

Q. What is the difference between Paraffinic, Naphthenic, Hydrotreated and Synthetic oils?

A. These oils all have one thing in common; they are, or have been, used as base oil for the formulation of transmission fluids. The viscosity-temperature characteristics of an ATF are dependent on the choice of base oil and on the viscosity index improver used (Viscosity index improvers reduce the change of viscosity with increasing temperature). Base oils are refined by a number of methods - from crude oil, as pumped from the ground. The type of crude oil used and the method of refinement determine the properties of the base oil.

- Paraffinic oils are prepared by solvent separation techniques from paraffinic crude oil, which give good yield of high viscosity index stocks containing a lot of wax. Paraffinics have good thermal and oxidative stability and good high-temperature viscosity characteristics. Low temperature dewaxing of paraffinic base oils is also required to achieve the low temperature flow requirements of ATF.
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- Naphthenic oils derived from naphthenic crude are very available and inexpensive. They yield medium viscosity index and low viscosity index base oils with very little wax and naturally low pour points. Unfortunately, their poor thermal and oxidative stability coupled with their modest viscosity characteristics rule them out for use in today's high performance transmission fluids.
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- Hydro-treated oils are derived from almost any crude oil using an alternative refining process which substitutes deep hydrogen treatment for solvent extraction. This process can increase the yield of high viscosity index components instead of unwanted low viscosity index components. This process also reconstructs cracked waxes into branched paraffins, which offer excellent low temperature properties.

The benefits of hydro-treated base oils are key in formulating current and future quality ATF's. Use of hydro-treated base oils has led to the proliferation of "synthetic" transmission fluids that have hit the market in the last few years. The higher costs of these products reflect the higher cost to produce base oils.

- Synthetic oils are perhaps the *least* understood of all the base oils currently in use. In the lubricant market today, there is no absolute definition of the word "synthetic". In Europe and the U.S., hydroisomerized base oils (hydro-treated) are being sold and marketed as "synthetic". Many engineers and chemists would argue that these base oils are not a true synthetic. For them, the definition of a "synthetic" would be a molecule built from simpler substances to give the precise properties required. The most widely used "synthetic" base oils are the polyalphaolefins (PAO's). There are others available which include the synthesized esters, but in general are expensive and have limited availability.

"Synthetic" base oils used for formulating ATF's all have viscosities in the range of the lighter high viscosity index mineral oils. Their viscosity indexes and flash

points are higher and their pour points are considerably lower. This makes them the best choice for formulating transmission fluids for extreme service in very hot or cold environments. The main disadvantage of "synthetics" is that they are more expensive and until recently, had somewhat limited availability.

To further complicate the whole base oil scenario, all of the above base oils can be mixed together in varying proportions to produce base oil blends that have "the properties of synthetics" and are sold as "semi-synthetic" ATF's.