Reliable Group I Replacement Supply from Nynas Naphthenics

In a fast-changing world, it pays off to think ahead

Due to swiping changes in the technology landscape, an appetite for significantly larger volumes of paraffinic base oils of API Group II and Group III is growing, fueled by ever-increasing demands on automotive engine oil performance.

Mineral base oils differ in production process and properties. Also, the differences in production process lead to differences in production cost and yields. The traditional solvent refining utilized to manufacture "Solvent Neutral" Group I base oils especially cost sensitive, compared to e.g. modern hydro treatment methods employed in the manufacture of Group II base oils.

A combination of production considerations and evolution of market requirements drives the profound changes that are re-shaping the global base oil industry.

Economies-of-scale and new capacity investments in Group II and Group III production worldwide has brought at sea change to the role for Europe's previous role as swing producer and net exporter of Group I base oils.

The European base oil production landscape is changing rapidly, with closures of Group I production base oil trains announced from Shell (Pernis, the Netherlands, 370 kt/pa), Total (Gonfreyville, France, 480 kt/pa), Colas (Dunkerque, France, 290 kt/pa), and by Nynas at the former Shell site in Harburg, Germany (165 kt/pa).

This leaves Europe well over 1 200 mt/pa short of Paraffinic Group I supply, oil which finds use across the industry as lubricant base oil and as process oil. Grades affected are of type SN 80, SN 100, SN 150, SN 500, SN 600, SN 650, Solvent Bright Stock (SBS), Residual Aromatic Extract (RAE) and Mild Extracte Solvate (MES).

A large part of this deficit is not readily substituted by the more highly refined paraffinic Group II and III, which indeed are available globally. This is due to two main root causes: limitations in viscosity range, and to rather significant differences in chemical composition which affect the solvency properties. The latter is of paramount importance in core segments of industrial lubricants, metalworking fluids and process oils.

The viscosity ranges offered by Group II is limited, and in the case of Group III severely limited, compared to the wide viscosity range offered by Group I base oils.

Especially the so-called Heavy Solvent Neutrals, ranging from 100-to 500 cSt, corresponding to SN 600 to SBS 2500 (Midpoint viscosity SUS @ 100 °F/ 40 °C equal to 600 to 2500) are not readily available from Group II nor Group III. The highest widely available viscosity in Group II is SN 600 (with a KV@40 °C of ca.

100 cSt), and for Group III the highest available viscosity corresponds to a SN 300 (with a KV@40 °C of 50 cSt; slightly lower than SN 300 SUS)

Thus, suitable replacement Group I base oils are needed across a wide viscosity range.

The requirements of such replacement grades are, for the lower viscosity range to supply higher polarity, aromaticity and sufficiently high solvency; and in the higher viscosity range “heavy solvent neutrals” to supply high enough viscosity, and solvency needed in lubricant formulations and as process oils.

At this point, it serves well to remind ourselves of that the parameters specified in the API Groups relate to the chemical composition, and properties, for the different base oils utilized to manufacture engine oils. The main objective of the API Base Oil Classification system is to serve as a handy reference for base oil interchange (BOI) and engine testing read-across guidelines.

Crude oils and base oils are categorized as either naphthenic or paraffinic; however, there is no sharp distinction, rather a sliding scale from the “very Naphthenic” to the “very Paraffinic”. Oils with a paraffinic carbon content (CP) of 42-50% (measured by infrared, IR) are considered to be Naphthenic base oils; the rest of the carbon content being naphthenic (CN) 35-50%, and aromatic CA 5-15 %.

Naturally occurring Paraffinic crudes have a paraffinic content up to 67% (CP), but more importantly, both API Group II and III have (CP) content well beyond that, with saturates (CP) +(CN) (i.e. non-Aromatic) content often above 99%. The naphthenic content in Group II base oils is in the range of (CN) 30-40%, with a negligible amount of aromatic CA. Thus, the solvency gap is readily explained and understood from the principal analysis chemical composition differences.

The solution to the Group I deficiency in most cases, i.e. where retention of both viscosity and solvency properties are required, is thus not to be found by switching to Group II or Group III base oils, as the differences simply are too large.

However, an oil very similar to Group I may readily be re-created by carefully blending naphthenic and paraffinic base oils- remember the sliding scale between naphthenic and paraffinic base oils!

Essentially, by adding paraffinic content to a naphthenic blend, a base oil range closely matching a broad selection of Group I base oils, from SN 70 to SN 600, can be created.

Naphthenic base oils are in ample supply in Europe and worldwide, as are Group II paraffinic base oils to utilize in blends closely re-creating the viscosity and solvency properties of Group I base oils.

The base oil end user market thus may attempt cope with the Group I deficiency in any and all of several different ways:

-Conversion to either Group II or Group III

-Conversion to Naphthenics (API Group V)

-Conversion to blends of Naphthenic and Group II and/or Group III

Nynas will supply Naphthenic blends that will be able to replace conventional Group I use, in many cases without needing significant reformulation efforts. The Nynas range will be available as base oil for lubricants and greases, and as process oil for the chemical and rubber industry.

In addition to our wide range of viscosity Nynas owns a blending program which enables to process blends meeting most of the clients' specifications.

Applications include:

- Plasticizers for rubber and tire industry
- Mould release agent
- Drilling muds mineral oil based
- Additives for Lubricant industry
- Carrier oïl for Anti-foam additives
- Metalworking Fluids (Neat and soluble oil)
- Greases and lubricants for heavy industry
- Leather industry
- Coldset offset printing inks
- Anti-caking solutions for NPK type fertilizers
- Spray oils for Agriculture protections
- Explosives : ANFO, Heavy ANFO, Emulsions and Watergel