



# TECHNICAL BULLETIN

## Base Oils – Synthetic, Semi Syn & Mineral

Issue: November 2015

### What is an engine base oil?

Modern engine oils are a complex mixture of base oils and additives. They are created by blending base stock(s) with additives. A base oil (base stock) is the lubricant base to which additives are added to blend a lubricating oil.

Base Stocks are defined into 5 different categories by the API (*American Petroleum Institute*). These 5 different groups of base stocks comprise crude mineral oil to synthetic base oils.

#### Group I

Group I base stocks are composed of fractionally distilled paraffinic mineral oil (Crude Oil) which is further refined with a solvent extraction process.

#### Group II

Group II base stocks are composed of solvent dewaxed, paraffinic mineral oil that is further refined by hydrocracking to remove impurities.

#### Group III

Originally derived from crude, they are produced by severely hydrocracking or synthesizing, Group III are extremely pure and are sold as synthetic base oil as they are deemed as synthesized hydrocarbons.

#### Group IV

PAOs, they are created by polymerizing olefin molecules. Created from synthesized ethylene gas molecules and are extremely pure whilst providing better viscosity characteristics, higher oxidation resistance as well as better low temperature operating properties than petroleum based oils.

#### Group V

Group V oils are all the oils not described in Group I to IV. They comprise Esters, Silicones, Poly esters, polyalkylene glycols etc. Esters as used in base oil are derived from reacting alcohols with certain acids.

API BASE OIL CATEGORIES						
Base Oil Category	Oil Type	Sulphur (%)	Sulphur (%)	Saturates (%)	Viscosity Index	Viscosity Index
GROUP I (Solvent Refined)	Mineral	>0.03	>0.03	<90	80 - 120	80 - 120
Group II (Hydrotreated)	Mineral	<0.03	<0.03	>90	80 - 120	80 - 120
Group III (Severely Hydrocracked)	Synthetic	<0.03	<0.03	>90	>120	≥120
Group IV	PAO's (Polyalphaolefins)					≥140
Group V	Esters and other Synthetics					

### The refining process

Crude oil is put through an oil refinery to be process to remove wax, sulphur and other impurities by boiling or cracking it under pressure. The process is as follows -



**Group I** process uses solvent refining separation process that –

- Removes Aromatics
- Removes Wax
- May include “Hydro Finishing”  
(**Hydrofinishing** process is to adjust colour and stability requirement of **base oil**. Polar compounds (oxygenate, unsaturated, ...), that are responsible for both brown colour in base oil and un-stability, are hydrogenated. This process uses low severity operating conditions (low temperature and low hydrogen partial pressure).



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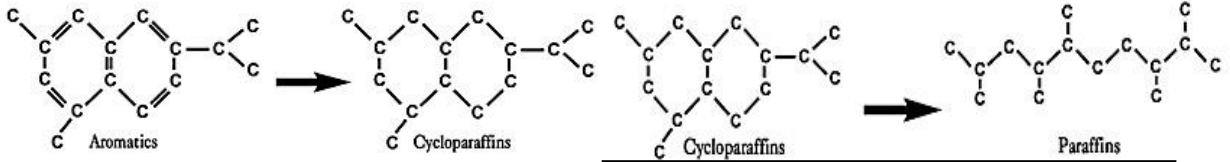
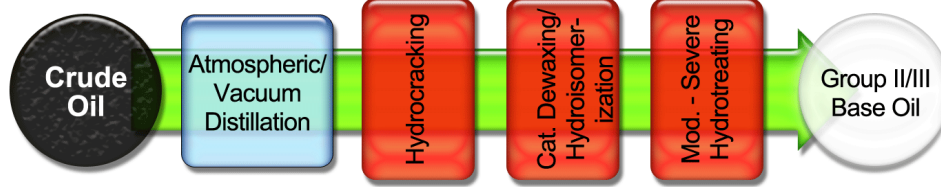


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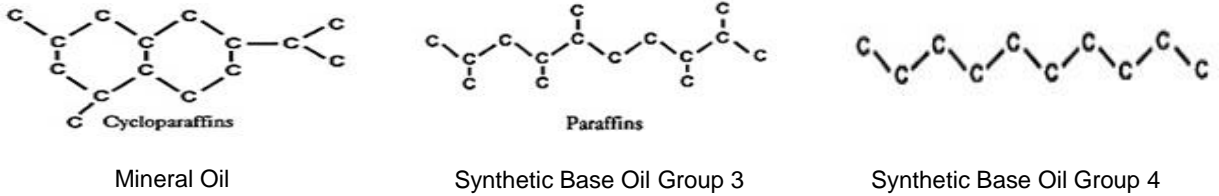


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**Group II**  
 400°C  
 >500 psi H  
 Removes sulphur & nitrogen  
 Converts aromatic hydrocarbons to cycloparaffins  
 Mix of cycloparaffins and straight chains

**Group III**  
 425-430°C  
 1,500-3,000 psi H  
 Converts cycloparaffins to paraffin chains  
 Group 3 (or III) has what they call "branched chain" hydrocarbons and no ring structures. This gives them better anti-oxidation performance and better low temperature performance – and higher a viscosity Index.



**Mineral, Semi Synthetic or Full Synthetic?**

Engine oils are generally classed into 1 of 3 groups. Mineral, Semi Synthetic or Full Synthetic. Mineral oils are made of either Group I, Group II or a combination of these two base stocks. Semi Synthetics are made from a combination Group II or Group I base stocks mixed with Group III, Group IV or Group V base stocks or a combination these. Penrite semi synthetics will have at least 20% synthetic base oil as part of their formulation. Full Synthetic oils use either a Group III, Group IV or Group V basestock or a mixture of these products.

**How do I know which one is which?**

Penrite clearly mark each of its engine oils with what type of base oil is used.

**How do you distinguish the synthetic oils from one another?**

Top range PAO & Ester Synthetics will carry a "100% PAO Ester" tag. Group 3 synthetics will have "Full Synthetic" marked on the label.

Penrite also provide an oil summary page that also lists Base oils, Zinc levels, API & ACEA specifications, fuel types and brands. Link to Penrite Oil Summary – [192 October 2015 - Automotive Engine Oil Summary.pdf](#)

[Click Here](#) to visit the Penrite Recommendation Guide, which will ensure you receive the correct oil for your vehicle.



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