



Naphtenic vs Paraffinic: “Beyond the Solvency”

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❑ Professional Summary:

- ❑ +12years leading R&D, Product Development, Cost Optimization and Technical Support projects globally.
- ❑ Formulation and Manufacturing skills around Lubricants, Greases, Coolants, Additives, Auto Care and HouseHold Products.
- ❑ Successful New Introduction Business portfolios in Lubricants and AutoCare Business over multiples geographies.
- ❑ Leadership experience with global brands: STP, Armor All, Tempo and Lubricants Multibrands of Toll Blenders in Mexico and LatAm.
- ❑ Strong technical background operating under ASTM, IATF 16949, ISO 9000, ISO 14000, and OEM specifications.

Agenda:

- **Purpose:** Clarify the strategic, chemical, and performance-driven distinctions beyond solvency between naphthenic and paraffinic oils.
- **Scope:** Address molecular structure, oxidation, viscosity, additive response, environmental impact, and market context.



Positioning the Technical Inquiry

- **Why Beyond Solvency?:** Modern applications demand performance far beyond solvency, including oxidative resilience, additive dynamics, and environmental compliance.
- **Multidimensional Evaluation:** Includes chemical structure, functional behavior, regulatory demands, and supply logistics.
- **Strategic Relevance:** Base oil selection directly impacts efficiency, durability, and compliance in specialized applications.

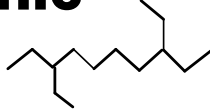


Base Oil Characterization

Paraffinic



Normal Paraffin (Wax)



Isoparaffin

High saturate level

Excellent oxidative stability

Low volatility

Higher pour point

High viscosity index

Low solvency

Naphthenic



Cycloparaffin (Naphthenes)

Moderate saturate level

Good oxidative stability

Moderate volatility

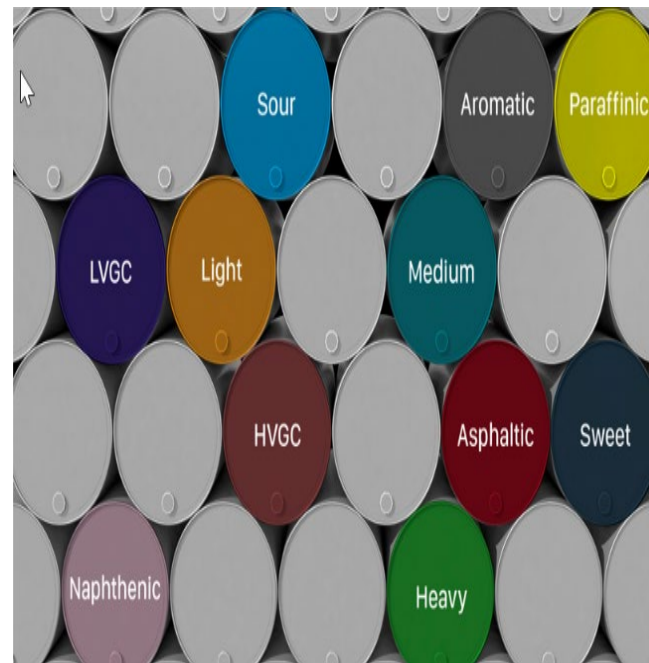
Lower pour point

Low viscosity index

High solvency

Understanding Hydrocarbon Classifications

- **Naphthenic Oils:** Characterized by saturated cycloalkanes; low VI, high polarity; refined from specific crudes like Venezuelan or Canadian.
- **Paraffinic Oils:** Dominated by straight and branched alkanes; high VI, low polarity; widely refined from Middle Eastern and American crudes.
- **Impact of Structure:** Molecular architecture dictates physical behavior—e.g., oxidation, solvency, and additive compatibility.



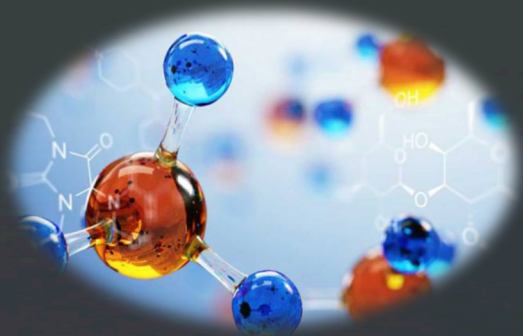
Functional Interactions Rooted in Chemistry

- **Polarity Differences:** Naphthenic oils exhibit higher polarity, enhancing solvency for polar additives and resins; paraffinics show weaker intermolecular forces.
- **Refractive Index:** Higher RI in naphthenics correlates with better solvency; used as a proxy in base oil quality evaluation.
- **Implications for Formulators:** Affects dispersant efficiency, seal compatibility, and additive solubility—critical in multi-additive blends.



