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The Kleenoil Filter Cartridge

Description: The Kleenoil filter cartridge is a densely wound paper made from a long fiber coniferous pine tree that grows in Scandinavia where the pulp is only processed once. It is held together in a material casing and comes in specified sizes for use in the appropriate filtration units as shown in the specifications table.

Action of the cartridge: The filtration cartridge acts both by *ab*sorbtion and by *ad*sorbtion in a continuous recycling process. The long fibers of the paper attract the water formed either through the combustion process or by condensation and absorb it like a sponge, at the same time rejecting the large oil molecules which are forced to pass between the tight windings of the cartridge. As the oil passes through the cartridge, minute carbon (soot), wear metals, and silicon particles (dirt) are extracted from the oil by adhering to the many surfaces of the filter - a process known as adsorbtion. Thus the cartridge, by removing water inhibits the production of acids which both degrade the oil and cause corrosion. The simultaneous removal of minute contaminants as they occur enables the oil life to be extended within its original operating specification.

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The Kleenoil filter cartridge will remove particles down to 1 micron (3 absolute) and totally remove water. The principle for filtering particulate matter is 'liquid liquid chromatography' which is in effect allowing a fluid to drain down a surface which will progressively arrest particles. This is achieved by having the tissue rolled on a core. Oil is passed up the core of a paper roll where it collects in a cavity between the lid of the filter housing and the paper roll. It is then forced down between the layers of the tissue where particles are adsorbed within the matrix created by millions of cellulose fibres which form the tissue layer. The principle for filtering water is capilliary absorbtion into the hollow vegetable fibre of the cellulose tissue. The molecular structure of the oil is too large to be absorbed by 'capilliary action' into the fibres, however the water is absorbed into the fibre and separates from the oil.

The construction of the Kleenoil filter cartridge is cellulose tissue (paper), and we seek to always obtain a long fibre tissue which has not been previously processed. Short fibers will absorb the water, but the pressure of flowing oil will cause the water to be released back into the oil. A long fibre will have the ends crushed by the pressure of flow and a small portion of water will be permanently retained in each fibre. Water retention is approximately 1 quart per pound of tissue.

Most papers are made with a large amount of repulped material, and as a general rule the fibre length is approximately halved each time it is re-pulped. The shortened fiber will not retain a significant amount of water, and tends to collapse into a repulped state when water is introduced. To be able to retain a large amount of very small particles the winding of the cellulose roll must be extremely precise. Normal paper converters operate at high speed and the motion is not particularly smooth.

To make an efficient filter the winding must reflect a constant and even tension, yet not be so to tight that oil will not freely flow. Re-pulped tissue with shorter fibres will not have the tensile strength to permit the tension without breaking.

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To conclude, the cellulose tissue used to manufacture a Kleenoil cartridge must be from 'virgin coniferous' or other long fibre wood. It must have no element of 'broke' (re-pulped material). There must be no chemicals such as optical bleach present, which could alter the features of other chemicals added to the oil being cleaned, There must be a constant slow wind to give the optimum density and tension of the material.

Any proprietory tissue would be unlikely to produce a filter which would meet the established specification of filtration to below 3 microns and total water removal within five passes.

Important Note: While the filtration unit is extracting the water and the contaminant, it is continuously safeguarding the desirable elements compounded within the actual oil in use. These typically include, dispersants, detergents, oxidation and rust inhibitors, metal de-activators, pour-point depressants, viscosity improvers, EP agents, friction modifiers, fungicidal, anti-foaming and gelling additives. These additives are held in suspension and their levels can be critical if the oil is to maintain its beneficial qualities.

Specification Table:	Light Duty		Heavy Duty		Heavy Duty EGR		Super Duty	
	Unit	Cartridge	Unit	Cartridge	Unit	Cartridge	Unit	Cartridge
Code Number	KU16	KC16	KU50	KC50	KU65	KC65	KU85	KC85
Water Retention <0.05%		0.07 Gallon		0.12 Gallon				0.26 Gallon
Height	6.29 inch	4.13 inch	6.50 inch	4.13 inch	6.37 inch	4.13 inch	7.09 inch	4.13 inch
Diameter	4.72 inch	4.06 inch	6.61 inch	5.63 inch	7.50 inch	7.06 inch	8.35 inch	7.80 inch
Weight (Cartridges +/- 5%)	3.31 lbs		6.61 lbs.	1.05 lbs.			13.23 lbs.	2.15 lbs.

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