CUTTING OILS

Introduction
Petro-Canada Cutting Oils are specially formulated to provide maximum performance over a wide range of metal removing operations. Petro-Canada Cutting Oils are available in two distinct families, namely:

- Soluble Cutting Oils - Cutsol
- Neat Cutting Oils - Transicut, Supercut and Cancut

Cutsol: Soluble Cutting Oils are used where rapid heat removal is the major requirement. When diluted with water, they produce stable emulsions which have excellent cooling ability and the necessary balance of lubricity and extreme pressure characteristics required for proper machining conditions.

Transicut, Supercut and Cancut: Neat Cutting Oils are designed for use as they are received and are non-miscible with water. They have excellent lubricity and anti-weld properties, assist in extending tool life and produce a quality finish on machined parts.

Primary Functions of a Cutting Oil
The main functions of a cutting oil are to lubricate or reduce the friction between the cutting tool and the workpiece and to act as a coolant by rapidly removing the heat generated at the interface of the cutting tool and the workpiece.

Lubricating Properties
To perform satisfactorily as a lubricant, a cutting oil must greatly reduce friction at or near the tool tip, where the highest temperatures occur and between the moving tip and the rake face of the cutting tool. Special additives are often included in the formulation to provide the needed lubricity under severe boundary lubrication conditions:

For moderate pressures and temperatures, up to approximately 150°C, fatty oils when blended into mineral oils make good boundary lubricants.

For extreme pressures and temperatures, additives such as chlorine and/or sulphur chemically react to form solid-lubricant surface films.

Proper lubrication reduces friction, thus:
- Less coolant is required to absorb the heat, since there is less friction to be dissipated
- Less cutting energy is required, which results in lower power consumption and/or higher production rates.
- Less cutting tool wear
- Improved surface finishes

Cooling Properties
A coolant’s main function is to remove heat from the cutting tool, chip and workpiece. To perform the cooling function properly in a given operation, an appropriate cutting oil should be selected in the lightest viscosity grade available to maximize heat removal.

As water has the highest thermal conductivity, water-soluble oils and synthetics are the best coolants for grinding operations involving high rates of metal removal. At the other end of the scale, high viscosity mineral oils have low thermal conductivity and are most suited to slow-speed cutting operations involving high contact pressures.

Cooling is also related to flowrate. Thus by increasing the flowrate of a cutting oil over the tool/workpiece area, the cooling action of the oil can be improved.

Anti-weld Properties
Extreme temperatures and pressures at the cutting interface may cause the metal to weld to the tool face. Effective anti-weld characteristics may be imparted to cutting oils by incorporating appropriate additives.

The most common agents for this application are elemental or combined sulphur and combined chlorine. These materials react chemically with metals, under the temperatures and pressures encountered at the chip/tool interface, to form a surface film of low shear-strength thus creating higher lubricity.

What is the HT difference?
Petro-Canada starts with the patented 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.
Features and Benefits

Soluble Oils

- **Outstanding emulsifying properties**
  - Forms fine, highly stable emulsions even in hard water
  - Resists oil separation
  - Long oil service life
- **Low foaming tendency**
  - Eliminates formation of undesirable foams
  - Facilitates easy settling of swarf
- **High lubricity**
  - Improves surface finish
  - Extends tool life
  - Lowers power consumption and/or increases production rates
- **Superior resistance to rust and corrosion**
  - Delivers excellent protection to both tools and workpieces against rust and corrosion

Neat Cutting Oils

- **Low viscosity**
  - Accelerates heat removal from tool and workpiece
  - Facilitates rapid settling of chips and swarf
  - Improves clarity of re-circulated oil
  - Prevents excessive wear at contact surfaces
  - Produces better surface finish
- **Contain friction reducing compounds**
  - Prevents welding and “built-up edge” on cutting tools
  - Reduces friction and heat between tool and workpiece
  - Lowers power consumption
  - Improves surface finish
- **Light in colour**
  - Permits easy viewing of the workpiece

Applications

Soluble Oils

Petro-Canada Soluble Oils are used where rapid heat removal is the major requirement. Petro-Canada Soluble Oils are blended from ultra pure HT Hydrocracked base oils and emulsifiers, rust inhibitors, EP additives and coupling agents. The products are mixed with water in normal starting proportions of 3% to 10% for most operations.