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Resistance to Degradation Under Thermal and Oxygen Stress



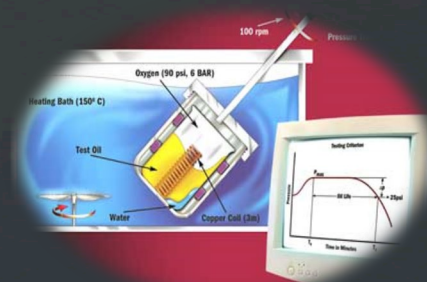
Chemical Influences

Paraffinic oils resist oxidation due to saturated structures; naphthenics oxidize faster but improve with inhibitors.



Inhibitor Synergy

Naphthenics rely more heavily on antioxidant systems; effectiveness varies by additive chemistry.



Measurement Metrics

Tests like RPVOT and TOST benchmark stability; paraffinic oils outperform in most oxidative scenarios.

Flow Performance Across Thermal Extremes

- **Viscosity Index (VI):** Paraffinics exhibit higher VI, offering better viscosity retention across temperatures; naphthenics require VI improvers.
- **Low Temperature Fluidity:** Naphthenics perform better at cold starts due to lower pour points and better natural flow properties.
- **Thermal Stability:** Paraffinics resist viscosity loss at high temperatures, aiding in high-load, high-temp operations.



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Tailoring Chemistry to Base Oil Profiles

- **Polarity & Solubility:** Naphthenics dissolve polar additives more effectively; paraffinics may require solubilizers.
- **Additive Efficiency:** Paraffinics show stronger stability with oxidation inhibitors; naphthenics enhance dispersant activation.
- **Compatibility Challenges:** Mismatched oil-additive polarity can reduce system stability, sludge control, or corrosion inhibition.



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Compliance, Biodegradability, and Toxicity Profiles

- **Biodegradability:** Naphthenics degrade more readily in the environment; paraffinics offer lower aquatic toxicity profiles.
- **Regulatory Trends:** REACH, GHS, and EPA increasingly favor lowaromatic, low-toxicity profiles—boosting paraffinic appeal.
- **Sustainability Strategy:** Refiners must align base oil selection with CSR, emissions, and product lifecycle goals.

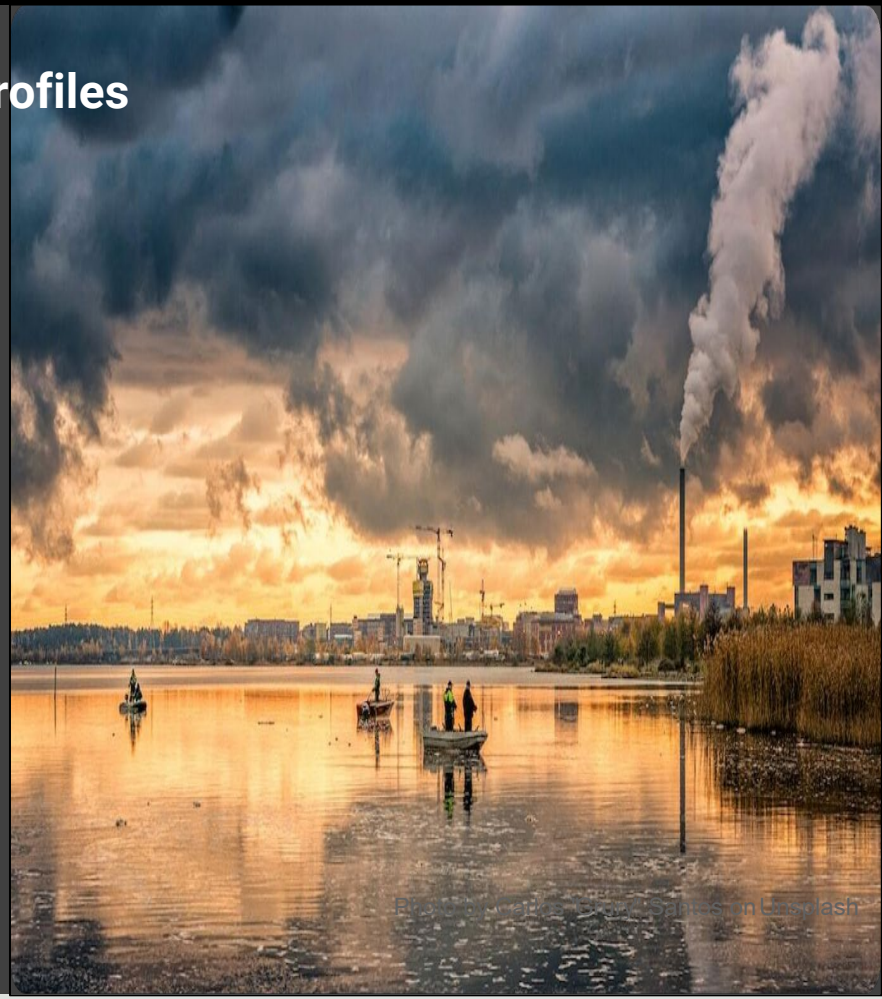


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Why Naphthenics Lead the Grid



Oxidation and Stability

Naphthenics perform well due to additive synergy and high thermal stability under oxidative stress.



