205	205 Litres	1

Base Oil: Premium Mineral **Viscosity:** 80W-90
Replacement Viscosities: 85W-90, SAE 90 **Colour:** Blue

Key Specifications: API GL-5/GL-6/MT-1/PG-2, MIL-L-PRF-2105E, MIL-L-2105D, Ford ESW-M2C1006-B/1013-A/104-A/105-A/197-A, GM HN 1181/1187/1386/1561, China National GB 13895-1992

Application: Hypoid & Limited Slip Differentials, Manual Gearboxes, Transfer Cases, Transaxles

Penrite Gear Oil 80W-90 is a premium, heavy duty, mineral automotive gear oil, manufactured with modern extreme pressure additives and friction modifiers, meeting the requirements of API GL-5/6 & MT-1, as well as many other manufacturer specifications. It is suitable for use in both limited slip and hypoid differentials. Coloured Blue for easy identification.



Gear Oil 85W-140

Product Code	Pack Size	Carton Qty
G085140001	1 Litre	6
G0851400025	2.5 Litres	4
G085140020	20 Litres	1
G085140060	60 Litres	1
G085140205	205 Litres	1

Base Oil: Premium Mineral **Viscosity:** 85W-140
Colour: Blue

Key Specifications: API GL-5/GL-6/MT-1/PG-2, MIL-L-PRF-2105E, MIL-L-2105D, GM HN 1181/1187/1386/1561, China National GB 13895-1992

Application: Hypoid & Limited Slip Differentials

Penrite Gear Oil 85W-140 is a premium, heavy duty, mineral automotive gear oil, manufactured with modern extreme pressure additives and friction modifiers meeting the requirements of API GL-5/6 & MT-1, as well as many other manufacturer specifications. It is suitable for use in both limited slip and hypoid differentials. Coloured Blue for easy identification.



Gear Oil 140

Product Code	Pack Size	Carton Qty
G0140001	1 Litre	6
G01400025	2.5 Litres	4
G0140020	20 Litres	1
G0140060	60 Litres	1
G0140205	205 Litres	1

Base Oil: Premium Mineral **Viscosity:** SAE 140
Colour: Blue

Key Specifications: API GL-5/GL-6/MT-1/PG-2, MIL-L-PRF-2105E, MIL-L-2105D, SAE J2360, China National GB 13895-1992

Application: Hypoid & Limited Slip Differentials

Penrite Gear Oil 140 is a premium, heavy duty, mineral automotive gear oil, manufactured with modern extreme pressure additives and friction modifiers meeting the requirements of API GL-5/6 & MT-1 as well as many other manufacturer specifications. It is suitable for use in both limited slip and hypoid differentials. Coloured Blue for easy identification.



HDPS Fluid (Honda Dual Pump System)

Product Code	Pack Size	Carton Qty
HDPS001	1 Litre	6

Base Oil: Semi Synthetic **Colour:** Amber

Key Specifications: Honda DPSF

Penrite HDPS Fluid is a premium semi-synthetic oil specially designed for use in Honda Dual Pump System differentials. It contains a unique combination of extreme pressure additives, long life friction modifiers, anti-shudder additives and synthetic base oils, to provide maximum wear protection and extended service life.



Limslip Additive

Product Code	Pack Size	Carton Qty	Colour: Purple
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LSADD000150 150 Millilitres 12

Key Specifications: GM Part Number 1052358, Ford M2C118-A, Dana 40819, Daimler Chrysler MS 5630, Ford Motorsport 7098

Penrite Limslip Additive is an additive designed specifically for use in limited slip differentials to overcome problems with squeal, squawk or chatter. It can also be added to both mineral and synthetic hypoid gear oils to change their frictional properties to give them the ability to be used in limited slip differentials. Penrite Pro Gear 75W-90 & 80W-140 do not require any further addition of Limslip Additive.



Penrite 4297 (Transmission Additive)

Product Code	Pack Size	Carton Qty	Colour: Dark Brown
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PEN4297000150 150 Millilitres 12

Penrite 4297 REPLACES LZ 7906

Penrite 4297 is a treatment additive formulated to alleviate shift problems in automatic transmission systems that require DEXRON®II automatic transmission fluids (ATFs). It is also suitable for manual transmissions that utilise an ATF as their lubricant. It can also be used to reduce noise and wear in power steering systems of passenger vehicles. It contains a balanced mix of additives including oxidation inhibitors and friction modifiers to alter the shift feel of many transmissions while providing for an improved margin of protection in others. Not suitable for use in DCT or CVT systems.



PENRITE PRODUCT	Millilitres	Litres				
	150	1	2.5	20	60	205
Pro Gear 70W-75	-	⊙	⊙	⊙	⊙	⊙
Pro Gear 75W-85	-	⊙	⊙	⊙	⊙	⊙
Pro Gear GL-5 75W-85	-	⊙	⊙	⊙	-	-
Pro Gear 75W-90	-	⊙	⊙	⊙	⊙	-
Pro Gear 80W-140	-	⊙	⊙	⊙	⊙	⊙
Pro Gear 85W-110	-	⊙	⊙	-	-	-
Trans Gear 75W-80	-	⊙	⊙	⊙	⊙	⊙
Trans Gear 75W-90	-	⊙	⊙	⊙	⊙	⊙
Gear Oil 80W-90	-	⊙	⊙	⊙	⊙	⊙
Gear Oil 85W-140	-	⊙	⊙	⊙	⊙	⊙
Gear Oil 140	-	⊙	⊙	⊙	⊙	⊙
HDPS Fluid (Honda Dual Pump System)	-	⊙	-	-	-	-
Limslip Additive	⊙	-	-	-	-	-
Penrite 4297 (Transmission Additive)	⊙	-	-	-	-	-

(All products are available in 1000L Pods, on request)

Key Features & Benefits of the Manual Gear / Differential range:

- > Specifically designed additives to improve the shift feel for the life of the oil drain.
- > Enhanced oxidation stability, reducing harmful deposits.
- > Excellent wear protection.
- > Compatible with different metal components to protect against corrosion.
- > Common differential oils for both limited slip and hypoid differentials.

Expert Tip: Anti wear agents prevent wear due to seizure or scuffing of rubbing surfaces. They are normally zinc, phosphorus or other organo-metallic based.



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