Petro-Canada

TechData

The HT Purity Process

Petro-Canada's HT severe hydrocracking makes the difference

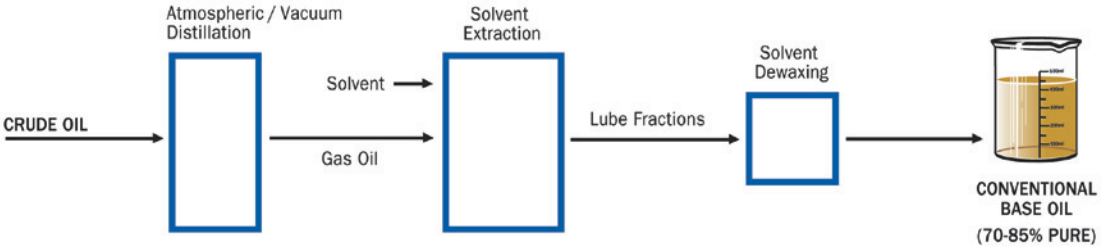
Conventional Solvent Refining

With conventional technology, the lube distillate fractions are separated and then treated individually in a solvent extraction tower to remove from 70 to 85% of impurities and aromatics. This is followed by chill dewaxing to improve the low temperature properties. The result is an amber-coloured basestock often referred to as conventional base oil. In some cases these stocks are further treated in a mild hydrofinishing step to improve colour, odour, stability and demulsibility. This hydrofinishing step should not be confused with the Severe Hydrocracking or HydroTreating process employed by Petro-Canada. Hydrofinishing is done at much lower pressure (typically 800 psi) and temperature.

What is the HT difference?

Petro-Canada starts with the HT purity process to produce water-white, 99.9% pure base oils. The result is a range of lubricants, specialty fluids and greases that deliver maximum performance for our customers.

Competitions' Solvent Refining/Extraction Process

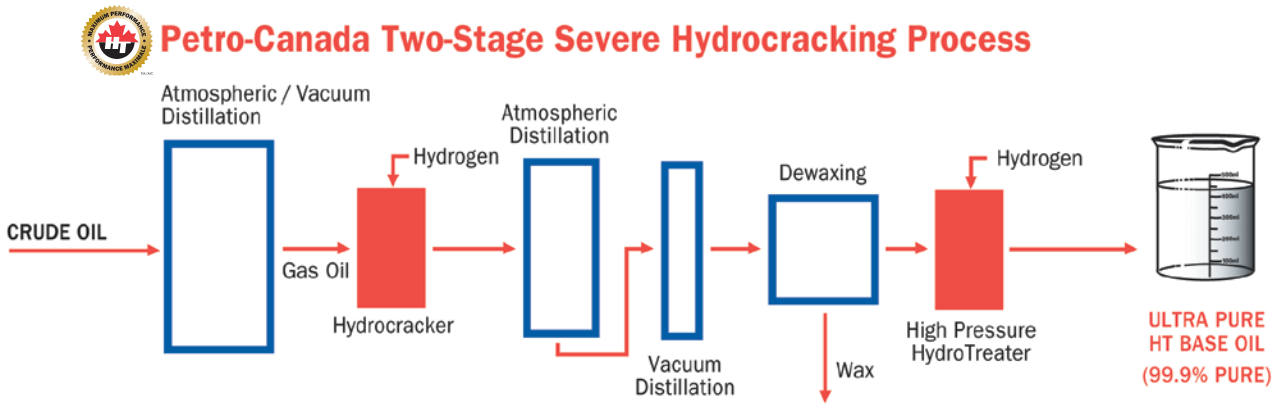


HT Severe Hydrocracking

In the first stage of Petro-Canada's HT Severe Hydrocracking process, the elimination of aromatics and impurities is achieved by chemically reacting the feed stock with hydrogen in the presence of a catalyst, at high temperature (400°C) and high pressure (3000 psig). Several different reactions occur in this hydrocracking process, the principle ones being:

- Removal of polar compounds, containing sulphur, nitrogen and oxygen
- Conversion of aromatic hydrocarbons to saturated cyclic hydrocarbons
- Breaking up of heavy molecules to lighter saturated hydrocarbons

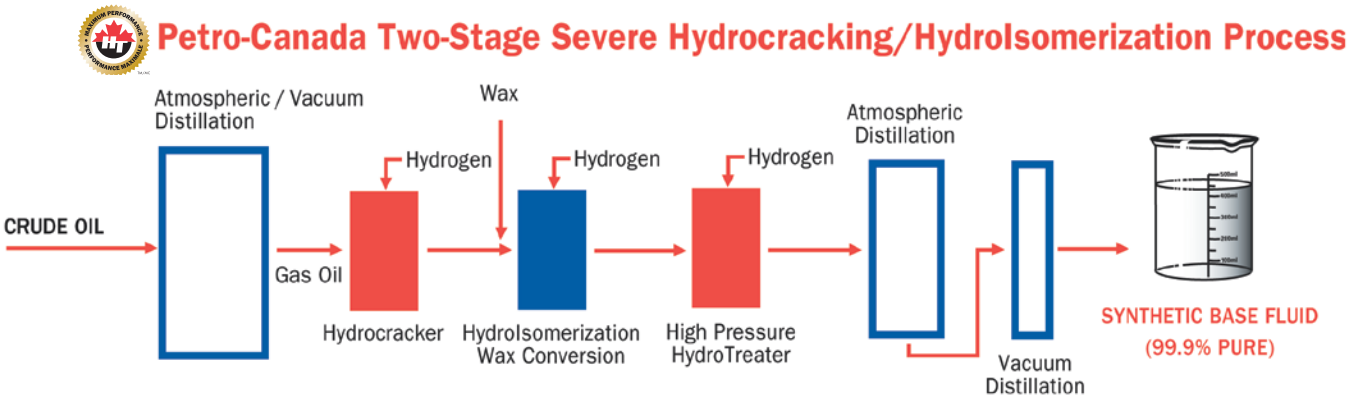
The Oils are separated by distillation and chill dewaxed to improve low temperature fluidity, and then passed through a second severe hydrotreater (290°C and 3000 psig) for additional saturation. This final step maximizes base oil stability, by removing the last traces of aromatic and polar molecules resulting in water-white stocks which are 99.9% pure. The hydrocarbon molecules that are formed are saturated and are very stable which makes them ideal for specialty process applications and high performance lubricants.