Pour Point Advantage

Superior low-temp fluidity critical for remote, cold-climate installations.



Electrical Insulation

Excellent dielectric properties and gas absorption critical to transformer protection.

Balancing Stability, Flow, and Additive Support

Blending Flexibility

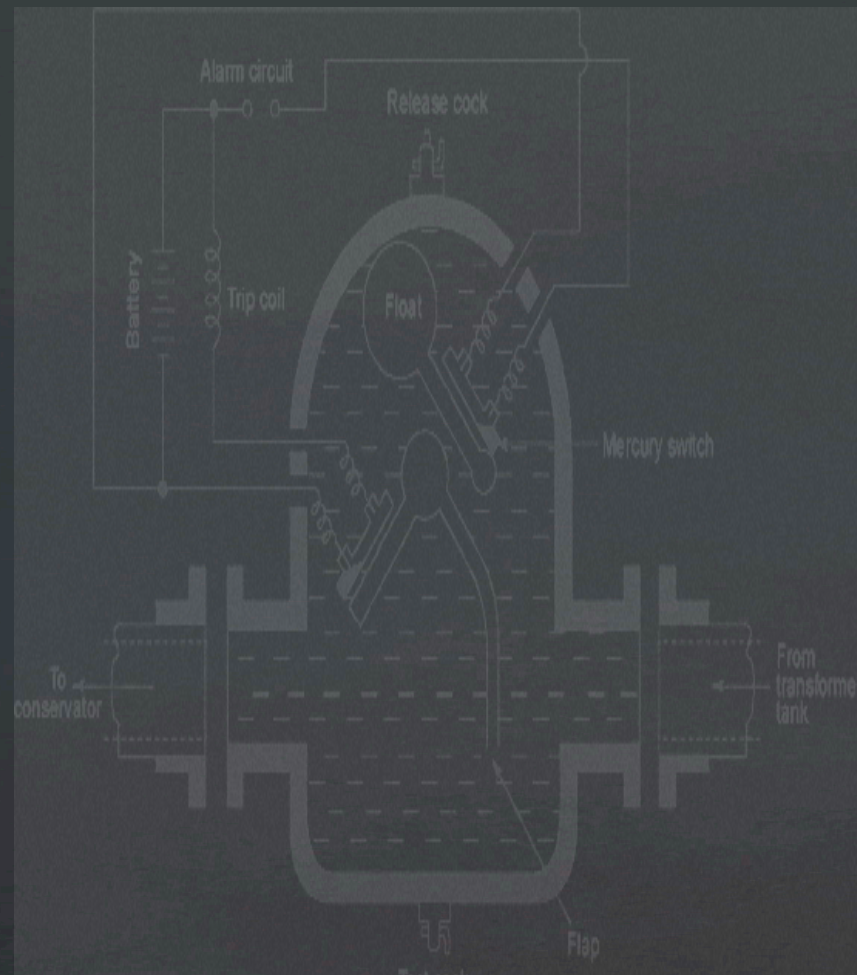
Paraffinics dominate due to higher VI and compatibility with a broad range of additives.

Pour Point Control

Naphthenics used to depress pour point naturally, especially in cold climate formulations.

Oxidative Longevity

Paraffinics offer extended oil life in high-temp engine and hydraulic systems.



Plasticization, Volatility, and Regulatory Impacts

- **Plasticization Efficiency:** Naphthenics improve filler dispersion and compound softening; favored in tire and sealant processing.
- **Volatility and Emissions:** Highly refined paraffinics meet stricter PAH emission standards; naphthenics under scrutiny for health concerns.
- **Regulatory Shifts:** EU REACH and other mandates phasing out certain naphthenic rubber oils; pushing for alternative plasticizers.



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Thermal Control, Lubricity, and Safety Considerations

- **Cooling & Lubrication:** Paraffinics provide superior thermal resistance; naphthenics offer better wetting and mist control.
- **Volatility Management:** Naphthenics reduce misting in high-speed operations; paraffinics favored for high-temp cutting.
- **Worker Safety & Regulations:** Formulations shifting to low-aromatic base stocks for improved workplace health profiles.



Crude Source, Refining Complexity, and Market Volatility

- **Crude Source Dependence:** Naphthenics are tied to fewer crude streams; paraffinics more globally diversified.
- **Refining Complexity:** Hydrotreating and dewaxing influence cost and quality; naphthenics require selective refining.
- **Market Volatility:** Paraffinics subject to broader market swings; naphthenics impacted by niche demand dynamics.