Petro-Canada Soluble Oils produce highly stable emulsions, which have excellent cooling ability and the necessary lubricity and extreme pressure characteristics for proper machining.

Cutsol is specially designed for general machining operations. Applications include cutting, drilling, milling and grinding, where a general purpose coolant is required. Cutsol is recommended for all machining operations, where cooling and rust protection are important. The product contains a biocide (anti-microbial agent).

Cutsol HD contains extreme pressure additives for use in metal removal operations, where a high degree of surface finish and long tool life are desired. Cutsol HD is intended for difficult machining operations. The product provides good rust protection and contains a biocide (anti-microbial agent).

Neat Cutting Oils

Petro-Canada Neat Cutting Oils are either mixtures of ultra pure HT Hydrocracked base oils, or blends of these base oils with varying amounts of extreme pressure additives, such as sulphur and chlorine and/or lubricity additives. They are designed to meet specific applications.

Petro-Canada Neat Cutting Oils have excellent lubricity and anti-weld properties, and assist in extending tool life and in creating a quality finish on machined parts.

Transicut Oils are formulated to give non-stain, transparent cutting oils intended for high-speed automatic screw machining and simple turning.

They are primarily recommended for use with low carbon steels, free machining steels and non-ferrous alloys.

Supercut Oils are designed for use in various machining operations such as taping, threading, broaching, and conventional turning.

- Supercut 13 is a low viscosity oil, specially suited to thread cutting and deep-hole drilling of tough to machine ferrous materials

Cancut 44 is a light coloured, straight cutting oil designed for severe operations on difficult to machine metals. It is especially suited for high speed threading of carbon steels.
Typical Performance Data

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>SOLUBLE CUTTING OILS</th>
<th>NEAT CUTTING OILS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CUTSOL</td>
<td>CUTSOL HD</td>
</tr>
<tr>
<td>Viscosity cSt @ 40°C</td>
<td>36</td>
<td>95</td>
</tr>
<tr>
<td>SUS @ 100°F</td>
<td>169</td>
<td>440</td>
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<tr>
<td>Oil Appearance</td>
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<td>Clear Amber</td>
</tr>
<tr>
<td>Sulphur, % wt</td>
<td>0.2</td>
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<tr>
<td>Chlorine, % wt</td>
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<tr>
<td>Fatty Ester, % wt</td>
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<td>1.0</td>
</tr>
<tr>
<td>Water to Oil Mix Ratio</td>
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<td>10:1/20:1</td>
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<tr>
<td>Emulsion Appearance</td>
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<td>Milky White</td>
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<tr>
<td>pH Emulsion</td>
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<tr>
<td>Colour, ASTM</td>
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<tr>
<td>Sulphur, % wt</td>
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<td>2.0</td>
</tr>
<tr>
<td>Chlorine, % wt</td>
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<td>0.1</td>
</tr>
<tr>
<td>Fatty Ester, % wt</td>
<td>n/a</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Health and Safety

When used as directed, Petro-Canada Cutting Oils have no adverse effects on health. Beyond normal hygiene, no special precautions are required. To obtain Material Health and Safety Data Sheets, contact one of Petro-Canada's TechData Info Lines.

TechData Info Lines

If you would like to know more about Petro-Canada Cutting Oils, or any other product in our complete line of quality lubricants, please contact us at:

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Lubricants Centre
385 Southdown Road
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Canada - West ............. Phone 1-800-661-1199
- East (English) .......... Phone 1-800-268-5850
(French) ................. Phone 1-800-576-1686
Other Areas ............... Phone (905) 403-6781
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