HydroIsomerization

In 1996, Petro-Canada added a second base oil manufacturing facility to run in parallel with the existing facility on the same refinery site. This unit also utilizes the HT Severe Hydrocracking process but replaces the chill dewaxing step with HydroIsomerization wax conversion.

The HydroIsomerization process employs a special catalyst which selectively isomerizes wax molecules to isoparaffinic lube oils. The process produces base stocks with higher VIs (Viscosity Index) and improved low temperature fluidity, compared to stocks produced with conventional dewaxing. This process can also be utilized to produce selected base oils with VIs approaching 130 and performance characteristics very similar to synthetic lubricants such as poly-alpha-olefins (PAO).



Comparison of solvent refining and Petro-Canada HT purity process

Base Oils

There are significant differences in certain characteristics of conventional Solvent Refined and HT Severely Hydrocracked base oils. The main difference is in the virtual elimination of aromatic molecules (often less than 0.1%) in the HT oils. By comparison, the aromatics content of Solvent Refined base oils is between 10 and 35%. Some grades of Petro-Canada base oils also utilize Hydrolsomerization if viscosity index is a performance requirement.

Typical Performance Data

CHARACTERISTIC	HT SEVERELY HYDROCRACKED ADVANTAGES VERSUS SOLVENT REFINED
Colour	HT base oils are clear and colourless
Viscosity Index	HT base oils usually have higher VI's than Solvent Refined base oils. (i.e. they 'thin-out' less at high temperatures and thicken up less at low temperatures). This is particularly true for oils produced in the Hydrolsomerization process.
Oxidation Resistance	HT base oils are saturated hydrocarbons and respond well to antioxidants giving superior resistance to oxidation.
Thermal Stability	Saturated HT base oils have better resistance to heat than Solvent Refined oils.
Carbon Residue	HT base oils have a lower carbon-forming tendency and thus produce less residue.
Demulsibility	Due to their extremely low polarity, HT base oils separate quicker and easier from water than conventional oils.
Volatility	Higher base oil VI and improved distillation allows opportunity for improved volatility which produces lower oil consumption and reduced emissions.
Low Toxicity	HT base oils have low toxicity due to the absence of impurities. Some of these oils are pure enough to be used in cosmetics and pharmaceuticals.
Biodegradability	HT base oils biodegrade faster than Solvent Refined oils - 60% vs 30%, as measured by the OECD 301B test procedure.
Low Temperature Fluidity	HT base oils that have been Hydrolsomerized have virtually no wax so their low temperature fluidity is far superior to conventional oil. This is in addition to the advantage gained by higher VI which produces less thickening at lower temperatures.

Finished Lubricants

Finished lubricants blended from either of the HT processes are superior to lubricants blended from conventional Solvent Refined base oils in several key areas. HydroIsomerized stocks may be utilized in some lubricants where high viscosity index or low temperature fluidity are a performance requirement (i.e. motor oils and transmission fluids).

- **Viscosity Stability**

  Lubricants tend to thicken in service due to oxidation and the development of solids. HT oils, when combined with inhibitors, resist this thickening far longer than conventional solvent refined oils. This feature contributes to greater fuel efficiency in motor oils and reduced power consumption from industrial lubricants.

- **Oxidation Resistance**

  HT lubricants provide superior resistance to oxidation compared to Solvent Refined lubricants. This allows them to be used for extended service life in some cases up to three times that of conventional lubricants. Applications where this superiority can readily be seen include: Gas / Steam Turbine Oils, Air Compressor Lubricants, Hydraulic Oils.

- **Thermal Stability**

  HT lubricants possess excellent thermal stability due to the higher level of molecular saturation. This leads to reduced deposits and cleaner equipment. Applications where this feature is exploited include: Heat Transfer Fluids, Air Compressor Lubricants, Turbine Oils and Automotive / Industrial Engine Oils.

- **Reduced Environmental Impact**

  HT base oils have low toxicity and biodegrade faster than Solvent Refined lubricants, due to a virtual absence of impurities. When carefully formulated with selected additives, these features can be preserved in finished lubricants. Applications where these features have been demonstrated include: Ashless Hydraulic and Paper Machine Oils, Process Defoamer Oils, etc.

Health and Safety

To obtain Material Safety Data Sheet (MSDS), contact one of Petro-Canada's TechData Info Lines.

TechData Info Lines

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