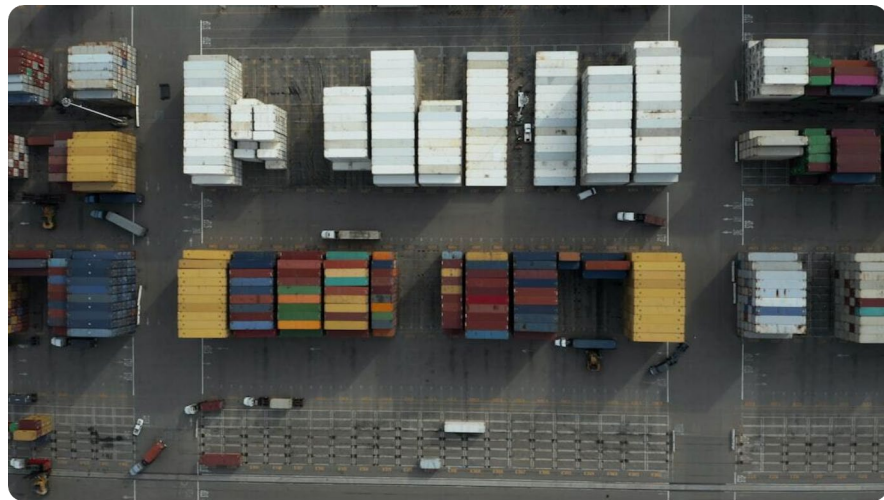


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Choosing Base Oils for Future-Proofed Formulations

- **Performance vs. Compliance:** Balancing technical superiority with environmental and regulatory mandates.
- **Formulation Agility:** Blending flexibility allows hybrid solutions to match niche requirements.
- **Risk Management:** Consideration of geopolitical, economic, and supply chain volatility in base oil selection.



Ergon's Strategic Molecule for Advanced Formulations

- **BS 5000 Introduction:** Ergon's proprietary molecule designed to enhance performance across lubrication and industrial applications.
- **Why It Matters:** Bridges the gap between paraffinic stability and naphthenic solvency, creating new formulation possibilities.
- **Strategic Applications:** Used in demanding environments requiring oxidative stability, additive synergy, and flow reliability.

Molecular Innovation for Performance Formulation



Engineered Structure

Designed with a balance of cyclic and linear hydrocarbons for tunable polarity and VI.



Refining Precision

Derived via proprietary hydroprocessing for stability, purity, and consistent performance.



Functional Versatility

Optimized for compatibility across a wide formulation space including polar and nonpolar systems.

Key Advantages of BS 5000 in Base Oil Engineering



Oxidation Resistance

Performs near Group II levels, extending lubricant life in high-temperature operations.



Solvency Balance

Offers polarity similar to light naphthenics, ensuring additive dispersibility and sludge control.



Viscosity Index Optimization

Achieves stable VI without extensive additive support, enabling better temperature response.

How BS 5000 Expands the Formulator's Toolkit

- **Base Stock Compatibility:** Easily co-blends with paraffinic and naphthenic oils without phase separation or loss of performance.
- **Additive Versatility:** Maintains solubility across complex additive packages including polar inhibitors and VI improvers.
- **Tailored Performance:** Enables formulation of multifunctional fluids across diverse viscosity, solvency, and oxidation specs.



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BS 5000 Across Industrial Sectors



Lubricants

Enhances oxidative life and VI stability in heavy-duty and automotive oils.



Transformer Oils

Improves dielectric strength, oxidation resistance, and gas solubility.



Rubber Processing

Acts as a compliant plasticizer with solvency advantages for dispersion.

Why BS 5000 Aligns with Future Demands

- **Low Aromatic Profile:** Minimizes environmental toxicity, meets REACH and global compliance standards.
- **Lifecycle Advantage:** Reduces oxidation-related waste and supports longer product life.
- **Eco-Innovation:** Enables safer alternatives to conventional plasticizers and solvent oils.



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- **Beyond solvency:** The choice between naphthenic and paraffinic oils must consider oxidative behavior, additive compatibility, thermal performance, and regulatory profile.
- **Contextual application :** Sectors such as energy, automotive, and rubber critically depend on the choice of base oil for the durability of the final product.
- **Market pressure:** The global reduction in Group I and naphthenic capacity generates import dependence in Latin America and supply risks.
- **Emerging opportunities :** The industrial and automotive boom in Latin America is increasing demand for lubricants and metalworking fluids.
- **Strategic innovation :** BS 5000 integrates key properties: oxidation, solvency, and thermal stability to serve multiple segments.
- **External risks:** Energy volatility, tariffs, and refinery closures demand strong supply chain relationships.

